Outer Continental Shelf Oil and Gas Activities in the Pacific (Southern California) and their Onshore Impacts: A Summary Report, May 1980

Prepared for the U.S. Department of the Interior, Geological Survey, in cooperation with the Bureau of Land Management and the Council on Environmental Quality

For specific questions regarding the Summary Report, contact:

Mr. David A. Nystrom  
Manager, OCS Oil and Gas Information Program  
U.S. Geological Survey 
750 National Center 
Reston, VA 22092  
(703) 860-7166.

To receive Pacific Summary Report updates, see the post card attached to the back cover, or write to Mr. David A. Nystrom.

COVER.—Platform Hondo, in the Santa Barbara Channel. When Platform Hondo was set in place in June 1976, it was the world's tallest oil drilling and production platform. Standing in 259 m (860 ft) of water, it is 310 m (945 ft) tall, weighs 16,704 metric tons (18,560 tons), and covers 3,600 square meters (40,000 square ft) of area at its base. The platform was built at a cost of $80 million. Photograph by Exxon Corporation.
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By George S. Macpherson and Janis Bernstein


This report has not been edited for conformity with the publication standards of the Geological Survey.

CONVERSION TABLE

<table>
<thead>
<tr>
<th>English</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.28 feet</td>
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<td>0.62 mile</td>
<td>1 kilometer</td>
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<tr>
<td>2.47 acres</td>
<td>1 hectare</td>
</tr>
</tbody>
</table>

ABBREVIATIONS

APCD - Air Pollution Control District
API - American Petroleum Institute
bbl - barrel(s)
BLM - Bureau of Land Management, U.S. Department of the Interior
bpd - barrels per day
CEIP - Coastal Energy Impact Program, administered by the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce
CEQA - California Environmental Quality Act
cfd - cubic feet per day
COST - Continental Offshore Stratigraphic Test
CZM - Coastal Zone Management
DEIS - Draft Environmental Impact Statement
DES - Draft Environmental Statement
EA - Environmental Assessment
EIR - Environmental Impact Report
EIS - Environmental Impact Statement
FO - Field office(s), BLM
GS - Geological Survey
IPP - Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities, BLM
mcfd - million cubic feet per day
MOA - Memorandum of Agreement
NEPA - National Environmental Policy Act
NPDES - National Pollutant Discharge Elimination System
OCS - Outer Continental Shelf
OCSIP - Outer Continental Shelf Oil and Gas Information Program, USGS
OS&T - Offshore storage and treating vessel
OSRAM - Oil Spill Risk Analysis Model
PNs - Proposed Notice of Sale
POPCO - Pacific Offshore Pipeline Company
RTWG - Regional Technical Working Group, BLM
SALM - Single anchor leg mooring
2974 - Order from the Secretary of the Interior on Inter-Bureau Coordination in the OCS Minerals Program
USGS - U.S. Geological Survey, Department of the Interior
WO - Washington Office, BLM
A number of persons have provided information and insights to the authors. These persons work for the State of California, for local governments, and in the oil industry. Mari Gottdiener at the California Coastal Commission and Dev Vrat in the Santa Barbara County Department of Environmental Resources were particularly generous with their time and knowledge.

The Field Draft Review Committee improved the report in a number of ways. Its members were: Richard Ballantyne, Thomas Dunaway, David Griggs, Richard Habrat, David Nystrom, and Louis Hecht, Jr., from the U.S. Geological Survey; and Yvonne Morehouse, Ellen Aronson, and Jennifer Dowling from the Bureau of Land Management. David Nystrom provided guidance and directed the project for the USGS. Louis Hecht, Jr., made significant contributions to chapters 2, 3, and 4 and appendix E. Richard Ensele, Lucille Tamm, and Cyril Bird from USGS were also helpful in providing information and comments. Mary Davis served as editorial coordinator for the USGS.

At Rogers, Golden & Halpern, Fritts Golden provided overall project management. Sandy Dechert designed and edited the report and supervised its production. Mark Yankoski, Stuart Huebler, and Kim Tomlinson executed the graphics. Valerie Smith, Bruni Haydl, Deborah Gould, Karen Collins, and Sue McGuire provided technical support.
Abstract

Outer Continental Shelf (OCS) oil and gas exploration and development have been under way in the Pacific (Southern California) Region since 1966. During that time, there have been four Federal lease sales: in 1966, 1968, 1975 (Sale 35), and 1979 (Sale 48). Oil and gas production from three leases has been going on since 1968. It peaked in 1971 and now averages around 31,400 barrels of oil and 15.4 million cubic feet of gas per day. Discoveries on areas leased in the 1968 and 1975 sales have led to plans for eight new platforms to begin production in the early 1980's. Five platforms are in the eastern end of Santa Barbara Channel, one is in the western Channel, and two are in San Pedro Bay, south of Long Beach. Three rigs are doing exploratory drilling in the Region.

The most recent estimates by the U.S. Geological Survey of remaining reserves for all identified fields in the Southern California Region are 695 million barrels of oil and 1,575 billion cubic feet of gas (January 1979). The USGS has also made risked estimates of economically recoverable oil and gas resources for all the leased tracts in the Region (March 1980). These risked estimates of economically recoverable resources are 394 million barrels of oil and 1,295 billion cubic feet of gas. The USGS estimates of undiscovered recoverable resources for the entire Southern California OCS Region (January 1980) are 3,200 million barrels of oil and 3,400 billion cubic feet of gas.

Because of the long history of oil and gas production in Southern California from wells onshore and in State waters, there are many existing facilities for the transportation, processing, and refining of oil and gas. Some of the expected new OCS production can be accommodated in these facilities. Four new onshore projects will be
required. Two of these are under construction: (1) a 9.6-
km (6-mi) onshore oil pipeline (capacity: 60,000 bpd)
between Carpinteria (Santa Barbara County) and the ex­
isting Mobil-Rincon separation and treatment facility
(Ventura County), and (2) a small supply base and dock
(upgrade of existing facility) and a 0.4-hectare (1-acre)
crude oil distribution facility in Long Beach (Los Angeles
County), connected to landfall by a 3-km (1.8-mi) onshore
pipeline. The two other facilities are awaiting permit
approval: (1) a gas treatment plant at Las Flores Canyon
(Santa Barbara County) and (2) a separation and treatment
plant at Mandalay Beach (Ventura County) with 4 km (2.5
mi) of onshore pipeline on the same right-of-way from
landfall to the plant and from the plant to an existing gas
transmission line.
## Contents

Acknowledgments
Abstract
Introduction

1. Offshore oil and gas resources of the Pacific (Southern California) Region
   Geological aspects of the Southern California Outer Continental Shelf
   Estimating hydrocarbon potential
   Resource and reserve estimates

2. Magnitude and timing of OCS development
   History of oil and gas activities off Southern California
   OCS exploration, development, and production off Southern California
   Unitization of leases
   Exploratory activities
   Discoveries and development of OCS oil and gas
   Santa Ynez Unit
   Santa Rosa Unit
   Dos Cuadras
   Carpinteria Offshore
   Pitas Point Unit
   Santa Clara Unit
   Hueneme Offshore
   Beta Unit (proposed)
   Production of OCS oil and gas
   Past and present production
   Carpinteria Offshore
   Dos Cuadras
   Expected production
   Future exploration, development, and production on the Southern California OCS
# Illustrations

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Southern California Region</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Geomorphic provinces and major faults in the Southern California Region</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Proven oil and gas fields in the Southern California Region</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Tracts used for resource and reserve estimates</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>OCS lands off Southern California by lease numbers and lease sale</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>Glomar Coral Sea, a drill ship currently working for Chevron on the Southern California OCS</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>Discoveries and wells currently being drilled off Southern California</td>
<td>28</td>
</tr>
<tr>
<td>8</td>
<td>Oil and gas fields and unit designations in the Southern California Region</td>
<td>29</td>
</tr>
<tr>
<td>9</td>
<td>Platform development off Southern California</td>
<td>30</td>
</tr>
<tr>
<td>10</td>
<td>Annual oil and gas production from Southern California OCS, 1969-1979</td>
<td>32</td>
</tr>
<tr>
<td>11</td>
<td>Daily oil and gas production from Southern California OCS, 1969-1979</td>
<td>32</td>
</tr>
<tr>
<td>12</td>
<td>Existing and proposed pipelines, platforms, and marine terminals, March 1980</td>
<td>38</td>
</tr>
<tr>
<td>13</td>
<td>Offshore storage and treating vessel, currently in storage near Orange, Texas</td>
<td>40</td>
</tr>
<tr>
<td>14</td>
<td>Platform Hondo crude oil transportation system</td>
<td>41</td>
</tr>
<tr>
<td>15</td>
<td>Types of primary energy use for California and the United States</td>
<td>47</td>
</tr>
<tr>
<td>16</td>
<td>Sources of California refinery crude oil feedstocks, 1965-1978</td>
<td>47</td>
</tr>
<tr>
<td>17</td>
<td>Sources of California natural gas supply, 1970-1978</td>
<td>48</td>
</tr>
<tr>
<td>18</td>
<td>Existing and proposed facilities for handling OCS production, March 1980</td>
<td>49</td>
</tr>
<tr>
<td>19</td>
<td>Organization of National OCS Advisory Board and reporting structure</td>
<td>98</td>
</tr>
<tr>
<td>20</td>
<td>Relationship of the OCS Oil and Gas Leasing Process and the IPP</td>
<td>100-101</td>
</tr>
<tr>
<td>21</td>
<td>Proposed tracts, Lease Sale 53</td>
<td>124</td>
</tr>
<tr>
<td>22</td>
<td>Proposed tracts, Lease Sale 68</td>
<td>126</td>
</tr>
</tbody>
</table>
Introduction

The United States is currently engaged in an effort to develop the oil and gas resources of the Outer Continental Shelf (OCS). Offshore activities must be supplied and supported from land, and the onshore activities required may have significant effects on the communities in which they occur. For example, oil and gas production might involve the expansion of existing transportation and processing facilities and the construction of new ones. The effects of these facilities could influence employment patterns, regional income, demand on public services, tax revenues, and air and water quality.

The need for planning to accommodate the onshore impacts of offshore oil and gas development and production has long been recognized. State and local governments need current information about offshore resources and related onshore activity to make these plans. The Outer Continental Shelf Lands Act Amendments of 1978 (Public Law 95-372) created an Outer Continental Shelf Oil and Gas Information Program (OCSIP) to provide such data. Authorities and operating procedures for the OCSIP are detailed in the Code of Federal Regulations (CFR) at 30 CFR 252, as published in the Federal Register of August 7, 1979. Under this program, the Director of the U.S. Geological Survey (USGS), in conjunction with the Director of the Bureau of Land Management (BLM) (43 CFR 3300), has prepared indexes of information used by the Federal Government in its OCS decisionmaking process. The Pacific, Atlantic, Gulf of Mexico, and Alaska Indexes have already been made available to the public. The Information Program also requires the Director of the USGS to make available to affected States a Summary Report of data and information designed to assist them in planning for the onshore impacts of potential OCS oil and gas development and production.

Pacific (Southern California) OCS Summary Report, May 1980
This report, the Pacific Summary Report, covers the Southern California Region, the area defined for purposes of this report as extending from Point Conception south to the United States-Mexico border. The Pacific is the second in a series of regional Summary Reports. The Mid-Atlantic Summary Report has already been completed, and others are currently under way for the South Atlantic, the Gulf of Mexico, and the Gulf of Alaska (including Lower Cook Inlet). A Pacific Summary Report for central and northern California will be issued following Lease Sale 53, scheduled to take place in May 1981.

The Summary Report is designed to assist the State and local communities in their planning by describing the OCS-related activity that has occurred to date and by projecting activity for the next 6 months. It complements the environmental impact statement (EIS) process by updating information and reporting on events that have taken place since the publication of an EIS.

Each of the Summary Reports begins by presenting the most recent OCS oil and gas resource and reserve estimates. The magnitude and timing of OCS activity are discussed in chapter 2 of the report. The third chapter presents information on offshore oil and gas transportation strategies, including those that are developed as part of the BLM's ongoing Intergovernmental Planning Program. Chapter 4 describes the nearshore and onshore activities that are occurring and/or probably will occur as a result of current and projected offshore activity. Appendices provide further detail, and a glossary presents definitions of geologic, industry-specific, and other special terms used in the report.

Resource and reserve estimates presented in the Summary Reports reflect the most recent Federal Government information. The Pacific Summary Report is based on data collected by Federal agencies in the course of leasing and managing the Pacific OCS and on studies and reports of OCS activities that have been prepared outside the Federal Government. Representatives of the OCSIP have also discussed oil and gas activities with Federal, State and local officials, oil industry representatives, and other interested persons. The OCSIP convened a public meeting in San Francisco, California, on February 1 and 2, 1979. Fifty-one persons attended the meeting, of whom 19 represented State and local governments. The concerns identified by participants at this meeting resulted in the identification of issues addressed in this Summary Report.

State and local officials in Southern California are primarily concerned with (1) the nature and location of OCS-related onshore facilities that may affect their com-
munities and (2) air emissions and the risk of oil spills from both onshore facilities and offshore development and production activity.

State agencies may consult with the OCSIP if they require additional information or clarification. Approximately every 6 months, a memorandum describing current levels of activity in the Region will be distributed, and when significant events occur, a revised Pacific Summary Report will be issued. To receive updates and revisions, return the postcard attached to the back cover.
1. Offshore Oil and Gas Resources of the Pacific (Southern California) Region

This chapter begins by summarizing the geology of the outer continental shelf in the Southern California Region, an area defined as extending from Point Conception south to the United States-Mexico border. Because the Federal Government must prepare resource estimates for a variety of purposes, different types of estimates and their applicability to onshore planning are discussed. The most recent information available on the oil and gas resources of the Southern California OCS is presented at the end of the chapter.

The Southern California outer continental shelf extends from Point Conception, California, southeast 350 km (220 mi) to the United States-Mexico border (fig. 1). The continental shelf in this area varies in width from 30 km (18 mi) off Point Conception to as much as 280 km (175 mi) off San Diego.

The Southern California OCS area is composed of the seaward parts of two distinct geomorphic provinces, as shown in figure 2: the Transverse Ranges province in the north, and the Southern California Borderland, or Peninsular Ranges province, in the south. The predominant topographic and structural trend of the Transverse Ranges is east-west. The Transverse Ranges province is bounded on the north by the Santa Ynez Mountains; the San Andreas Fault and San Bernardino Mountains form its eastern boundary. The Santa Monica Mountains and their seaward extension, the Channel Islands (San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands), form the boundary on the south; and the Santa Barbara Channel forms the submerged western part of the province. Water
FIGURE 1.—The Southern California Region (Modified from BLM, Pacific OCS office, 1976, by Rogers, Golden & Halpern, 1980).
depths are as great as 625 m (2,000 ft) in the Central Deep part of the Channel.

The Southern California Borderland is a province of relatively uniform ridge and basin geomorphology trending generally northwest-southeast. The eastern, onshore boundary of the province is formed by the Peninsular Ranges. On the OCS, maximum water depths in the basins range from 400 to 3,000 m (1,300 to 9,750 ft). The peaks of some of the underwater ridges rise above sea level to form islands (San Nicholas, Santa Barbara, Santa Catalina, and San Clemente), which are also generally oriented northwest-southeast. Major submarine features of the Borderland portion of the Southern California OCS are the Santa Rosa-Cortes Ridges (North and South), Tanner Bank, and Cortes Bank (see fig. 1).

Portions of the Southern California OCS are extensions of the Los Angeles and Ventura Basins, the two largest petroleum basins in the California coastal region.

![Geomorphic Provinces and Major Faults](image)

west of the San Andreas Fault. The San Pedro Bay area is an offshore extension of the Los Angeles Basin, and the Santa Barbara Channel area is the offshore continuation of the Ventura Basin. Oil and gas have been discovered in both these offshore areas. Fourteen fields, shown in figure 3, have been identified in these two areas.

The U.S. Geological Survey is responsible for estimating oil and gas resources on OCS lands. For this purpose, it performs and analyzes various geologic and geophysical investigations, which include extensive geophysical surveys. In addition to conducting its own geophysical studies, the USGS has information that oil companies have gathered under prelease permits or as a result of exploration and development activity on leases obtained from the Government. Analysis of this public and proprietary information has enabled the USGS to develop an overview of the petroleum geology of the Southern California OCS. A summary of current thinking about the geologic setting is presented in appendix A.

Certain geologic features and conditions encountered in the course of exploring for, developing, and producing offshore oil and gas may jeopardize the offshore activities or platforms and pipelines. Failure to identify, avoid, or take proper engineering precautions against potential geologic hazards could result in the failure of a platform or pipeline. In areas where these conditions have been identified, special engineering procedures may be required, or planned well or facility locations may have to be changed. Existing standard design and engineering technology can also be used to minimize adverse effects. Potential hazards identified in the leased areas of the Southern California Region include shallow gas deposits, faulting, submarine canyons, mass movement (such as landslides, slump, and creep), sand waves, and bedrock outcrops. New evidence uncovered by the USGS indicates recent mass movement of sediments on five Sale 48 tracts. The Conservation Manager of the USGS has notified lessees about this possible hazard.

Estimating hydrocarbon potential is a complex process. Until a well has been drilled, investigators derive all their knowledge of subsurface geology indirectly, from geologic and geophysical data collected at the surface.
FIGURE 3.—Proven oil and gas fields in the Southern California Region, January 1980 (Bird, 1979; Bird, 1980).
In estimating resources, certain assumptions are often made. For example, a resource estimate conditioned by the word recoverable takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface. An estimate of economically recoverable resources takes into account the costs of exploration and development, transportation costs, and the market price of oil and gas. A third uncertainty stems from the probability that resources are, or are not, present in a given area. A risked resource estimate is one that has been modified according to the estimator's confidence in the estimate (i.e., "risked" to account for the probability that economically recoverable resources will actually be encountered within the area of interest).

For areas of the Southern California OCS that have not been extensively drilled, it is only possible to estimate the Region's potential in terms of undiscovered resources: quantities of oil and gas that have been estimated to exist outside known fields. Undiscovered resource estimates are made by identifying areas of resource potential on the basis of broad geologic knowledge and theory. Using available data as a basis for further investigations, petroleum geologists then conduct a variety of geologic assessments of the region. The geologists' data base may or may not include physical confirmation of the presence of hydrocarbons by exploratory drilling, which can provide valuable information for appraising resource potential. Although these additions to the geologic and geophysical data base enable estimates to be refined, estimates of undiscovered resources are always matters of subjective, albeit expert, interpretation. To delineate the reservoir and determine if the accumulation is commercially attractive, the area must be extensively explored by further drilling.

After the commercial potential of a reservoir has been established, it is possible to calculate reserves. Reserve estimates are estimates of the portion of the identified resource that can be economically extracted. A preliminary estimate of reserves might be based on information obtained from one or more wells and maps of subsurface geology.

For additional information on the process of resource estimation, see appendix B, which explains in greater detail how resource and reserve estimates are derived, what they mean, what they should be used for, and how the process of estimating resources relates to the process of exploring for oil and gas.

The USGS's most recent resource and reserve estimates for the Southern California Region and for the offshore areas currently under lease are presented in table I.

The undiscovered recoverable resource estimates are given in the first line of the table. These estimates cover the entire Southern California OCS, including leased tracts, from Point Conception south to the United States-Mexico border, extending offshore to a water depth of 2,500 m (8,200 ft). The estimates were made in January 1980. Because they are based on interpretations of broad-scale geologic data, these estimates can provide only a first approximation of the total hydrocarbon potential of the Region.
TABLE 1. — Southern California oil and gas resources and reserve estimates

<table>
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<th>Oil (million barrels)</th>
<th>Gas (billion cu ft)</th>
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<tbody>
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<td>Undiscovered recoverable resources (January 1980)</td>
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<tr>
<td>Southern California Region (Including leased tracts)</td>
<td>3,200</td>
<td>3,400</td>
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<tr>
<td>Risked, economically recoverable resources (March 1980)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leased tracts</td>
<td>394</td>
<td>1,295</td>
</tr>
<tr>
<td>Reserves (January 1979)</td>
<td>695</td>
<td>1,575</td>
</tr>
</tbody>
</table>

SOURCES: USGS, Geologic Division (Undiscovered recoverable resource estimates); USGS, Conservation Division (Risked, economically recoverable resource estimates and reserve estimates).

The risked estimates of economically recoverable resources are given next. They cover all leased tracts in which oil and/or gas fields have not been identified and delineated and were made only on the basis of seismic data and scattered exploratory drilling. Tracts for which risked, economically recoverable resource estimates were made are indicated on figure 4 by dot screening. Estimates were calculated in March 1980.

The reserve estimates, which appear at the bottom of the table, are based on actual discoveries on leased tracts. Reserve estimates are therefore preferable to resource estimates for site-specific onshore planning purposes. In figure 4, the tracts for which the reserve estimates were made are indicated by diagonal hatching. These estimates were made in January 1979.
FIGURE 4.—Tracts used for resource and reserve estimates (Adapted from Bird, 1979).
2. Magnitude and Timing of OCS Development

This chapter presents a brief history of oil and gas activities off Southern California and discusses the scope and timing of offshore exploration, development, and production activity.

Oil production off Southern California began in 1896. Approximately 400 shallow wells were drilled from wooden piers extending from the Summerland shoreline, near Santa Barbara, California, in State waters. This was the first time offshore oil was produced in the United States. In the 1950's, the first State leases were issued. Today, there are 52 State oil and gas leases in the Santa Barbara Channel tidelands and off the Los Angeles and Orange County coasts. Fifteen platforms and 16 subsea completions are now operating on those leases. Production of oil and gas is declining, however, and within the next decade, resources from the State leases are expected to be depleted.

The first Federal lease sale in Southern California took place in 1966 when the Department of the Interior leased a single tract in the Santa Barbara Channel. The tract was leased to protect the Federal block from drainage by adjacent State wells in the Carpinteria Offshore field. It later became the site of two platforms that are currently producing oil and gas.
The first full-scale Federal lease sale of OCS tracts in the Santa Barbara Channel was held in 1968. This sale resulted in the lease of 71 tracts. Exploration here led to the discovery of Dos Cuadras, an oil field off Southern California that is also producing at this time. Subsequent exploratory drilling on the 1968 leases led to the discovery of nine other offshore oil fields. Currently, 37 leases are still active.

On January 28, 1969, a blowout occurred at Union's Platform A in the Dos Cuadras field, resulting in a major oil spill. This event caused a public outcry against offshore drilling and prompted the Secretary of the Interior to suspend all operations on Federal leases in the Santa Barbara Channel.

No further lease sales were held in Southern California until 1975 when the Department held Lease Sale 35, the first numbered California OCS lease sale. The 56 leases from this sale included tracts in areas around Santa Barbara Island, North and South Santa Rosa-Cortes Ridges, the Tanner and Cortes Banks, and San Pedro Bay. Discoveries in San Pedro Bay have led to development commitments on two leases; production is expected to begin in October 1980.

Lease Sale 48 was the third and most recent Southern California OCS sale. It was held in June 1979. At that time, 54 leases were awarded in the Santa Barbara Channel, on North and South Santa Rosa-Cortes Ridges and Cortes Bank, and in San Pedro Bay. Exploration of these leases will occur when lessees' amendments are approved for existing EPA National Pollutant Discharge Elimination System (NPDES) permits. Figure 5 shows OCS lands off Southern California by lease number and lease sale.

As of November 1979, the Federal Government has leased a total of 385,394 hectares (963,485 acres) off Southern California. Of the 145 active leases, only 3 are presently in production.
FIGURE 5.—OCS lands off Southern California by lease number and lease sale, 1980 (Modified from BLM, Pacific OCS Office, 1979a, by Rogers, Golden & Halpern, 1980. NOTE: The initial zero preceding each lease number (e.g., 0217) has been deleted because of space limitations.).
OCS exploration occurs after a lease sale and until either a discovery of economically recoverable resources is made or until a sufficient number of unsuccessful wells have been drilled to discourage further exploration. Exploratory drilling rigs used include barges, jack-ups, drill ships, and semisubmersible rigs. The onshore facilities needed to support offshore exploratory activity include temporary service bases and repair and maintenance yards. If a discovery is made, an oil company will continue to drill in order to establish the size of an oil or gas field and to assure that all possible geologic structures containing marketable resources have been located. Exploratory activity may continue for several years after a lease sale.

UNITIZATION OF LEASES. Companies holding leases off Southern California have in some cases consolidated their operations on those leases through unitization. Unitization is a cooperative agreement of two or more lease holders whereby one company becomes the operator for exploration, development, and/or production of all the affected leases. The advantages of exploring and/or developing an area as a unit are that unnecessary wells and duplicate facilities may be avoided and the ultimate recovery of hydrocarbons may be maximized.

In almost all cases, leases off Southern California have been unitized because of requests from the companies that own them. The Conservation Manager of the USGS Pacific OCS Office, however, has the authority to impose unitization if it is determined that "the national interest will be best served by unitization of a competitive reservoir" (30 CFR 250).

As a result of some companies consolidating their operations, seven units have been formed off Southern California and one other unit has been proposed. Of the seven units formed, the Santa Ynez Unit, the Santa Rosa Unit, the Pitas Point Unit, and the Santa Clara Unit are active; the Oakridge Unit, the San Miguel Unit, and the Tecalote Unit have been terminated. The proposed unit will be named the "Beta Unit" after the Beta field in San Pedro Bay.

Three other OCS oil and gas fields now producing or being developed are not unitized. They are Dos Cuadras, Carpinteria Offshore, and Hueneme Offshore.

EXPLORATORY ACTIVITIES. Three exploratory rigs are currently located off Southern California: the Glomar Coral Sea, the Diamond M General, and the Glomar Pacific. Table 2 provides the location of the wells being drilled and those for which exploration plans
unusual delay resulted from the controversy and litigation associated with Federal, State, and local environmental protection requirements.

The platform stands in 259 m (850 ft) of water in the eastern area of the Hondo field. When its 28 wells are drilled and operating at peak production, Platform Hondo should produce 30,000 barrels of oil per day and 30 million cubic feet of gas per day (Adams, 1979, p. 4). Most of this oil will be extracted from the Monterey formation, which contains heavy oil with a high sulfur content. While there is still uncertainty about the level of production this reservoir can sustain, Exxon expects Platform Hondo to ultimately recover 94 million barrels of oil and 30 billion cubic feet of gas (Exxon Company, U.S.A., 1979). The unit as a whole may contain as many as 500 million barrels of oil (Adams, 1979, p. 3). The OS&T for Platform Hondo will be moored 6 km (3.8 mi) from the coast. It is attached to a single-anchor-leg mooring (SALM) system, through which oil, water, and fuel gas are transferred from the production platform to the vessel. A 12-inch gas pipeline is proposed to run from Platform Hondo to the Pacific Offshore Pipeline Company's (POPCO's) proposed Las Flores gas treatment plant. The oil will be tankered to a refinery at a location presently undecided.

**SANTA ROSA UNIT.** The Santa Rosa Unit is located in the eastern portion of the Santa Barbara Channel. The unit is composed of leases OCS P-0222, 0223, 0230A, 0232, 0238, and part of OCS P-0231 (1968 sale). Exxon, the unit operator, made a discovery on lease OCS P-0232 in 1978, but this discovery has not yet resulted in the submittal of a plan to develop the unit. Development of the unit will be decided when the Department of the Interior rules on a request by Exxon in late 1979 to suspend its drilling program temporarily.

**DOS CUADRAS.** The Dos Cuadras field leased in the 1968 Santa Barbara Channel sale lies under Sun's lease OCS P-0240 and Union's lease OCS P-0241. A series of discoveries led to the development and installation of four production platforms. Sun filed a Development Plan in the late 1960's that resulted in the installation of Platform Hillhouse. Union filed a Development Plan in 1977 which was approved later that year. This plan resulted in the installation of Platforms A, B, and C. Oil and gas from all four platforms are piped to the Mobil separation and treatment plant at Rincon. These platforms complete the development of the Dos Cuadras field. Additional information on the Dos Cuadras field is discussed in the section on Production.

**CARPINTERIA OFFSHORE.** The Carpinteria Offshore field lies under Federal and State waters. The
Federal portion of the field consists of leases OCS P-0166 and OCS P-0240, leased in 1966 and 1968. Sun is the field operator. Discoveries made in State waters led to the leasing of this field by the Federal Government.

Two Development and Production Plans have been filed with the USGS for development of the Carpinteria Offshore field. Phillips filed a plan in the late 1960's which resulted in the installation of platforms Hogan and Houchin, which have been producing oil and gas since 1968. Production from these two platforms is piped to the Phillips separation and treatment plant at La Conchita. Additional information concerning the Carpinteria Offshore field is presented in the section that discusses production.

Sun filed a Development and Production Plan in 1977 which was subsequently approved late in that year. This plan resulted in the installation of Platform Henry on lease OCS P-0240, which lies in the western portion of the Carpinteria Offshore field. The 30-slot platform stands in 53 m (175 ft) of water, 8 km (5 mi) off the coast. The crude oil produced by the platform will be processed at Mobil's facility at Rincon. Development drilling for Platform Henry began in February 1980 and production is expected to begin shortly. This completes the platform development of the Carpinteria Offshore field.

PITAS POINT UNIT. Two tracts acquired in the 1968 sale form the Pitas Point Unit, located 14.5 km (9 mi) south of Carpinteria in the Santa Barbara Channel. Texaco is the unit operator. The first oil discovery was made in 1968 on lease OCS P-0234, but at that time no decision was made to develop. Nine years later, in 1979, a gas discovery in another well on the same tract prompted Texaco to file a Development and Production Plan. The plan, now pending USGS approval, calls for a platform on lease OCS P-0234 and additional exploratory wells on lease OCS P-0233.

Texaco plans to install its Pitas Point Platform in 92 m (302 ft) of water, 18 km (11 mi) southeast of Santa Barbara, in order to develop the natural gas field. If the platform starts producing in January 1982, as anticipated, Texaco expects production to peak in 1983 at approximately 63 million cubic feet of gas per day. Production at this rate should continue for 4 or 5 years and then decline. Texaco expects the gas in this field to be depleted in 20 years.

The gas produced in the Pitas Point Unit will be treated at the platform before it is transported by pipeline to Carpinteria, where it will enter the existing
Southern California Gas Company transmission line for distribution.

**SANTA CLARA UNIT.** The Santa Clara Unit, located at the southeast end of the Santa Barbara Channel, consists of eight tracts leased in 1968. Chevron is the unit operator for seven of the leases (OCS P-0204, 0205, 0208, 0209, 0210, 0215, 0217) but has designated Union as an agent for lease OCS P-0216.

The first discovery in the Santa Clara Unit occurred in 1970 (lease OCS P-0205). That, and subsequent discoveries (leases OCS P-0215, 0216, and 0217) led to the planning of production platforms for this unit.

Two platforms (Gilda and Grace) that overlie the north fields of the Santa Clara Unit are in different stages of development. The Development and Production Plan submitted by Union for Platform Gilda, on lease OCS P-0216, has not yet been approved by the USGS. However, the platform is expected to be set in September 1980. Once installed and operating, Platform Gilda's 90 wells are expected to produce 18,000 barrels of oil and 19 million cubic feet of gas daily at peak production (Union Oil Company of California, 1979). Gilda will stand in 64 m (210 ft) of water, approximately 16 km (10 mi) from shore. Oil and gas produced from the proposed Platform Gilda will be piped to Mandalay Beach, where Union plans to construct a separation and treatment plant.

Chevron submitted a Development and Production Plan for Platform Grace in 1976. The platform was approved in 1977. Platform Grace was installed on lease OCS P-0217 in 97 m (318 ft) of water, 16 km (10 mi) off the coast. From 1982 to 1983, Grace's 48 wells are expected to reach a peak daily production of 16,000 barrels of oil and 16 million cubic feet of gas (Adams, 1979, p.4). Production is expected to begin in 1980. Oil and gas produced from Platform Grace will be piped to Chevron's separation and treatment plant located in Carpinteria.

**HUENEME OFFSHORE.** The Hueneme Offshore field (leases OCS P-0202 and OCS P-0203) is located in the southeast portion of the Santa Barbara Channel, approximately 6.5 km (4 mi) from Port Hueneme. In 1968, Mobil and Union leased the tracts in this field, in which two discoveries of oil were made during the next year. Union is the designated operator of the leases. A Development and Production Plan for the field was submitted in February 1979, and approval is pending. Union plans to install Platform Gina on lease OCS P-0202 in the Hueneme Offshore area. Platform Gina will stand in 29 m
(95 ft) of water, 6.5 km (4 mi) off Ventura-Oxnard, California. After the platform is installed and its 15 wells are operating, Union expects the daily peak production to reach 6,450 barrels of oil (September 1981). In 18 years of operation, the platform should ultimately recover 9.53 million barrels of oil and 1.72 billion cubic feet of gas (Union Oil Company of California, 1978).

Oil and gas produced from the platform will be piped to Mandalay Beach, where Union plans to build facilities to receive, heat, separate, measure, and distribute the products.

**BETA UNIT (PROPOSED).** The proposed Beta Unit is located in the San Pedro Bay, 14.5 km (9 mi) from Huntington Beach. It consists of four leases awarded in the 1975 lease sale (Sale 35) and one unleased tract. Shell is the operator of the unit and has made crude oil discoveries on leases OCS P-0300 and OCS P-0301. Development on these leases is under way. The other leases in the unit are Chevron's OCS P-0306 and OCS P-0296. A discovery has been made on OCS P-0296, and Chevron intends to submit a Development and Production Plan.

Shell has installed Platform Ellen and plans to install two other platforms on leases OCS P-0300 and OCS P-0301. Shell's initial plan for development of the unit is to connect Platform Ellen, an 80-slot drilling platform, by a 60 m (200 ft) walkway and pipeline to Platform Elly, a production platform for initial treatment and storage of oil. Platforms Ellen and Elly were part of Shell's Development and Production Plan submitted in late 1979 and approved in early 1980. Ellen stands in 81 m (265 ft) of water, Elly will stand in 78 m (255 ft) of water. Shell plans to submit a Supplemental Development and Production Plan for installation of Platform Eureka, a 60-slot drilling platform standing in 213 m (700 ft) of water.

If production begins in 1982, as anticipated, Shell expects Platform Ellen to produce 16,000 barrels of oil daily and Platform Eureka to produce 10,000 barrels of oil daily when production peaks in 1983-1985. The crude oil will be processed at Platform Elly and then piped to a proposed storage and distribution facility located in Long Beach. Platforms Ellen and Eureka could recover 150 million barrels of oil in 35 years (Adams, 1979, p. 3). Gas will be reinjected into the formation.

Chevron plans to submit a Development and Production Plan for installation of Platform Edith on lease OCS P-0296. This platform is expected to have 60 slots and stand in 46 m (150 ft) of water. No production estimates are yet available for Platform Edith.
### TABLE 4.—Status of development and production plans for the Southern California OCS

<table>
<thead>
<tr>
<th>Unit/field</th>
<th>Operator</th>
<th>Date of plan submittal</th>
<th>Date of plan approval</th>
<th>Platform(s) (P=Proposed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Ynez</td>
<td>Exxon</td>
<td>11/11/71 Rev. 8/15/72</td>
<td>8/16/74</td>
<td>Hondo</td>
</tr>
<tr>
<td>Santa Rosa</td>
<td>Exxon</td>
<td>None submitted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dos Cuadras</td>
<td>Sun</td>
<td>late 1960's</td>
<td>late 1960's</td>
<td>Hillhouse</td>
</tr>
<tr>
<td></td>
<td>Union</td>
<td>5/12/77</td>
<td>6/9/77</td>
<td>A, B, C</td>
</tr>
<tr>
<td>Carpinteria Offshore</td>
<td>Sun</td>
<td>6/14/77</td>
<td>11/11/77</td>
<td>Henry</td>
</tr>
<tr>
<td></td>
<td>Phillips</td>
<td>late 1960's</td>
<td>late 1960's</td>
<td>Hogan, Houchin</td>
</tr>
<tr>
<td>Pitas Point</td>
<td>Texaco</td>
<td>9/26/79</td>
<td>Pending</td>
<td>Pitas Point (P)</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Chevron</td>
<td>12/30/76</td>
<td>7/14/77</td>
<td>Grace</td>
</tr>
<tr>
<td></td>
<td>Union</td>
<td>12/12/79</td>
<td>Pending</td>
<td>Gilda (P)</td>
</tr>
<tr>
<td>Hueneme Offshore</td>
<td>Union</td>
<td>5/7/79</td>
<td>Pending</td>
<td>Gina (P)</td>
</tr>
<tr>
<td>Beta</td>
<td>Shell</td>
<td>11/7/79</td>
<td>1/3/80</td>
<td>Ellen, Elly</td>
</tr>
<tr>
<td></td>
<td>Shell</td>
<td>None submitted</td>
<td></td>
<td>Eureka (P)</td>
</tr>
<tr>
<td></td>
<td>Chevron</td>
<td>None submitted</td>
<td></td>
<td>Edith (P)</td>
</tr>
</tbody>
</table>

SOURCE: USGS, Development and Production Plans for Southern California OCS.
### TABLE 5.—Current and proposed oil and gas development off Southern California

<table>
<thead>
<tr>
<th>Unit/Field</th>
<th>Platform</th>
<th>Lease</th>
<th>Operator</th>
<th>Number of slots</th>
<th>Water depth (m)</th>
<th>Distance to shore (km)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Ynez</td>
<td>Hondo</td>
<td>OCS P-0188</td>
<td>Exxon</td>
<td>28</td>
<td>259</td>
<td>8</td>
<td>Platform installed, drilling 12th development well, awaiting OS&amp;T installation</td>
</tr>
<tr>
<td>Santa Rosa</td>
<td></td>
<td>No development to date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dos Cuadras</td>
<td>Hillhouse</td>
<td>OCS P-0240</td>
<td>Sun</td>
<td>60</td>
<td>58</td>
<td>9</td>
<td>Producing</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>OCS P-0241</td>
<td>Union</td>
<td>56</td>
<td>56</td>
<td>9</td>
<td>Producing</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>OCS P-0241</td>
<td>Union</td>
<td>61</td>
<td>57</td>
<td>9</td>
<td>Producing</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>OCS P-0241</td>
<td>Union</td>
<td>59</td>
<td>59</td>
<td>9</td>
<td>Producing</td>
</tr>
<tr>
<td>Carpinteria Offshore</td>
<td>Henry</td>
<td>OCS P-0240</td>
<td>Sun</td>
<td>30</td>
<td>53</td>
<td>8</td>
<td>Platform installed, development drilling started 2/8/80 Producing</td>
</tr>
<tr>
<td></td>
<td>Hogan</td>
<td>OCS P-0166</td>
<td>Phillips</td>
<td>66</td>
<td>46</td>
<td>6</td>
<td>Producing</td>
</tr>
<tr>
<td></td>
<td>Houchin</td>
<td>OCS P-0166</td>
<td>Phillips</td>
<td>60</td>
<td>49</td>
<td>8</td>
<td>Producing</td>
</tr>
<tr>
<td>Pitas Point</td>
<td>Pitas Point</td>
<td>OCS P-0234</td>
<td>Texaco</td>
<td>24</td>
<td>92</td>
<td>18</td>
<td>Plan approval pending</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Grace</td>
<td>OCS P-0217</td>
<td>Chevron</td>
<td>48</td>
<td>97</td>
<td>16</td>
<td>Platform installed, drilling started 2/20/80</td>
</tr>
<tr>
<td></td>
<td>Gilda</td>
<td>OCS P-0216</td>
<td>Union</td>
<td>90</td>
<td>64</td>
<td>16</td>
<td>Plan approval pending</td>
</tr>
<tr>
<td>Hueneme Offshore</td>
<td>Gina</td>
<td>OCS P-0202</td>
<td>Union</td>
<td>15</td>
<td>29</td>
<td>6.5</td>
<td>Plan approval pending</td>
</tr>
<tr>
<td>Beta</td>
<td>Ellen</td>
<td>OCS P-0300</td>
<td>Shell</td>
<td>80</td>
<td>81</td>
<td>14.5</td>
<td>Jacket installed, platform under construction</td>
</tr>
<tr>
<td></td>
<td>Élly</td>
<td>OCS P-0300</td>
<td>Shell</td>
<td>*</td>
<td>78</td>
<td>14.5</td>
<td>Approved</td>
</tr>
<tr>
<td></td>
<td>Eureka</td>
<td>OCS P-0301</td>
<td>Shell</td>
<td>60</td>
<td>213</td>
<td>14.5</td>
<td>Awaits plan submission</td>
</tr>
<tr>
<td></td>
<td>Edith</td>
<td>OCS P-0296</td>
<td>Chevron</td>
<td>60</td>
<td>46</td>
<td>11</td>
<td>Awaits plan submission</td>
</tr>
</tbody>
</table>

*Platform Elly is a production platform from which no wells will be drilled. Only initial treatment and storage of oil will be done there.

**SOURCES:** USGS, Conservation Division (Pacific OCS Region), 1979, unpublished documents; Development Plans for Southern California OCS; Ensele, 1980, oral commun.; Ballantyne, 1980, oral commun.
FIGURE 7.—Discoveries and wells currently being drilled off Southern California, 1980 (USGS, Exploration Plans for Southern California OCS).
FIGURE 8.—Oil and gas fields and unit designations in the Southern California Region, 1980 (Bird, 1979; Bird, 1980; USGS, Development Plans for Southern California OCS).
FIGURE 9.—Platform development off Southern California, 1980 (USGS, 1979, Development Plans for Southern California OCS).
OCS oil and gas production begins when the drilling platform starts extracting oil and/or gas from a field and these hydrocarbons are transported to shore by pipeline or vessel. Production usually continues for a period of 10 to 25 years until field shutdown. During production, further exploration and development may continue in the same unit or field.

**PAST AND PRESENT PRODUCTION.** Statistics on daily and yearly oil and gas production from the Southern California OCS since 1968 are presented in figure 10 and figure 11. Average daily production peaked in 1971 at 85,200 barrels per day of oil and 48.9 million cubic feet per day of gas. Production from the six platforms on both fields averaged about 31,400 barrels of oil per day and 15.4 million cubic feet of gas per day in 1979 (Adams, 1979, p. 3).

As previously discussed, Carpinteria Offshore and Dos Cuadras the only two Federal oil fields off Southern California that are currently in production (leases OCS P-0166, OCS P-0240, and OCS P-0241) (see fig. 9). Both fields are located in the eastern part of the Santa Barbara Channel. Production began in 1968, and six platforms now produce oil and gas on these Federal OCS leases. As of December 1979, the cumulative production from these three leases was 190.9 million barrels of oil and 95.5 billion cubic feet of gas (USGS, Production records for Southern California OCS).

**Carpinteria Offshore.** OCS oil and gas production off Southern California began in June 1968 from Carpinteria, a field lying partly within the State tideland and submerged land area and partly on Federal leases OCS P-0166 and OCS P-0240. Phillips installed two platforms (Hogan and Houchin) on lease OCS P-0166, which it acquired in 1966 when the Department of the Interior leased a single tract to prevent State production from draining oil from the Federal portion of Carpinteria. Production from these platforms peaked in 1969 at 28,000 barrels of oil a day (California OPR, 1977, p. 664). As of December 1979, the cumulative production from the platforms in Federal waters was 32.4 million barrels of oil and 22.3 billion cubic feet of gas (Ensele, 1980, oral commun.). The oil and gas produced from Carpinteria are piped to the Phillips separation and treatment plant at La Conchita for processing. Platforms Hope and Heidi, in State waters, have been producing since 1965.

**Dos Cuadras.** The Dos Cuadras field lies under leases OCS P-0240 and OCS P-0241, which were leased in the Santa Barbara Channel sale of 1968. Sun operates Platform Hillhouse on lease OCS P-0240, and Union operates Platforms A, B, and C on lease OCS P-0241. As
FIGURE 10.—Annual oil and gas production from the Southern California OCS, 1968-1979 (USGS, Production records for Southern California OCS; Adams, 1979. NOTE: OCS production is expected to increase significantly in the 1980's. See table 6.).

FIGURE 11.—Daily oil and gas production from the Southern California OCS, 1978-1979 (USGS, Production records for Southern California OCS; Adams, 1979. NOTE: OCS production is expected to increase significantly in the 1980's. See table 6.).
of December 1979, Sun's lease had produced about 41.2 million barrels of oil and 22 billion cubic feet of gas since production began in 1970. With production beginning in 1969, Union's lease produced about 117.2 million barrels of oil and 51.2 billion cubic feet of gas (USGS, Production records for Southern California OCS). The produced oil and gas from the field are piped to the Mobil facility at Rincon for processing.

**EXPECTED PRODUCTION.** If development plans are approved and the operators receive all necessary permits, eight new platforms will begin to produce additional OCS oil and gas between 1980 and 1984. These eight platforms are expected to produce oil and gas from five units and two fields. Table 6 lists expected production figures for each unit or field and each platform. The projections indicate a substantial increase over present production in the quantity of OCS oil and gas to be produced. This projected increase in production has already stimulated offshore and onshore oil and gas transportation planning and onshore facility siting activity by industry in the Southern California Region. In turn, State and local governments are planning for the impacts that these OCS-related activities may have on communities in the Region. These activities are discussed in chapters 3 and 4.

<table>
<thead>
<tr>
<th>Unit/Field</th>
<th>Platform</th>
<th>First year of production</th>
<th>Peak year</th>
<th>Daily peak oil production (bbl)</th>
<th>Ultimate oil production (million bbl)</th>
<th>Daily peak gas production (mmcf)</th>
<th>Ultimate gas production (bfcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Ynez</td>
<td>Hondo</td>
<td>1981</td>
<td>1983-86</td>
<td>30,000</td>
<td>94</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Ynez</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpinteria Offshore</td>
<td>Henry</td>
<td>1980</td>
<td>1981</td>
<td>6,000</td>
<td>12.7</td>
<td>4</td>
<td>8.65</td>
</tr>
<tr>
<td>Offshore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitas Point</td>
<td>Pitas Point</td>
<td>1982</td>
<td>1983</td>
<td>0</td>
<td>0</td>
<td>63</td>
<td>n.a.</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Gilda</td>
<td>1981</td>
<td>1983</td>
<td>18,000</td>
<td>43</td>
<td>19</td>
<td>40</td>
</tr>
<tr>
<td>Clara</td>
<td>Grace</td>
<td>1980</td>
<td>1982-1983</td>
<td>16,000</td>
<td>44.6</td>
<td>16</td>
<td>44.6</td>
</tr>
<tr>
<td>Hueneme Offshore</td>
<td>Gina</td>
<td>1981</td>
<td>1982</td>
<td>6,450</td>
<td>9.53</td>
<td>1.2</td>
<td>1.72</td>
</tr>
<tr>
<td>Beta</td>
<td>Ellen</td>
<td>1982</td>
<td>1983-1985</td>
<td>16,000</td>
<td>150</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Eureka</td>
<td></td>
<td>1984</td>
<td>1983-1985</td>
<td>10,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**SOURCES:** Adams, 1979; USGS, Development Plans for Southern California OCS, Ensele, 1979, oral commun.
As shown in table 2, presented earlier in this chapter, exploration continues on non-unitized leases from the 1968 Santa Barbara sale and from Sale 35 (1975). In addition, exploration is about to commence on certain leases from Sale 48 (1979). Exploration also continues on leases within the Santa Ynez, Pitas Point, and Santa Clara Units. If discoveries of oil and gas are made, they will be described in updates of this Summary Report.

Exxon plans to develop the western portion of the \textbf{Hondo} field in the \textbf{Santa Ynez Unit} if Platform Hondo demonstrates economic feasibility. Exxon may install a second platform that would stand in 305 m (1,000 ft) of water and might ultimately recover 123 million barrels of oil (Richter, 1979). According to Exxon, if a second platform were installed, production in the western portion of Hondo would begin in 8 years.

Production from Hondo and the results of further exploratory drilling will determine the economic viability of developing the other known fields in the \textbf{Santa Ynez Unit (Sacate and Pescado)}. Because these fields are smaller than Hondo and lie in deep water, development is less certain to take place there than at Hondo.

In 1978 Exxon discovered a field (unnamed) on lease OCS P-0232 in the \textbf{Santa Rosa Unit}. At present, Exxon has not submitted a Development Plan for this unit.

As discussed in the previous section, Shell and Chevron plan additional development and production operations in the \textbf{proposed Beta Unit}. Shell is expected to submit a supplemental Development and Production Plan for Platform Eureka. Chevron is expected to submit a Development and Production Plan for Platform Edith.

Exploration, development, and production in the Southern California OCS have implications for the nature and type of transportation strategies and onshore facilities planning that must be conducted by the State of California. New development and production information from these fields and any new discoveries made in Southern California will be presented in Summary Report updates.
3. OCS Oil and Gas
Transportation and Strategies

Oil and gas produced offshore are generally transported to land for processing, refining, and distribution, although partial processing or treatment may be done offshore. This chapter deals with the offshore transportation facilities currently in place or proposed for the Southern California Region. (Onshore pipelines and other onshore oil-and gas-related facilities are discussed in chapter 4.) The chapter also describes the Bureau of Land Management's Intergovernmental Planning Program (IPP) for OCS oil and gas leasing, transportation, and related facilities.

Oil and gas can be transported ashore either by pipeline or by vessel. Gas is usually transported ashore by pipeline because its low density makes it uneconomical to ship. However, in its liquefied state, (when it is refrigerated to -260°F), gas occupies only one-six-hundredth of its volume at ambient temperature. Technology has recently been developed to liquefy gas offshore for shipment to shore in insulated tankers. However, in California, the expense of such equipment, the current resource estimates, and the proximity to shore make it likely that all gas produced from the OCS for sale will be piped ashore rather than liquefied offshore and tankered.

In the case of oil, barging or tankering is preferable where reserves only meet minimum requirements for economic production. Constructing a pipeline involves large capital costs, which could exceed the revenues expected to be generated from production. For greater oil reserves, a pipeline is usually the economically preferable alternative.
Considerations other than economics must also be included in the choice of transportation mode. It is generally agreed, for example, that pipelines present less risk of a large oil spill than do tankers, for two reasons. First, a pipeline requires less handling of oil, which simply enters the pipeline network at the production platform and is pumped to a facility onshore. Tankering requires that oil be loaded onto a tanker and offloaded at a facility onshore, and these extra handling operations increase the possibility of an oil spill. Second, tanker or barge movements carry the risk of collisions, groundings, or other accidents that might result in an oil spill. The risk of accident is of concern in Southern California because of the volume of ship traffic through the Santa Barbara Channel and around the Ports of Los Angeles and Long Beach (California OPR, 1977, p. 569). In 1975, there were six to seven vessels per day in each direction between Point Conception and Port Hueneme. Traffic to the south of Port Hueneme is heavier: in 1977, there were an estimated 13 vessels per day in each direction between Port Hueneme and Los Angeles and Long Beach (California OPR, 1977, p. 564-565). Figure 12 shows the shipping lanes and their proximity to the platforms.

Air quality conditions in Southern California also make pipelines preferable over tankering or barging. Emissions of hydrocarbons, which contribute to the formation of photochemical oxidants, or smog, are also of particular concern in Southern California. In general, fewer hydrocarbons are emitted when crude oil is transported by pipeline. In tanker or barge loading, hydrocarbon vapors are displaced from the vessel's hold into the atmosphere. Tankers and barges may emit additional vapors during transit. Pipelines lose hydrocarbons mainly through fugitive emissions from pump seals and valves. Other sources of emissions associated with pipelines are the electricity-generating plants that supply the power to run the pumps and the storage tanks associated with the pipelines.

Pipelines are the mode of transportation preferred by the State of California (California Coastal Act) and local jurisdictions. The State's experience has indicated that pipeline transportation results in fewer negative environmental consequences in terms of air quality and oil spills than transportation by vessel.

This section of chapter 3 provides information on (1) the existing transportation network for OCS oil and gas (i.e., methods of transport from currently producing oil...
and gas fields) and (2) methods proposed to be used for transporting expected production.

As of 1979, 31,400 barrels of oil per day and 15.4 million cubic feet of gas per day were being produced from three leases overlying two fields (Dos Cuadras and Carpinteria Offshore). Oil and gas are transported from both fields by pipeline. The Dos Cuadras oil and gas comes ashore at Rincon, and the Carpinteria Offshore oil and gas comes ashore at La Conchita (see fig. 12).

**PIPEDLINE TRANSPORT.** Additional discoveries of OCS oil and gas in the Santa Barbara Channel and San Pedro Bay have necessitated new production platforms. These were discussed in chapter 2. Oil and gas produced from most of these platforms will be piped to onshore facilities. The new production platforms, their associated landfalls, and their pipeline sizes and types are listed in table 7. Locations are shown in figure 12.

### TABLE 7.—Existing and proposed OCS pipelines in Southern California

<table>
<thead>
<tr>
<th>Field/Unit</th>
<th>Pipeline operator</th>
<th>Platform</th>
<th>Landfall</th>
<th>Type and size</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Ynez</td>
<td>Exxon</td>
<td>Hondo</td>
<td>Las Flores Canyon</td>
<td>12-in gas&lt;sup&gt;2&lt;/sup&gt; (POPCO)</td>
<td>Proposed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dos Cuadras/</td>
<td>Union and</td>
<td>Rincon</td>
<td>12-in oil</td>
<td>Existing</td>
</tr>
<tr>
<td>Carpinteria</td>
<td>and Sun</td>
<td>&quot;A&quot;, &quot;B&quot;, &quot;C&quot;</td>
<td></td>
<td>12-in gas</td>
<td></td>
</tr>
<tr>
<td>Offshore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpinteria</td>
<td>Phillips</td>
<td>Hogan</td>
<td>La Conchita</td>
<td>10-in oil</td>
<td>Existing</td>
</tr>
<tr>
<td>Offshore</td>
<td></td>
<td></td>
<td></td>
<td>12-in gas</td>
<td></td>
</tr>
<tr>
<td>Pitas Point</td>
<td>Texaco</td>
<td>Pitas Point</td>
<td>Carpinteria</td>
<td>12-in oil</td>
<td>Proposed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(POPCO)</td>
<td></td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Chevron</td>
<td>Grace</td>
<td>Carpinteria</td>
<td>12-in oil</td>
<td>Proposed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10-in gas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Union</td>
<td>Gilda</td>
<td>Mandalay Beach</td>
<td>12-in oil</td>
<td>Proposed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10-in gas</td>
<td></td>
</tr>
<tr>
<td>Hueneme Offshore</td>
<td>Union</td>
<td>Gina</td>
<td>Mandalay Beach</td>
<td>10-in oil</td>
<td>Proposed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and gas</td>
<td></td>
</tr>
<tr>
<td>Beta (proposed)</td>
<td>Shell</td>
<td>Elly&lt;sup&gt;3&lt;/sup&gt;, Ellen, Eureka</td>
<td>Long Beach</td>
<td>16-in oil</td>
<td>Proposed</td>
</tr>
</tbody>
</table>

<sup>1</sup>Development Plans have been submitted for pipelines listed as "proposed."

<sup>2</sup>Oil from Platform Hondo is expected to be shipped via an O5&<T rather than a pipeline.

<sup>3</sup>These platforms are intermediate stops before landfalls.

**Existing OCS transportation network**

**Transportation of expected OCS production**

TANKER TRANSPORT. Oil produced from Platform Hondo will not be piped ashore. Rather, it will be handled by an offshore storage and treating vessel (OS&T) (shown in fig. 13), a tanker refitted with equipment for separation and treatment of crude oil.

The OS&T will be moored at a single-anchor-leg mooring (SALM) and will be connected to Platform Hondo by subsea pipelines. Figure 14 is a schematic representation of the system. Crude oil, gas, and water will be piped from the platform to the OS&T for separation and treatment. For the present, gas will be reinjected into the formation. In the future, Exxon plans to sell Hondo's gas to the Pacific Offshore Pipeline Company (POPCO), which will pipe it ashore for processing at a proposed site in Las Flores Canyon. Exxon hopes that this will begin in 1982 (Richter, 1980, oral commun.).

The OS&T will have the capacity to store several days' production at the anticipated peak daily production rate of 30,000 to 40,000 barrels (Richter, 1980, oral commun.). Every 4 to 5 days the oil will be transferred to

<table>
<thead>
<tr>
<th>County</th>
<th>Location</th>
<th>Operator</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Barbara</td>
<td>Cojo Bay (Point Conception)</td>
<td>Union</td>
<td>Onloading crude oil</td>
</tr>
<tr>
<td>Gaviota</td>
<td>Getty</td>
<td>Exxon</td>
<td>Abandoned</td>
</tr>
<tr>
<td>Capitan</td>
<td>Aminoil</td>
<td>Chevron</td>
<td>Onloading crude oil</td>
</tr>
<tr>
<td>Carpinteria</td>
<td></td>
<td></td>
<td>Onloading crude oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Offloading product</td>
</tr>
<tr>
<td>Ventura</td>
<td>Ventura River</td>
<td>Getty</td>
<td>Onloading OCS and other crude oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Union</td>
<td>Onloading OCS and other crude oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southern Cal.</td>
<td>Offloading fuel oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Edison</td>
<td></td>
</tr>
<tr>
<td>Los Angeles</td>
<td>El Segundo (4 terminals)</td>
<td>Chevron</td>
<td>Offloading crude oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gulf</td>
<td>Offloading crude oil</td>
</tr>
<tr>
<td>Orange</td>
<td>Huntington Beach</td>
<td>Gulf</td>
<td>Offloading crude oil</td>
</tr>
<tr>
<td>San Diego</td>
<td>Encina</td>
<td>San Diego Gas and Electric</td>
<td>Offloading fuel oil</td>
</tr>
</tbody>
</table>

FIGURE 13.—Offshore storage and treating vessel, currently in storage near Orange, Texas. Photograph by Exxon Company, U.S.A.
a shuttle tanker for shipment to a refinery. Exxon has not yet made a final decision as to where this crude oil will be refined.

**MARINE TERMINALS.** At present, there are 14 marine terminals in the Southern California region. Two of the 14 terminals, the Getty Terminal at the mouth of the Ventura River and the Union Terminal in Ventura, store OCS crude oil for later shipment elsewhere. The other 12 marine terminals are used almost exclusively for oil produced onshore or in State waters. These terminals are listed in table 8 and shown in figure 12.

The current level and pace of exploration, development, and production activity offshore have required the development and implementation of transportation strategies. Future production will require additional transportation planning.

The process of planning and constructing facilities for transporting OCS oil and gas is complex, time-consuming, and expensive. Economic, environmental, and
physical factors need to be included to ensure that the alternatives being considered are both technically and economically feasible. These factors include (1) the size of the oil and/or gas field, (2) distance from shore, (3) meteorological conditions, (4) oceanographic conditions, (5) availability of marine terminals, and (6) availability of offshore pipelines and onshore connections (NERBC-RALI Factbook, 1976, pp. 3.4-3.6). These and other considerations involved in designing OCS transportation strategies make it desirable to begin planning as early in the exploration and development process as possible.

The U.S. Bureau of Land Management (BLM) takes a lead role in the OCS transportation planning process through its Intergovernmental Planning Program (IPP) for OCS Oil and Gas Leasing, Transportation, and Related Facilities. The IPP also addresses two other elements of the BLM OCS oil and gas leasing program: the Leasing Process and the Environmental Studies Program. Discussion of the Oil and Gas Leasing Process and the Environmental Studies Program may be found in Appendix C.

IPP transportation planning has four phases, each of which is related to steps in the OCS leasing, exploration, and development sequence. Each planning phase is more detailed and site-specific than the preceding one, and the third and fourth phases are begun only in the event of a discovery of oil and/or gas in commercially producible quantities. The result of IPP planning is a set of detailed transportation management plans.

The IPP was officially activated on September 20, 1979, when final selection was made for the Regional Technical Working Group (RTWG) Committees. These committees, which implement the IPP, are composed of Federal and State officials and representatives of industry and other special and private interests. The members of the Pacific States RTWG Committee are listed in table 9.

The movement of oil and/or gas from the Outer Continental Shelf to use points or to processing points is an important part of the overall RTWG planning function. The principal end product of this planning effort is a Regional Transportation Management Plan (RTMP). In the Pacific Region the RTWG is in the preliminary stages of transportation planning for undeveloped areas of the Santa Barbara Channel. At a minimum, the final RTMP will include the following information and recommendations:

- analysis and recommendations for definite transportation corridors and alternatives, including all routes to onshore facilities or to offshore terminals serving as collection points for more than one production area;
• identification of environmentally sound alternative areas for the location of onshore facilities;

• alternatives regarding surface vessel transportation, in accordance with appropriate regulatory agencies;

• plans for monitoring of construction and operations and any required follow-up studies; and

• any stipulations and use restrictions identified as applicable to transportation rights-of-way.

Each RTMP will result from the efforts of a State Technical Working Group composed of all members of the Pacific RTWG Committee. Other Federal agencies and individuals whose expertise may be needed by the State Technical Working Group during RTMP development activities may participate in Working Group deliberations on an ad hoc basis.

A number of studies have been conducted in the Pacific Region that may aid in transportation planning. More information on these Federal, State, and local OCS-related studies may be found in appendix D.

---

**TABLE 9.—Pacific States Regional Technical Working Group Committee of the IPP**

<table>
<thead>
<tr>
<th>Member</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maurice Adams</td>
<td>U.S. Geological Survey</td>
</tr>
<tr>
<td>John Byrne</td>
<td>U.S. Fish &amp; Wildlife Service</td>
</tr>
<tr>
<td>William Grant ¹</td>
<td>U.S. Bureau of Land Management</td>
</tr>
<tr>
<td>Sue Sakaki</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>Gary Smith</td>
<td>U.S. National Oceanic &amp; Atmospheric Administration</td>
</tr>
<tr>
<td>Captain Donald Taub</td>
<td>U.S. Coast Guard</td>
</tr>
<tr>
<td>William Ahern</td>
<td>State of California (permanent ad hoc member)</td>
</tr>
<tr>
<td>William Northrop ¹</td>
<td>State of California</td>
</tr>
<tr>
<td>John Christenson</td>
<td>State of Oregon</td>
</tr>
<tr>
<td>Duane Wegner</td>
<td>State of Washington</td>
</tr>
<tr>
<td>Hon. Dorill Wright ²</td>
<td>City of Port Hueneme</td>
</tr>
<tr>
<td>Gordon Cota</td>
<td>Commercial Fishermen of Santa Barbara, Inc.</td>
</tr>
<tr>
<td>Warner Chabot</td>
<td>Northern California Trust</td>
</tr>
<tr>
<td>Michael Herz</td>
<td>The Oceanic Society</td>
</tr>
<tr>
<td>Captain Carl Larkin ²</td>
<td>Pacific Merchant Shipping Association</td>
</tr>
<tr>
<td>Ronald Ritschard</td>
<td>University of California</td>
</tr>
<tr>
<td>B.J. Taylor</td>
<td>Western Oil &amp; Gas Association</td>
</tr>
</tbody>
</table>

¹ Co-chairpersons.
² Private-sector members appointed by the Secretary of the Interior in May 1980.

NOTE: For additional information, contact William Grant at (213) 688-4551.
4. Nature and Location of Nearshore and Onshore Facilities

This chapter provides California and other interested parties with planning information on the nature and location of nearshore and onshore facilities. First, background information concerning energy supply and consumption is presented. Onshore oil and gas facilities in California are then inventoried and, where possible, those that handle OCS oil and gas are identified. Next, expected development and production requiring onshore facilities are discussed and environmental and economic impacts are summarized. Development and Production Plans not requiring new onshore facilities are also presented. Where applicable, site-specific issues and planning considerations related to facility siting impacts are addressed.

California is the nation's fourth-largest producer of oil and gas. However, it leads the nation in energy consumption, and despite its large production, the State manages to supply only one-third of its own energy demand (California Energy Commission, 1979a, p. 30). The deficit must be made up by out-of-State sources and foreign imports.

Per capita consumption of total primary energy in California is about 80 percent of the national average due to a mild climate and a relatively small proportion of energy-intensive heavy industry. Transportation is the leading use of energy, making up almost 50 percent of all the energy used in the State. Gasoline accounts for 58 percent of that, or for 30 percent of California's total energy consumption.

Oil and gas are also used by facilities that generate a large proportion of California's electricity. Between 33
percent and 45 percent of the State's electricity is provided by oil-fired plants (California Energy Commission, 1979b, p. 63). Altogether, oil and oil-based products provide about 64 percent of California's total energy supply. Natural gas supplies another 27 percent. Oil and gas together thus account for more than 90 percent of California's energy needs.

Figure 15 compares the types of primary energy used by California to those for the United States. The principal difference is that California makes up for a comparative lack of coal with petroleum. In 1978, California consumed a total of 6,800 trillion Btu (TBtu) of primary energy, of which 62 percent came from out-of-State sources and foreign imports (California Energy Commission, 1979a, p. 30, 96-98). The foreign imports share, mainly foreign crude oil, amounted to 25 percent of the total 6,800 TBtu.

Crude oil imports from out-of-State sources amounted to 950,000 barrels per day (bpd) in 1978 (California Energy Commission, 1979b, p. 54). Figure 16 shows the sources of California refinery crude oil feedstocks from 1965 through 1978. Crude oil from California wells accounted for less than one-half the total in 1978, with foreign imports from Indonesia, Latin America, and the Middle East providing one-quarter and Alaska imports providing slightly more than one-quarter. (Since 1977, Alaska crude oil has begun to displace foreign imports.) Of the approximately 1,950,000 bpd of oil refined in California presently, only 31,400 bpd is contributed by Southern California OCS production. Expanded crude oil production from California OCS sources will increase the contributions of crude oil to refineries as each new production platform is brought on line (see ch. 2).

Natural gas produced in California is only a small portion of the State's total energy supply, and availability of this resource has been steadily declining in the State since 1971. Figure 17 shows the State's sources of gas for 1970 through 1978. By far the greatest portion, about 67 percent, comes from the American Southwest. The second-largest contribution, about 25 percent, is imported from Canada. Only about 7 percent is from California. The contribution of OCS natural gas to the California energy supply has been minuscule but is expected to increase as additional gas production comes on line (see ch. 2).
FIGURE 15.—Types of primary energy use for California and the United States (California Energy Commission, 1979a, p. 23).

Because oil and gas production have been going on in Southern California since the last century, many of the support, transportation, and processing facilities necessary to bring crude oil and gas to market already exist (fig. 18). This section describes the onshore facilities associated with Southern California's offshore oil and gas production.

Offshore exploration, development, and production must be supported from bases onshore. During exploratory and development drilling, large quantities of supplies and equipment must be taken out to the drilling rigs or platforms. Supply boats carry water, fuel, provisions, drilling mud, cement, drill pipe, and casing out to the rigs or platforms and bring back waste materials that cannot be disposed of offshore. Personnel are shuttled by crew boat or helicopter. A support base generally includes berthing for supply and crew boats, dock space for loading and unloading, warehousing and open storage areas, a helipad, and space to house supervisory and communications personnel (NERBC-RALI Factbook, 1976, p. 1.2-1.18).

OCS activity in the Santa Barbara Channel is principally supported from Port Hueneme, at the eastern end of the Channel in Ventura County. Port Hueneme has been used as a support base for offshore activity in State waters since 1957. The Port has 550 m (1,800 ft) of wharf and an 11-m (35-ft) channel, and it can accommodate ships up to 250 m (820 ft) in length. Port Hueneme can handle large vessels and heavy equipment and is used as a
FIGURE 18.—Existing and proposed facilities for handling OCS production, 1980 (see facility descriptions in text for sources).
support base by supply boats for all the platforms in the Santa Barbara Channel.

Crew boats do not require port facilities as elaborate as those necessary for supply boats, as crew boats are smaller and do not require heavy cranes and other equipment. Crew boats for a number of platforms in the eastern Channel use the Chevron pier at Carpinteria. This pier has a small crane and an electric hoist (Reitz, 1980, oral commun.). A small pier at Goleta is used by other crew boats, and crews on Platform Hondo are brought out from Elwood pier near Gaviota. Because all the platforms are relatively near shore, crews are usually changed by boat. However, helicopters are sometimes used. They fly out of the Ventura County Airport at Oxnard, from Santa Barbara Airport near Goleta, and from a helipad in Ventura.

Development of the Beta field in San Pedro Bay is being supported from an existing supply base, now upgraded, in the Port of Long Beach. The level of activity required to support the Beta field is not expected to have significant environmental effects on the Port of Long Beach, and the required facilities are consistent with the Port's master plan (USGS and others, 1978, v. 2, p. 182).

PLANNING CONSIDERATIONS. Port Hueneme is occasionally crowded, which makes it necessary to berth supply boats two deep. This makes loading and unloading them more time-consuming and less efficient. Six hundred and sixty hectares (1,650 acres) and five wharves adjacent to Port property are owned by the U.S. Navy, which allows the Port to use them when they are available; however, they are not always available when the Port needs them. Port Hueneme would like to acquire 200 m (650 ft) of wharf from the Navy and extend it an additional 215 m (700 ft) (Elmore, 1980, oral commun.)

Port Hueneme and the Oxnard Harbor District commissioned a study to determine the future needs of the Port. The study concluded that a minimum of 10 new berths will be needed, each 60 m (200 ft) long, for a total of 600 m (2,000 ft) of new berth space (John J. McMullen Associates, 1979, p. V-5).

A supply boat can take up to 10 hours to travel the 90 km (55 mi) from Port Hueneme to Platform Hondo. Because of the distance between Port Hueneme and the western end of the Santa Barbara Channel, the Supply Base Corporation (SBC) is studying the feasibility of building an industrial pier at Gaviota. If a decision is made to go forward with this project, SBC would acquire from Getty a 39-hectare (96-acre) site at Getty's marine terminal at Gaviota and would construct a pier out to a water
depth of at least 6 m (20 ft). The site could be served by the Southern Pacific Railroad. An industrial pier at Gaviota could be expected to support most of the future exploratory operations, as well as development and production activity, in the western Channel. SBC will decide in early July whether to make formal application and begin the environmental review process.

When crude oil is produced, it often has water and gas in it. These and other substances must be removed from the crude oil prior to refining. Natural gas may contain water or natural gas liquids, which must also be removed before the natural gas--or methane--can be marketed. In the case of crude oil produced from offshore wells, the separation process may be performed either offshore before transporting or at a facility onshore before the crude oil is sent to a refinery.

In the case of gas, as many as three related steps can be employed in a facility (offshore or onshore) to prepare the gas for sale. If the gas is unassociated (if no oil is present) or the gas has been separated from oil and water, it is sent to a dehydrator where additional water vapor is removed. Next, if the gas is sour (if it contains high amounts of hydrogen sulfide), it is sent to a gas treatment plant, where sulfur is removed. The gas then goes through a gas processing plant where certain liquids and their components are removed for use in refineries and petrochemical complexes. If natural gas is sweet (if it contains low amount of hydrogen sulfide), it goes through a gas processing plant only. After the natural gas is processed, it enters commercial gas transmission lines for consumer use.

Existing onshore separation and treatment facilities in Southern California service both State and Federal production. There are 13 separation and treatment facilities in Santa Barbara County, 11 in Ventura County, 9 in Los Angeles County, and 7 in Orange County.

Existing OCS production from the Dos Cuadras field is piped to Mobil's separation and treatment plant at Rincon. The crude oil can be stored on-site for later transportation or piped to the Union or Getty marine terminals in Ventura. From a marine terminal, the crude oil is either loaded on tankers for shipment out of the region, piped to the Getty Tank Farm, piped to Newhall, or piped to the Wilmington Refinery in Los Angeles. Gas from Dos Cuadras is processed and sold to a subsidiary of the Southern California Gas Company.

Production from the Carpinteria Offshore field is piped to Phillips' separation and treatment plant at
### TABLE 10.—Separation and treatment facilities handling present OCS production in Southern California

<table>
<thead>
<tr>
<th>Unit/Field location</th>
<th>Facility operator</th>
<th>Capacity</th>
<th>Surplus capacity</th>
<th>Process/equipment</th>
<th>Land area</th>
<th>Expansion potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dos Cuadras, Ventura County</td>
<td>Mobil</td>
<td>Oils: 95,000 bpd Gas: 60,000 mcfd</td>
<td>Oils: 65,000 bpd Gas: 43,000 mcfd</td>
<td>Oils: Dehydration, shipping water cleanup, and shipping Gas: Compression, CO₂ removal, low temperature conditioning. Lease Automatic Custody Transfer (LACT) Unit.</td>
<td>0.56 hectares (140 acres)</td>
<td>Yes</td>
</tr>
<tr>
<td>Carpinteria Offshore, Ventura County</td>
<td>Phillips</td>
<td>Oils: 27,000 bpd Gas: 22,000 mcfd</td>
<td>Oils: 22,500 bpd Gas: 20,000 mcfd</td>
<td>Oils: Dehydration, shipping water cleanup, and shipping Gas: Compression and dehydration LACT unit.</td>
<td>0.64 hectares (16 acres)</td>
<td>Yes</td>
</tr>
</tbody>
</table>


**La Conchita.** After separation, the crude oil and gas are piped to the Mobil-Rincon facility or the Getty or Union marine terminal in Ventura for storage. The site characteristics of the Mobil and Phillips separation and treatment facilities are detailed in table 10.

The expected gas production from the Santa Ynez Unit (Platform Honda) is planned to be piped through a new 12-inch pipeline to the proposed Las Flores Canyon gas treatment plant. Expected gas production from the Santa Clara Unit (Platform Grace) will be piped to Chevron's separation and treatment plant at Carpinteria. Expected oil and gas production from the Santa Clara Unit (Platform Gilda) and Hueneme Offshore (Platform Gina) will be piped to a proposed separation and treatment facility at Mandalay Beach.

Table 11 describes separation and treatment facilities to handle expected OCS oil and gas production. The proposed facilities indicated in table 11 are discussed in detail in later sections of this chapter.

**PLANNING CONSIDERATIONS.** There are 40 existing separation and treatment plants in Southern California. These are listed in table 12. Of this total, 17 have land available for potential expansion.
such facilities on the basis of the following:

- relationship between these separation and treatment facilities and new platform and transportation strategies;
- distance between the new platforms and the shore;
- well stream characteristics;
- existence of available capacities in offshore pipelines;
- location of existing onshore pipelines and landfalls;
- proximity of any proposed facility to existing refineries; and
- collocation opportunities and constraints with other onshore facilities such as marine terminals and gas treatment plants (NERBC-RALI Factbook, 1976, pp. 4.15-4.22).

After gas is processed and treated, it can be distributed for consumer use. Gas produced offshore in Southern California can be introduced into existing natural gas pipelines that run up the coast from Los Angeles.

After oil is partially processed, it may be transported to refineries by one of two methods: pipeline or vessel. Crude oil may also come ashore by pipeline or vessel to a marine terminal, where it can be stored and then shipped elsewhere, either by pipeline or vessel, for refining.

There are nine onshore transportation systems operating in Southern California, all of which are in Ventura County. Four of the nine systems handle OCS crude oil. Four others handle oil produced from State leases, and the

---

### TABLE 11. Separation and treatment facilities handling OCS production in Southern California

<table>
<thead>
<tr>
<th>Unit/Field</th>
<th>Platform</th>
<th>Facility operator</th>
<th>Facility Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Ynez</td>
<td>Hondo</td>
<td>POPCO(^1)</td>
<td>Las Flores Canyon (P)</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Grace</td>
<td>Chevron</td>
<td>Carpinteria</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Gilda</td>
<td>Union</td>
<td>Mandalay Beach (P)</td>
</tr>
<tr>
<td>Hueneme Offshore</td>
<td>Gina</td>
<td>Union</td>
<td>Mandalay Beach (P)</td>
</tr>
</tbody>
</table>

\(^1\)Exxon proposes to sell gas from the Santa Ynez Unit to POPCO at the platform.

Source: USGS, Development and Production Plans for Southern California OCS.
### Table 12—Onshore separation and treatment facilities in the Southern California Region

(n.a. = Information not available at the time of writing. As information becomes available, it will be included in future Summary Report updates. * = Facility handling current or expected OCS production.)

<table>
<thead>
<tr>
<th>Facility location</th>
<th>Facility operator</th>
<th>Capacity</th>
<th>Age (years)</th>
<th>Expansion potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Santa Barbara County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point Conception</td>
<td>Union</td>
<td>Oil: 200 bpd</td>
<td>10</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 100 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Augustine</td>
<td>Texaco</td>
<td>Abandoned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gaviota</td>
<td>Texaco</td>
<td>Idle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gaviota</td>
<td>Chevron</td>
<td>Gas: 30,000 mcfd</td>
<td>15</td>
<td>No</td>
</tr>
<tr>
<td>Gaviota</td>
<td>Arco</td>
<td>Oil: 1,000 bpd</td>
<td>16</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 900 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molino</td>
<td>Shell</td>
<td>Gas: 500 mcfd</td>
<td>16</td>
<td>No</td>
</tr>
<tr>
<td>Tajiguas</td>
<td>Phillips</td>
<td>Gas: 30,000 mcfd</td>
<td>15</td>
<td>No</td>
</tr>
<tr>
<td>Capitan (Corral Canyon)</td>
<td>Shell</td>
<td>Oil: 1,000 bpd</td>
<td>43</td>
<td>Possible</td>
</tr>
<tr>
<td>Capitan (Las Flores)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elwood</td>
<td>Aminoil</td>
<td>Oil: 1,000 bpd</td>
<td>33</td>
<td>Yes</td>
</tr>
<tr>
<td>Elwood</td>
<td>Arco</td>
<td>Oil: 9,600 bpd</td>
<td>13</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 10,000 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal Oil Point</td>
<td>Arco</td>
<td>Oil: 1,000 bpd</td>
<td>19</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 2,500 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpinteria*</td>
<td>Chevron</td>
<td>Oil: 25,000 bpd</td>
<td>20</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 29,000 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ventura County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>La Conchita*</td>
<td>Phillips</td>
<td>Oil: 27,000 bpd</td>
<td>12</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 22,000 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rincon Island</td>
<td>Arco</td>
<td>Oil: 5,000 bpd</td>
<td>20</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 5,000 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobil-Rincon* (Sea Cliff)</td>
<td>Mobil</td>
<td>Oil: 95,000 bpd</td>
<td>11</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 60,000 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferguson</td>
<td>Mobil</td>
<td>Oil: 3,000 bpd</td>
<td>48</td>
<td>No</td>
</tr>
<tr>
<td>Rincon</td>
<td>Cabot</td>
<td>Oil: 500 bpd</td>
<td>43</td>
<td>No</td>
</tr>
<tr>
<td>Sea Cliff</td>
<td>Chanslor</td>
<td>Oil: 5,000 bpd</td>
<td>33+</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 1,000 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Padre</td>
<td>Mobil</td>
<td>Oil: 2,500 bpd</td>
<td>44</td>
<td>No</td>
</tr>
<tr>
<td>Ventura Avenue</td>
<td>Shell</td>
<td>Oil: 65,000 bpd</td>
<td>28</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas: 15,000 mcfd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barnard</td>
<td>Mobil</td>
<td>Oil: 3,000 bpd</td>
<td>46</td>
<td>No</td>
</tr>
<tr>
<td>Notten</td>
<td>Mobil</td>
<td>Oil: 1,500 bpd</td>
<td>46</td>
<td>No</td>
</tr>
<tr>
<td>Gas Plant No. 7</td>
<td>Getty</td>
<td>Gas: 20,000 mcfd</td>
<td>3</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Los Angeles County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Plant No. 20</td>
<td>Chevron</td>
<td>Gas: 25,000 mcfd</td>
<td>16</td>
<td>Yes</td>
</tr>
<tr>
<td>Inglewood</td>
<td>Chevron</td>
<td>n.a.</td>
<td>10</td>
<td>Yes</td>
</tr>
<tr>
<td>Torrance</td>
<td>Chevron</td>
<td>Gas: 3,000 mcfd</td>
<td>11</td>
<td>No</td>
</tr>
</tbody>
</table>
The Phillips pipeline is a 10-inch line that connects the Phillips-La Conchita separation and treatment facility with the 268,000-barrel storage tank at Mobil-Rincon. It is owned by the Ventura Pipeline Company, a consortium of major oil operators, and is operated by Phillips. This line handles OCS production from the Carpinteria Offshore field.

There are three Mobil pipelines. The first is a 22-inch gravity-fed pipeline, owned by the Ventura Pipeline Company, which originates at the 268,000-barrel storage tank at the Mobil-Rincon facility and terminates at Union Oil Company's marine terminal in Ventura Harbor. This pipeline is also connected to the Getty marine terminal in Ventura. Additionally, Mobil operates a 12-inch pipeline that connects the 22-inch pipeline to the Texaco and Shell pipelines. An 8-inch pipeline can also deliver crude oil...
from the Mobil 12-inch pipeline to Getty's Willett tank farm. This system handles OCS production from Dos Cuadras and Carpinteria Offshore fields and is expected to handle oil from the Santa Clara Unit (Platform Grace).

The **Union pipeline** is made up of three segments routed from Union's Ventura Harbor marine terminal to the Los Angeles Basin. The first segment consists of an 8-inch pipeline from the marine terminal to Union's Santa Paula pump station. The second segment is an 8-inch pipeline used to transport crude oil from the Santa Paula pump station to Union's Torrey Canyon pump station. The third segment is a 12-inch pipeline connecting the Torrey Canyon pump station to the Los Angeles Basin. This system will handle oil production from the Santa Clara Unit (Platform Gilda) after separation and treatment at Union's proposed Mandalay Beach site.

The **Shell pipeline** is a 10-inch crude oil pipeline that originates at Shell's tank terminal located in the Ventura River area and terminates at the company's Wilmington refinery in the Los Angeles Basin. This pipeline handles OCS production from Dos Cuadras and Carpinteria Offshore through a connector from the Getty marine terminal.

The **Texaco pipeline** is an 8-inch pipeline which originates near the Shell tank terminal in the Ventura River valley and connects with a Mobil 10-inch pipeline near Newhall in Los Angeles County.

The **ARCO pipeline** is a 6-inch pipeline which originates in the Upper Ojai Valley and terminates at the Texaco pump station in Fillmore, where it connects with the Texaco 8-inch pipeline discussed above.

The **ARCO pipeline** is a 20-inch pipeline which begins at Cuyama and terminates at Southern California Edison's Mandalay Beach generating station. This pipeline currently handles gas, but it has the potential to be converted for transport of crude oil from either Elk Hills to Port Hueneme or from the Ventura-Santa Barbara County area to the Bakersfield area.

The **Union marine terminal** loads either crude oil transported to the terminal through the Mobil 22-inch pipeline or crude oil produced at the West Montalvo field onto tankers. Crude oil received from the Mobil 22-inch pipeline for tanker loading is primarily from Santa Barbara Channel offshore oil production in the Dos Cuadras and Carpinteria Offshore fields. The Union marine terminal has a crude oil storage capacity of 285,010 barrels and is connected to an offshore monobuoy by a 4,300-foot-long, 20-inch pipeline with a capacity of 1,430 barrels per
minute. The offshore monobuoy can accommodate tankers of up to 35,000 dead weight tons (dwt) with a maximum draft of 32.5 feet.

**Getty** does not operate any major pipelines in Ventura County. It uses a marine tanker terminal to transport its own crude oil production from an onshore field (the Ventura Avenue field) to a refining center. The Getty marine terminal, located at the mouth of the Ventura River, is connected to an offshore monobuoy system by a 9,100-foot-long, 18-inch pipeline with a capacity of 2,050 barrels of oil per minute. The offshore terminal can accommodate marine tankers of up to 40,000 dwt with a maximum draft of 40 feet. The Getty marine terminal has a crude oil storage capacity of 110,000 barrels, with an additional 240,000 barrels of storage capacity located at Getty's Willett tank farm in the Ventura Avenue area. The tank farm is connected to the marine terminal by pipeline. The marine terminal serves the USA Petrochem refinery as well, by loading fuel oil produced at the refinery onto barges, and it also has the capability to offload crude oil for refining at the USA Petrochem refinery. On occasion the Getty marine terminal is used to load crude oil obtained from the Mobil 22-inch pipeline and from Shell's Ventura field operations.

A new onshore pipeline connecting Chevron's Carpinteria separation and treatment plant with the Mobil-Rincon plant is now ready for operation. This 10-inch pipeline will carry crude oil and will eliminate the need for tanker transport from the Carpinteria plant to a refinery in Los Angeles. A detailed discussion of this new onshore pipeline is presented in a later section of this chapter.

**PLANNING CONSIDERATIONS.** Onshore pipelines are a central element to OCS development because they connect OCS production and transport elements to onshore processing/refining facilities. In 1976, the Ventura County crude oil transportation and distribution system (i.e., pipelines, marine terminals, tanker trucks, and local refineries) accommodated approximately 60,000 barrels per day (bpd) of onshore and State tidelands production and 38,000 bpd of OCS production. Of the total 98,000 bpd in 1976, the major portion (64.4 percent) was transferred out of the County to Los Angeles through the three major pipelines (Shell, Union, and Texaco); 20.4 percent was transferred out of the County through the two marine terminals; 10.2 percent was input to local refineries; and the remaining 5.0 percent was transferred out of the County by tanker trucks.
The Ventura County pipelines currently have significant surplus capacity. Table 13 is a summary of the 1976 crude oil throughput, capacity, and surplus capacity available for each major pipeline in Ventura County. Based on table 13, future OCS production will warrant use of the Mobil 22-inch pipeline, and possibly the Phillips 10-inch pipeline, for transfer to the Ventura area.

The three major pipelines leading from Ventura to Los Angeles—the Shell, Union, and Texaco lines—have a total combined capacity of 87,000 bpd, with an unused capacity in 1976 of 31,000 bpd. The most restrictive (smallest in diameter) segment of the Texaco line, from Ventura to Fillmore, has a maximum capacity of 18,000 bpd but could be upgraded to accommodate 33,000 bpd. This would increase the total combined capacity of the three major pipelines to 102,000 bpd, with an unused capacity of approximately 46,000 bpd.

The State of California and Santa Barbara and Ventura Counties are concerned about onshore transportation of heavy crude oil. The Joint Industry/Government Pipeline Working Group (table 14) was established to determine the feasibility of crude oil transportation via land pipeline. The Santa Barbara County Department of Environmental Resources, lead agency of the Pipeline Working Group, awarded a contract to Hallanger Engineers to identify the technical problems and economic costs of various onshore alternative pipeline systems to transport crude oil from the Santa Barbara Channel onshore area to refineries in San Francisco, Los Angeles, and the mid-continent. The pipeline technical and cost study, completed in 1978, represents one element of an overall feasibility study. Other elements include tanker ing, marketing, permitting, air quality, and oil spill studies.

The Joint Industry/Government Pipeline Working Group found movement of heavy oil from Las Flores Canyon to Los Angeles by an 18-inch pipeline to be feasible from a technical standpoint. Its economic feasibility has not yet been determined.

In 1979 the price of high-sulfur, high-viscosity oil (so-called "heavy" crude oil) was decontrolled by the U.S. Department of Energy. There have been new oil discoveries in the OCS and State tidelands, and production of heavy oil is expected to increase dramatically. State policy supports oil pipelines instead of oil tankers, and sufficient oil may be produced to provide economic justification for a new heavy oil pipeline.
TABLE 13.—Crude oil pipeline use and capacity in Ventura County

(All throughput and capacity figures are approximate)

<table>
<thead>
<tr>
<th>Company</th>
<th>Size (inches)</th>
<th>Pipeline segment</th>
<th>1976 throughput (bpd)</th>
<th>Max. capacity with no modification (bpd)</th>
<th>Surplus capacity (bpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phillips</td>
<td>10</td>
<td>La Conchita to Rincon</td>
<td>5,000</td>
<td>45,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Mobil</td>
<td>22</td>
<td>Rincon to Getty Marine Terminal</td>
<td>48,000</td>
<td>170,000</td>
<td>122,000</td>
</tr>
<tr>
<td>Mobil</td>
<td>22</td>
<td>Getty Marine Terminal to Union Oil Marine Terminal</td>
<td>16,000</td>
<td>170,000</td>
<td>154,000</td>
</tr>
<tr>
<td>Mobil</td>
<td>12</td>
<td>Mobil 22&quot; line near Getty Marine Terminal to Shell/Texaco metering station Ventura Ave.</td>
<td>32,000</td>
<td>84,000</td>
<td>52,000</td>
</tr>
<tr>
<td>Union</td>
<td>8</td>
<td>Union Marine Terminal to Santa Paula pump station</td>
<td>2,000</td>
<td>24,000</td>
<td></td>
</tr>
<tr>
<td>Union</td>
<td>8</td>
<td>Santa Paula pump station to Torrey Canyon pump station</td>
<td>8,000</td>
<td>18,000</td>
<td>10,000²</td>
</tr>
<tr>
<td>Union</td>
<td>12</td>
<td>Torrey Canyon pump station to Los Angeles Basin</td>
<td>10,000</td>
<td>48,000</td>
<td></td>
</tr>
<tr>
<td>Shell</td>
<td>10</td>
<td>Shell/Texaco metering station to Somis pump station</td>
<td>33,000</td>
<td>51,000</td>
<td>17,000²</td>
</tr>
<tr>
<td>Shell</td>
<td>10</td>
<td>Somis pump station to Los Angeles Basin</td>
<td>34,000</td>
<td>51,000</td>
<td></td>
</tr>
<tr>
<td>Texaco</td>
<td>8</td>
<td>Shell/Texaco metering station to Fillmore pump station</td>
<td>13,000</td>
<td>18,000</td>
<td>5,000²</td>
</tr>
<tr>
<td>Texaco</td>
<td>8</td>
<td>Fillmore pump station to Arco &amp; Mobil pipelines at Newhall</td>
<td>17,000</td>
<td>33,000</td>
<td></td>
</tr>
<tr>
<td>Arco</td>
<td>6</td>
<td>Ojai oil production area to Texaco Fillmore pump station</td>
<td>3,000</td>
<td>3,000</td>
<td>None</td>
</tr>
</tbody>
</table>

¹ Under normal oil flow conditions assuming API 23-30 gravity oil.
² Determined by most restrictive pipeline segment.

The California State Lands Commission is investigating the economic implications of such a pipeline. One concept under study is the combination of the heavy oil to be produced in the Santa Ynez Unit with heavy oil being produced in State onshore fields in Kern County and transportation of this mixture by pipeline to Los Angeles.

The results of these feasibility studies and the Federal Government's decision to decontrol heavy oil have prompted the California Legislature to consider enacting an Oil Pipeline Evaluation Act. Currently, companies wishing to site onshore transportation facilities must make a proposal, go through the construction permit

| TABLE 14.—Joint Industry/Government Pipeline Working Group representation |
|---------------------------------------------------|---------------------------------------------------|
| **FEDERAL**                                       | **CITIZEN GROUPS**                                 |
| Environmental Protection Agency                   | Coast Watch                                       |
| U.S. Coast Guard                                  | GOO!                                               |
| U.S. Department of the Interior                   | League of Women Voters                            |
| Bureau of Land Management                         | Sierra Club                                        |
| Geological Survey                                 | University of California                          |
| OCS Field Coordinator                             | at Santa Barbara                                   |
| U.S. Forest Service                               |                                                    |
| U.S. Navy                                         |                                                    |
| **CALIFORNIA**                                   | **INDUSTRY**                                      |
| Air Resources Board                                | Aminoil                                            |
| Caltrans                                          | Arco                                               |
| Energy Commission                                 | Cabot                                              |
| Justice Department                                | Continental                                       |
| Lands Division                                    | Exxon                                              |
| Office of Planning and Research                   | Getty                                              |
| Public Utility Commission                         | Gulf                                               |
| Regional Coastal Commission                       | Marathon                                           |
| Resources Agency                                   | Mobil                                              |
| State Coastal Commission                          | Pacific Gas & Electric Company                     |
| **LOCAL**                                         | Pauley                                             |
| Carpinteria                                       | Phillips                                           |
| San Luis Obispo                                   | Shell                                              |
| Santa Barbara City                                | SOHIO                                              |
| Santa Barbara County                              | Southern California Gas Company                    |
| Air Pollution Control District                     | Southern Pacific Railroad                          |
| Board of Supervisors                              | Sun                                                |
| County Counsel                                    | Standard                                           |
| Department of Environmental Resources             | Texaco                                             |
| Petroleum Department                              | Union                                              |
| Planning Department                               |                                                    |
| Santa Maria                                       |                                                    |
| Ventura County                                    |                                                    |
| **NOTE:** For additional information, contact Dev Vrat, Santa Barbara County Department of Environmental Resources, at (805) 963-7171. |
| **SOURCE:** Joint Industry/Government Pipeline Working Group, 1979a, appendix. |
process, and conduct environmental studies as required by State and Federal law. If this bill becomes law, the State will prepare environmental studies and obtain permits for an oil pipeline from coastal Santa Barbara County and/or Kern County to Los Angeles. At the end of 2 years, the State will seek a private applicant to build and operate the pipeline. This company will reimburse the State for all costs incurred in preparing the environmental documents and obtaining permits.

In chapter 2, the issue of future development and production of heavy oil from the Santa Ynez Unit was mentioned. Ultimate production from the western Channel could be quite substantial, perhaps as much as 500 million barrels of oil (Adams, 1979, p. 3). At present, Exxon states that Platform Hondo is expected to recover 94 million barrels of oil, and that if a second platform on Hondo field were built, that platform would be expected to recover 123 million barrels of oil (Richter, 1979, p. 1-2).

Oil produced from the first Hondo platform is to be treated and stored offshore on the OS&T and then transferred to a tanker for shipment out of the Santa Barbara Channel. If a decision is made to build additional platforms and produce more oil from the western Channel in amounts that could justify the cost of an offshore pipeline, then Santa Barbara and Ventura Counties would prefer such a pipeline over tanker transportation. This preference is based on the likelihood that pipeline transport would result in lower air emissions than tanker transport and less risk of oil spills. If a western Channel offshore and onshore network of pipelines were to carry heavy crude oil directly to Los Angeles refineries, the total reduction of air emissions could be substantial. But if there were no market for the crude oil in Los Angeles and it had to be loaded onto tankers there for shipment to other markets, then the pipeline would only relocate the air emissions problem; it would not eliminate it. Thus, any environmental and economic benefits from such a pipeline might be reduced or eliminated (Joint Industry/Government Pipeline Working Group, 1979b, p. 8).

There are 20 refineries in the Southern California Region: 1 in Santa Barbara County, 2 in Ventura County, and 17 in Los Angeles County. Refineries in the region are listed in table 15. Their capacities and the types of crude oil they are designed to handle are described according to American Petroleum Institute (API) gravity and sulfur content (see sidebar).
California is a major crude oil refining state, with total refining capacity of approximately 2,500,000 bpd (Oil and Gas Journal, March 24, 1980, p. 135). About 54 percent of this capacity, roughly 1,340,000 bpd, is in Southern California.

Refineries are constructed to handle a certain range of crude oil types that are usually described by American Petroleum Institute (API) gravity and sulfur content. If the crude oil is considered heavy, (20 degrees API or below), like that of the western Santa Barbara Channel, refineries must make certain adjustments. In order for highly viscous oil to be piped, either the oil must be

<table>
<thead>
<tr>
<th>Facility location</th>
<th>Facility operator</th>
<th>Capacity (bpd)</th>
<th>API gravity required (%)</th>
<th>Sulfur limit (% weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Barbara County</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santa Maria</td>
<td>Douglas</td>
<td>9,500</td>
<td>10-12</td>
<td>5.0</td>
</tr>
<tr>
<td>Ventura County</td>
<td>Oxnard Refining</td>
<td>2,500</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>Ventura</td>
<td>USA Petrochemical</td>
<td>28,500</td>
<td>26-28</td>
<td>n.a.</td>
</tr>
<tr>
<td>Los Angeles County</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carson</td>
<td>Atlantic Richfield</td>
<td>180,000</td>
<td>10-70</td>
<td>1.3</td>
</tr>
<tr>
<td>Carson</td>
<td>Fletcher</td>
<td>30,500</td>
<td>29-36</td>
<td>0.3</td>
</tr>
<tr>
<td>Carson</td>
<td>Golden Eagle</td>
<td>16,500</td>
<td>17-40</td>
<td>1.0</td>
</tr>
<tr>
<td>Compton</td>
<td>DeMenno Resources</td>
<td>15,000</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>El Segundo</td>
<td>Chevron</td>
<td>405,000</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>Long Beach</td>
<td>Edgington</td>
<td>40,000</td>
<td>20-25</td>
<td>Any</td>
</tr>
<tr>
<td>Paramount</td>
<td>Douglas</td>
<td>46,500</td>
<td>27-31</td>
<td>2.5</td>
</tr>
<tr>
<td>Santa Fe Springs</td>
<td>Gulf</td>
<td>51,500</td>
<td>29-31</td>
<td>1.3</td>
</tr>
<tr>
<td>Santa Fe Springs</td>
<td>Powerline</td>
<td>44,120</td>
<td>25-35</td>
<td>1.5</td>
</tr>
<tr>
<td>Signal Hill</td>
<td>Eco Petroleum</td>
<td>5,600</td>
<td>18-25</td>
<td>n.a.</td>
</tr>
<tr>
<td>Signal Hill</td>
<td>MacMillan Ring-Free</td>
<td>12,200</td>
<td>20-35</td>
<td>1.5</td>
</tr>
<tr>
<td>South Gate</td>
<td>Lunday-Thagard</td>
<td>10,000</td>
<td>33-34</td>
<td>1.5</td>
</tr>
<tr>
<td>Torrance</td>
<td>Mobil</td>
<td>123,500</td>
<td>20-25</td>
<td>1.5</td>
</tr>
<tr>
<td>Wilmington</td>
<td>Champlin</td>
<td>30,400</td>
<td>17-23</td>
<td>1.5</td>
</tr>
<tr>
<td>Wilmington</td>
<td>Shell</td>
<td>108,000</td>
<td>30</td>
<td>1.0</td>
</tr>
<tr>
<td>Wilmington</td>
<td>Texaco</td>
<td>75,000</td>
<td>20-35</td>
<td>2.0</td>
</tr>
<tr>
<td>Wilmington</td>
<td>Union</td>
<td>108,000</td>
<td>18-40</td>
<td>1.8</td>
</tr>
</tbody>
</table>

heated or the oil must be cut with a lighter and less viscous petroleum product such as natural gasoline.

If the crude oil contains sulfur (i.e., is "sour"), the sulfur must be removed, either before or during the refining process. Sulfur can occur in crude oil in the form of compounds, one of which, hydrogen sulfide, can corrode pipelines and equipment. In the past, West Coast refiners have used low-sulfur foreign oil to "sweeten" their feedstocks. Few refineries in Southern California are equipped to handle crude oils with sulfur contents greater than 1.5 to 2.0 percent by weight.

PLANNING CONSIDERATIONS. The West Coast refineries' demand for crude oil from Alaska has recently increased because this source is presently cheaper than foreign oil. Some West Coast refineries have begun to modify their equipment to handle this relatively heavy and high-sulfur oil. Demand for domestic crude oil is growing in other regions also, so the glut of Alaska crude oil on the West Coast has disappeared. In fact, it was recently estimated that between 150,000 and 200,000 additional barrels of Alaska oil could be used now by West Coast refineries, if it were available (James, 1980).

A more difficult question relates to the marketing of crude oil from the western Santa Barbara Channel. Like Alaska crude oil, oil from the Hondo field is heavy and sour, with API gravity of about 18 and sulfur content of around 4 percent. Hondo-type oil is easily and cheaply refined into asphalt. There are now five asphalt refineries in Southern California (Douglas at Paramount, Newhall Refining at Newhall, Edgington at Long Beach, Lunday-Thagard at South Gate, and Oxnard Refining at Oxnard), with a combined capacity of 94,000 bpd (BLM, 1979b, p. 14; Cook and Randall, 1980, oral commun.), These refineries already have existing sources of feedstocks, and it may prove difficult to market an additional 30,000 bpd, the estimated peak production from Platform Hondo.

Exxon is considering the possibility of shipping crude oil from Platform Hondo through the Panama Canal to be refined on the Gulf Coast or the East Coast. There is also the possibility of transporting it to the company's nearest refinery at Benicia, near San Francisco, which is not currently equipped to handle Hondo-type crude. A final decision has not yet been made (Richter, 1980, oral commun.).

Since heavy oil was deregulated from certain price controls, companies capable of producing this type of crude may well desire to increase production. The desire...
to increase production will probably stimulate industry to seek other long-term solutions for processing and marketing heavy crude oil.

The State of California and the refining industry are concerned about the air quality impacts and the possible additional capital investment stemming from changes in the quantity and quality of oil and gas supplies in the future. A study was conducted jointly by the State and an industry group to investigate these issues. The purpose of the 1985 California Oil Scenario Study (Refinery Retrofit Task Force, 1980) was to facilitate understanding of the amount of additional equipment needed by California's refineries to meet estimated 1985 product demand in the face of various possible combinations of changes in crude oil and natural gas supplies and in product specifications required to meet environmental objectives. An ad hoc group of industry members contracted with Bonner & Moore Associates, Inc., an independent consultant, to create a "model" of the California refining industry and use it to examine 20 detailed scenarios. Bonner & Moore's progress was monitored by an advisory group, which included representatives of the California Governor's Office, seven State agencies, and approximately the same number of oil industry representatives (see table 16). The results of the study are estimates of the amount and types of new refining equipment that would have to be added to meet the projected product demand under each scenario and the investment costs of the new equipment. The study also provided an estimate of air pollutant emissions from combustion in furnaces and boilers associated with the new equipment.

Such an analysis is important because many believe the combination of increasingly heavier and higher-sulfur crude oil, demand shifts toward lighter petroleum products, and tighter environmental restriction on the sulfur content of products will make significant changes in California refineries a necessity. The comparisons made by the study between today's refining industry and 20 different combinations of variables for 1985 define the potential dimensions of these changes.

The year 1985 was chosen because it is close enough to encompass the traditional 5-to-7-year planning horizon used by many companies in the petroleum industry. The year 1985 is also within the time frame for long-term environmental quality and energy planning goals set by State agencies such as the Air Resources Board, the Public Utilities Commission, and the Energy Commission. While 1985 is far enough into the future that construction lead time does not create a special study constraint, it is still near enough that the forms of energy supply available
An important input to all scenarios was a forecast of the demand for refinery products in 1985. In addition, the 20 scenarios used forecasts for four events that could develop by 1985 and that would substantially affect California refinery operations. These four possible events were as follows:

- changes (both increases and decreases) in the expected availability of natural gas for industrial and electric power generation uses;
- a change (elimination of imports) in foreign crude oil import levels;
- a change (increase) in the amount of crude oil produced in California; and
- a change (becoming more stringent) in the maximum allowable sulfur content of industrial fuel oils burned in the State.

Of significance are the last three events. The possible elimination of foreign crude oil imports was considered an obvious potential event that could be precipitated by either foreign or domestic political actions. Most imported crude is of a highly desirable quality, being low in sulfur; replacements will be heavier, higher-sulfur crudes that require more extensive refining.

California crude oil production increases were studied because the State has a large potential for them. In the event that production increases are achieved by 1985, California refiners would have available more domestic crude, but of a heavier-than-average quality that requires new refining equipment.

Finally, studying the possible imposition of more stringent sulfur specifications for heavy fuel oil was important because such changes have been dictated by Government regulation in the past and may be further dictated in the future. Removing more sulfur from refinery products requires higher operating costs and more new equipment.

Most of the detailed study effort was directed toward estimating the investments (in 1978 dollars without accounting for inflation) refiners would have to make by 1985, and toward predicting the resultant furnace stack-gas emissions from the new facilities. In general, most of the future events examined—singly or in combination—would require that refiners spend more for equipment than would be necessary if today's refinery business circumstances were simply to extend unchanged to 1985. Although these added equipment investments will mean higher product costs (due to the depreciation charges for added equipment and the fuel, power, labor, and related costs that derive from operating the equipment), this study did not specifically evaluate added product costs; rather, it concentrated on the investment and emissions aspects—the two factors most likely to be considered in determining how readily and how quickly the State refining industry would respond to changing business circumstances.

The study made no single recommendation. It presented some possible pictures of the future developed by the techniques of mathematical simulation. These simulations calculated, for each scenario, what kinds of refinery processes must be built, how they should be operated, the associated investment costs, and the resultant furnace stack-gas emissions.

The study results suggest many different conclusions. The most important and clearest is that the range of uncertainty for required refinery capital investments
and for new stack-gas emissions equipment is so large that it might inhibit industry's decision-making.

Elimination of foreign crude oil imports would affect the large, complex refineries much more than the smaller, simpler refineries. This is principally because the large refiners have the most ready access to tanker-delivered crude oil and therefore process most of the State's imports. On the other hand, a change in the relative demand for fuel oil, as brought on by changes in the availability of natural gas, would affect the smaller, simpler refineries much more dramatically than the large, complex refineries. Adding further restrictions on fuel oil sulfur content would produce a similar result.

The greatest investments will be required for overcoming uncertainties surrounding the availability of foreign crude oil and natural gas supplies. Further restrictions on the sulfur content of industrial fuel oil would also require substantial new investments. Refining the expected increased volumes of new California crude oil is the future scenario that the industry can most easily assimilate.

Pipe coating yards are facilities where various coatings are applied to the outside of steel pipe to be used in a subsea pipeline. Most of the types of coatings used--mastic, asphaltic enamel, and coal tar enamel--are for protection against corrosion. Polyurethane foam may be used for thermal insulation. Large-diameter pipe must also be coated with concrete to ensure that it stays in place when laid. Some companies also favor concrete coating on smaller diameter pipe (12 inches or less) for the protection it provides against damage.

Only one facility in Southern California, the Ameron-Price Company pipe coating yard in Fontana, is actively engaged in coating pipe for OCS use. This yard has coated the pipe to be used by Shell for the proposed Beta Unit (Faulk, 1980, oral commun.). The Ameron-Price yard is about 22 hectares (55 acres) in size and currently employs about 45 people. Peak employment, however, has been as high as 130. The yard is served by the Southern Pacific Railroad.

The principal business of the facility is the coating of water pipe, which is unrelated to OCS activity, and the yard is not permanently set up for heavy concrete coating such as the Shell pipe required. For that job, portable concrete coating equipment was shipped by rail from Galveston, Texas, to Fontana. It has since been returned to Galveston but could be brought back again if there were demand for it.
Other oil companies have made other arrangements for coating pipe. For the Chevron pipeline from Platform Grace to Platform Hope, the pipe was coated in Galveston, where it was manufactured. The coated pipe was shipped by barge through the Panama Canal to Port Hueneme, where the barges were moored. The pipe was transferred directly from the barges to the supply boats: it never came ashore in Southern California (Shore, 1980, oral commun.)

There is a pipeline staging area in Ventura County just east of La Conchita. This is a 3-hectare (7-acre) site which is used only as needed. The site is separated from the beach by U.S. Route 1 and by the Southern Pacific Railroad line. Already coated pipe joints, which normally come in either 40-foot or 60-foot lengths, are welded on the site into 600-foot lengths. The welds are coated and the coating of the entire pipe is then tested for flaws. Two straight culverts run under the tracks and highway. The 600-foot lengths of pipe are pulled through the culverts and loaded onto lay barges. When this site is not being used as a pipeline staging area, it is used as a horse pasture (Gillen, 1980, oral commun.).

**PLANNING CONSIDERATIONS.** Pipe coating yards may range in size from 10 to 100 hectares (25 to 250 acres) or more. Most of this land is used for open storage. Shop space is required for pipe cleaning and the coating operations. After coating, the pipe must be tested for coating flaws. If the pipe has been coated with concrete, the concrete must be allowed to cure for a number of days.

Proximity to certain other oil- and gas-related facilities influences the decision of where a pipe coating yard should be sited. Easy access to the oil industry service base or the pipe laying firm's base of operations is particularly important, since supply boats may operate out of either one and close cooperation with the pipe-laying firm is essential.

Other factors that influence the firm's decision to site a yard near new offshore finds include the following: (1) distance between the offshore finds and existing competition, (2) ability of existing yards to meet the required delivery schedule of the oil or gas industry for the duration of the operation, (3) expected quantity of work, (4) whether subsequent lease sales can be served from the region, (5) the possibility of competitors locating nearby, and (6) access to the source of raw materials and pipe (NERBC-RALI Factbook, 1976, pp. 9.1-9.20).
Drilling and production platforms are constructed at large waterfront facilities called platform fabrication yards. Platforms may be constructed of either steel or concrete, but all the platforms off Southern California are steel. These steel platforms consist of two parts: the platform jacket (steel legs that are anchored to the seabed and rise above the water surface) and the deck (the structure that sits on the jacket and supports drilling and production equipment and living accommodations). The jacket and deck are constructed separately and need not be built at the same facility.

There are presently no platform fabrication yards in Southern California, and all the platforms in the region were fabricated elsewhere. It is not necessary for fabrication yards to be located near the site where the platforms are to be installed: the platforms can be barged long distances. Platform Hondo was fabricated in Oakland, California. Other platforms in the region have come from the Gulf of Mexico and from as far away as Malaysia. If a large number of new platforms are required in a region, it may be cheaper for a fabricator to a new yard in the region, rather than ship a large number of platforms over long distances. No fabricator has yet made that decision in the Southern California region.

**PLANNING CONSIDERATIONS.** Fabrication yards for steel platforms require cleared level land—up to several hundred hectares—directly adjacent to a channel at least 4.5 m (15 ft) deep with clear access to the sea. A platform jacket is built on its side, then rolled by dolly or rail onto barges and towed to the installation site. Storage buildings, shop space, and administrative offices are required in the fabrication yard in addition to level land. Good road access for workers and materials is a necessity, and railroad access is highly desirable. Electricity and water use are high.

Fabrication yards employ relatively large numbers of workers. A yard 200 hectares (500 acres) in size, capable of producing five or six platform jackets per year, might employ 1,500 workers. Roughly half this number would be welders and shipfitters (NERBC-RALI Factbook, 1976, p. 8.21). In general, the characteristics and requirements of a fabrication yard are similar to those of a shipyard, and platforms have, in fact, been fabricated in shipyards.

As noted in chapters 2 and 3, only three OCS leases in the Southern California Region are currently producing. Gas and oil produced from Platforms A, B, C, and Hillhouse (Dos Cuadras) are piped ashore to Rincon, in
Ventura County, for processing at the large Mobil separation and treatment facility there. Gas and oil produced from Platforms Hogan and Houchin (Carpinteria Offshore) are piped to the Phillips separation and treatment facility at La Conchita, Ventura County, which is connected to Mobil-Rincon by a 10-inch pipeline. Mobil-Rincon, in turn, is connected both with the network of pipelines linking Ventura and Los Angeles and with the Getty and Union tanker terminals in Ventura. The most recent estimates (1976) show that more than half of California's OCS oil is sent to Los Angeles by pipeline, with the remainder being shipped by tanker from the Getty and Union terminals (Joint Industry/Government Pipeline Working Group, 1979a, app. 2, p. 1). Figure 18 (p. 49) showed the locations of all the onshore facilities engaged in bringing current OCS production to market. Table 17 provides a summary of the production, movement, processing, and distribution of OCS oil and gas in Southern California.

<table>
<thead>
<tr>
<th>Unit/field</th>
<th>Originating and feeding platforms</th>
<th>Size/type of pipeline (inches)</th>
<th>Landfall</th>
<th>Facility operator function</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Ynez</td>
<td>Hondo</td>
<td>12/gas</td>
<td>Las Flores Canyon</td>
<td>POPCO/ treatment</td>
<td>Gas will enter existing transmission line.</td>
</tr>
<tr>
<td>Pitas Point</td>
<td>Pitas Point</td>
<td>12/gas</td>
<td>Carpinteria</td>
<td>POPCO/ metering</td>
<td>Gas will enter existing transmission line.</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Grace</td>
<td>12/oil, 10/gas</td>
<td>Carpinteria</td>
<td>Chevron/ separation &amp; treatment</td>
<td>Oils: 10-in line to Mobil-Rincon (under construction). Gas: will be sold to a utility, enter existing transmission line.</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>Gilda</td>
<td>12/oil, 10/gas</td>
<td>Mandalay Beach</td>
<td>Union/ separation &amp; treatment</td>
<td>Oils: 8-in line tying into Union 8-in line to Los Angeles. Gas: will be sold to a utility, enter existing transmission line.</td>
</tr>
<tr>
<td>Hueneme</td>
<td>Gina</td>
<td>15/oil and gas</td>
<td>Mandalay Beach</td>
<td>Union/ separation &amp; treatment</td>
<td>Same as above.</td>
</tr>
<tr>
<td>Beta</td>
<td>Elly, Ellen, Eureka</td>
<td>16/oil</td>
<td>Long Beach</td>
<td>Shell/ distribution</td>
<td>Oil will be metered and distributed into existing network of pipelines to various Los Angeles refineries.</td>
</tr>
</tbody>
</table>

**TABLE 17.—Existing and proposed OCS oil and gas processing and distribution in the Southern California Region**

**SOURCES:** See facility descriptions in text.
The State of California and Santa Barbara and Ventura Counties are engaged in intensive and thorough planning efforts to accommodate expected and future OCS production and to minimize its onshore impacts. Part of the expected production will be handled by surplus capacity in existing facilities, but a number of new onshore facilities are either under construction or in the permit approval process. Table 17, which summarizes the movement of existing and expected OCS production from field to market, and figure 18 indicate the location and descriptions of these new facilities.

Six Development and Production Plans have been submitted by several companies to bring expected OCS oil and gas production onshore. These are Exxon's plan for the Santa Ynez Unit, Texaco's for the Pitas Point Unit, Chevron's for the Santa Clara Unit, Union's for the Santa Clara Unit, Union's for the Hueneme Offshore field, and Shell's for the proposed Beta Unit. The offshore aspects of these plans were discussed in chapter 2.

Texaco's development of Pitas Point Unit does not require a new or expanded onshore facility. It will be discussed in a separate section.

Union's proposed development of the Santa Clara Unit and its development of the Hueneme Offshore field will be handled by the same onshore facility. The other three Development and Production Plans call for a new facility each. A total of four new onshore facilities will thus be required to handle expected production: (1) a gas treatment plant proposed for Las Flores Canyon to treat gas from the Santa Ynez Unit (Exxon and POPCO), (2) an onshore pipeline to carry Santa Clara Unit crude oil from Carpinteria to Rincon (Chevron), (3) a separation and treatment plant proposed for Mandalay Beach to separate and treat oil and gas from the Santa Clara Unit and the Hueneme Offshore field (Union), and (4) a crude oil distribution facility and supply base in Long Beach to service the proposed Beta Unit (Shell). Table 18 characterizes the new facilities and their onshore impacts. A discussion of each facility follows.

Two of the proposals for new onshore facilities have received all the necessary permit approvals, and the companies are going ahead with construction. The facilities are the onshore pipeline from Carpinteria to Rincon and the crude oil distribution facility and supply base in Long Beach.

OIL PIPELINE FROM CARPINTERIA TO RINCOn. Oil and gas produced by Chevron's Platform Grace in the Santa Clara Unit will be dewatered, cleaned, and treated
on the platform and then sent through two new pipelines to Chevron's Platform Hope, in State waters. From there the oil and gas will be sent through existing pipelines to Chevron's separation and treatment facility at Carpinteria. At present, the Carpinteria facility handles no OCS production: oil from State waters is treated there and shipped out of the area from Chevron's marine terminal in Carpinteria. When Chevron completes the new 10-inch onshore oil pipeline connecting this Carpinteria facility with the Mobil-Rincon facility in Ventura County it will be able to send oil (both State production and crude oil from the OCS) to refineries in the Los Angeles area by pipeline, thereby eliminating all the tanker traffic that now carries crude oil from Carpinteria to Los Angeles. Gas from Platform Grace will be sold to a utility and will enter an existing gas transmission line at Carpinteria.

No new onshore facilities other than the oil pipeline to Mobil-Rincon will be required for Platform Grace's production. The capacity of the pipeline will be 60,000 bpd. Current plans call for no more than 17,000 bpd to be sent through it, so it will have considerable surplus...
capacity in case of future increases in production in the area (Billeter, 1980, oral commun.).

A Development Plan for both the offshore and onshore aspects of this project has been filed with the Pacific OCS Regional Office of the USGS in Los Angeles. In addition, a detailed, four-volume Environmental Impact Report/Environmental Assessment (EIR/EA) was prepared in May 1979. This document, entitled *Chevron USA Proposed Pipeline Installation, Santa Barbara Channel*, fulfills the National Environmental Policy Act (NEPA) requirements of the Federal Government and the California Environmental Quality Act (CEQA) requirements of the State. The EIR/EA was prepared by the U.S. Geological Survey, the U.S. Army Corps of Engineers, the Santa Barbara County Department of Environmental Resources, and the California Coastal Commission, with technical assistance from Woodward-Clyde Consultants and others. The Development Plan and the EIR/EA, on file for public information in the Los Angeles USGS office, are required for OCS lease development.

The EIR/EA considers the potential effects of the installation of an oil and gas pipeline from Platform Grace to Platform Hope and of the 10-inch onshore oil pipeline from Carpinteria to Mobil-Rincon. Land use, air quality, geology and seismology, oceanography, hydrology and water quality, biology, socioeconomics, and cultural resources are addressed in the report.

The land requirements of the onshore pipeline will be slight: a 15-m (50-ft) working area during construction, and a permanent right-of-way 7.5 m (25 ft) wide. For the 10-km (6-mi) length of the pipeline, this totals roughly 7 hectares (18 acres). For the most part, roughly 95 percent of its distance, the pipeline follows the Southern Pacific railroad bed and existing roads.

In considering air quality, while there will be some short-term effects associated with pipeline construction, the more general effect on air quality will be to improve it, since construction of the pipeline will eliminate the need for tanker loading in Carpinteria. The emissions resulting from tanker loading are significantly greater than the emissions resulting from the electric pumps used to move oil through the pipeline.

The report estimates that a work force of 50 will be required during construction and concludes that this number of workers is available locally and would involve no relocation. No new personnel would be required for pipeline operation: the effect on housing and the demand for public services is thus considered negligible (Santa
The report considers a number of potential physical effects of the pipeline. It calculates the possibility of an oil spill at one spill in 180 years. As is the case with air quality, the pipeline can be considered more of a beneficial measure than a source of negative effects because it presents less risk of an oil spill than the tanker traffic from Carpinteria that it will replace. Other effects considered relate to geology and seismology, hydrology and water quality, biology, and cultural resources. None were seen as representing problems serious enough to prevent the project from going forward.

Chevron expects the onshore pipeline to be completed and the first production from Platform Grace to begin around July 1, 1980.

CRUDE OIL DISTRIBUTION FACILITY AND SUPPLY BASE IN LONG BEACH. The oil produced from Platforms Ellen and Eureka, in the proposed Beta Unit, will be dewatered and cleaned on Platform Elly and sent through a 16-inch pipeline to the Port of Long Beach. Three km (2 mi) of new onshore pipeline will be required to take the oil from landfall to a new distribution facility, from which the oil will be distributed through existing pipelines to various Los Angeles refineries. The distribution facility, 0.4 hectare (1 acre) in area, will contain pumps, meters, and a 10,000-bbl surge tank. Twenty persons will be employed during construction. When this facility begins operating, it will have one permanent employee who will monitor its operation. It is designed to function unattended. Supplies and work crews for the offshore platforms will be moved through a 1.2-hectare (3-acre) supply base and dock in the Port of Long Beach. This is an existing facility that Shell is upgrading (Faulk, 1980, oral commun.).

A Development Plan for both the offshore and onshore aspects of this project has been filed with the Pacific OCS Regional Office of the U.S. Geological Survey in Los Angeles. In addition, a detailed, four-volume Environmental Impact Report/Environmental Assessment was prepared on December 1, 1978, by the U.S. Geological Survey, the State Lands Commission, and the Port of Long Beach, with technical assistance from Westec Services, Inc. This document fulfills the NEPA requirements of the Federal government and the CEQA requirements of the State. These documents are on file for public information in the Los Angeles USGS office.
The EIR/EA considers the potential effects of the onshore and offshore facilities and the measures necessary to mitigate negative effects. It examines potential impacts of the project in terms of geotechnical considerations, onshore hydrology, air quality, oceanography and water quality, biological impacts, and socioeconomic impacts.

Among the most pressing issues in the Long Beach area is that of air quality. During construction of the crude oil distribution facility, the major pollutant will be nitrogen oxides (NO\textsubscript{x}). However, the expected increase over current Los Angeles County emissions is only 0.01 percent, and the report concludes that this is insignificant in terms of the current regional levels. During construction onshore, fugitive dust emissions will occur, but they will be mitigated by water spray. Exhaust from workers' automobiles will result in increases in carbon monoxide (CO), NO\textsubscript{x}, and hydrocarbon emissions, but these will be short-term and of limited impact. The report finds that during the operational phase, concentrations of nitrogen dioxide will be well within allowable standards, that sulfur dioxide emissions will create "no adverse impact," that concentrations of particulates and CO will be insignificant on shore, and that emissions of hydrocarbons will be within allowable limits. Shell will use Best Available Control Technology (BACT). If necessary, Shell and its co-lessees will be able to reduce emissions from their own facilities to offset the increases from the Beta field facilities.

Oil spills are another important concern addressed by the report. It concludes that there is a possibility of a significant oil spill from the offshore platforms or the pipeline, but that the probability is low. If a sizable spill occurred, it is likely that the oil would reach shore if containment and cleaning were not highly effective. The Pacific OCS Orders issued by the USGS, which the study quotes (USGS and others, 1978, v. I, p. VII-IX), are designed to reduce the possibility of an oil spill.

Related to the question of oil spills is the issue of shipping conflicts and marine traffic. This is of particular importance to the proposed Beta Unit project because the platforms will be located within the traffic separation zone of the Gulf of Santa Catalina shipping lanes. Approximately nine ships per day use these lanes. The report calculates that the annual risk of collision of a large ship with any of the platforms is 0.0046, equivalent to one collision every 217 years. Measures being taken to minimize this risk include navigation aids and distinctive
Facilities awaiting permit approval

color and markings on the platforms and placement of the platforms no less than 500 m (1,600 ft) from the shipping lanes. The possibility of damage to the pipeline by shipping will be mitigated by burial of the pipeline in the harbor area.

The EIR/EA also considers the economic and demographic effects of the Beta project. The platforms were fabricated in Malaysia and Japan; therefore, this labor-intensive activity had no effects on Southern California. The labor force in the local area will reach a peak in the construction, site preparation, and platform installation phases. The report expects a total direct employment of 360 persons, although the maximum at any one time would be only 220. Assuming secondary employment of 430, this would be a total of 790 new jobs. Assuming that all these jobs would be filled by workers moving into the area, the maximum possible population increase would be 1,900, or 0.03 percent of the current Los Angeles and Orange County population. Effects on regional income and public services are on a similar scale, except that police services may be required for traffic control during the construction phase.

In the EIR/EA, it was planned that work crews on the platforms would be moved through a small launch site in Huntington Harbor, just south of Long Beach. Shell has since changed its plans and will move both supplies and crews through the Port of Long Beach (Faulk, 1980, oral commun.)

Jackets for both Platforms Ellen and Elly have been installed, and platform construction is being completed. Production is scheduled to begin in the first quarter of 1981. After the construction phase has been completed, total employment, both onshore and offshore, for the Beta field will be about 150 persons. Six months after production has begun from Ellen and Elly, Shell will make a decision as to whether to begin fabrication of Platform Eureka. If the company decides to proceed, the platform is expected to be installed in the second half of 1983 (Faulk, 1980, oral commun.).

Chevron is also considering installing Platform Edith in the proposed Beta Unit. If Edith is installed, its oil will probably be cleaned on the platform and then sent to Platform Elly to be piped ashore. However, Chevron has not yet submitted a Development Plan for Platform Edith to the USGS.

Two of the proposed onshore facilities required to handle new OCS oil and gas production are still in the permit approval stage. These facilities are a gas
treatment plant at Las Flores Canyon and a separation and treatment facility at Mandalay Beach.

GAS TREATMENT PLANT AT LAS FLORES CANYON. The gas produced by Exxon's Platform Hondo will be sold at the platform to the Pacific Offshore Pipeline Company (POPCO), which plans to send it through a 12-inch pipeline to the proposed gas treatment plant at Las Flores Canyon, part of the Corral Canyon area in Santa Barbara County. POPCO, a wholly-owned subsidiary of Pacific Lighting Company, is leasing from Exxon a 6-hectare (15-acre) site for the plant approximately 2 km (1.3 mi) inland from the coast. Permits are being sought for a plant capacity of 60 million cubic feet of gas per day, although initially the plant will handle only 30 million cubic feet per day, the expected daily peak production of gas from Platform Hondo. Natural gas liquids and sulfur are to be removed from the gas at the plant and sold. The treated gas will be sent through a 12-inch pipeline back along the same right-of-way as the incoming pipeline to an existing gas transmission line that runs along the coast.

The pace of development of the Santa Ynez Unit, of which the Hondo field is a part, has been slow because the project has been surrounded by controversy and litigation. In August 1979 a Federal appellate court ruling that the U.S. Department of the Interior rather than the Environmental Protection Agency had jurisdiction for regulating air emissions on the OCS removed the last Federal barrier to the project. More recently, in February 1980, Exxon signed a Memorandum of Agreement (MOA) with the State of California, Santa Barbara County, and the Santa Barbara Air Pollution Control District that air emission control equipment would be installed on the OS&T. This equipment consists of a vapor balance line, a Claus sulfur recovery unit, and a water injection system to reduce emissions of nitrogen oxides from the OS&T's gas turbines. These measures satisfy the State and County with regard to Hondo's air emissions. In return, the State and County will exert every effort to complete expeditiously the decisions on all permits and approvals for POPCO's gas treatment plant.

Exxon owns a total of 600 hectares (1,500 acres) in the Corral Canyon area, and all parties to the MOA concur that this area is an appropriate location for onshore facilities required for future western Channel oil and gas developments. The area is zoned as a Planned Manufacturing (PM) district. Exxon is willing, depending on its own development needs, to allow others to use the site for oil- and gas-related activities (Memorandum of Agreement, 1980, p. 2).
The Santa Ynez EIS was one of four EIS's written by the USGS on OCS operations. The others were Oil and gas development in the Santa Barbara Channel Outer Continental Shelf off California (1976), Exploratory drilling in the Santa Barbara Channel (1971), and Proposed installation of Platforms "C" and Henry (1971). These documents are on file in the Pacific OCS Regional Office of the USGS in Los Angeles.

Development of the Santa Ynez Unit has been the subject of careful scrutiny. In 1971, Exxon filed a Development Plan with the Pacific OCS Regional Office of the USGS in Los Angeles. Exxon's plan is the most extensive ever filed by an OCS lessee. In 1974, the USGS completed a three-volume EIS on the Proposed plan of development, Santa Ynez Unit, Santa Barbara Channel.

The EIS on the Santa Ynez Unit Development Plan considers the potential impacts of both the offshore and onshore aspects of the project. At the time the EIS was written, Exxon proposed to treat both gas and oil at its onshore facility, and the EIS evaluated this proposal. The EIS considered the impacts of the entire project on water quality, air quality, commercial fishing, benthic organisms, bottom sediments, beaches and shoreline recreation, wildlife, archeological and cultural resources, human safety, and shipping traffic. The most severe impacts were found to be those associated with a major oil spill. The impacts of the onshore facility on air quality were found to be relatively minor, and impacts on employment and regional income were found to be beneficial (U.S. Department of the Interior, Geological Survey, 1974, p. III-207).

In October 1974, the Santa Barbara County Office of Environmental Quality commissioned a two-volume Environmental Impact Report (EIR) for the onshore facility. As in the EIS, it was assumed in the EIR that the facility would handle both gas and oil. The EIR considered potential impacts relating to geology, air quality, hydrology, ambient noise, fauna and flora, oil spills, land use, transportation, historical and archeological features, population economics, and esthetics. Like the EIS, the EIR concluded that the most serious potential impact would be presented by an oil spill. Because the facility will not be handling oil, this is no longer an issue. Projected air emissions were not expected to exceed standards. The additional truck traffic involved in moving the sulfur and natural gas liquids to market in Los Angeles was found to be insignificant. No appreciable changes in the County's population or the demand for housing or public services were anticipated. New property tax revenues were expected to represent roughly 1 percent of the total county levy for the preceding year (Santa Barbara County Office of Environmental Quality, 1974, v. I, p. 9-16).

Approximately 24 persons are now working on Platform Hondo as development drilling proceeds. Exxon plans to install its OS&T and to begin production by April 1, 1981. When production begins, the Hondo work force will increase to 68 persons. Of these, about 20 will be roustabouts expected to be hired locally. Of the remainder, not all are expected to move into the Santa Barbara
area since platform workers will work 7 days on and 7
days off and can thus commute long distances (Hutchin­
son, 1980, oral commun.). Until the gas treatment plant is
operating, Exxon will re-inject gas into the formation.
POPCO hopes to get County approval on its construction
permit and approval from the Santa Barbara Air Pollu­tion
Control District (APCD) so that it can construct the plant
in time to begin operation in the first quarter of 1982
(Pospishil, 1980, oral commun.).

**SEPARATION AND TREATMENT FACILITY AT
MANDALAY BEACH.** Union plans to pipe the oil and gas
produced from Platform Gilda in the Santa Clara Unit and
Platform Gina in the Hueneme Offshore field to a pro­
posed separation and treatment facility in Ventura
County. The company's preferred plan is for this facility
to occupy a 0.6-hectare (1.5-acre) site immediately adja­
cent to Southern California Edison's Mandalay Beach
power plant. Three alternative sites in the Oxnard area
are also under consideration (Gillen, 1980, oral commun.).
Using the Mandalay Beach site would require an amend­
ment to the City of Oxnard's general plan, which has
established a planned industrial area some miles away.

Oil and gas will come from the platforms through a
12-inch oil and water line and a 10-inch gas line from Gilda
and a 10-inch oil and gas line from Gina. Original plans
called for waste heat from the steam plant to be used in
treating the oil, but Southern California Edison now plans
to change the Mandalay Beach Steam Station from a
baseload plant to a peaking plant, which would not provide
a constant source of heat for oil treatment (Gillen, 1980,
oral commun.).

The gas produced from Platforms Gilda and Gina
will be cleaned, treated, and sold to a utility. This may
require the construction of a short segment of onshore
pipeline to tie into the existing gas transmission system,
but this segment would be no longer than 180 m (600 ft).
The oil will be sent through a new 4-km (2.5-mi) segment
of onshore pipeline that will cross the Santa Clara River
and tie into Union's existing pipeline between Ventura and
Santa Paula, from which the oil will continue on to Torrey
Canyon and then into Los Angeles. This new segment is
expected to be 8 inches in diameter.

Development Plans and accompanying Environmen­tal
Reports covering Union's development of its portion of
the Santa Clara Unit and of the Hueneme Offshore field
have been filed with the Pacific OCS Regional Office of
the USGS in Los Angeles. These plans and reports
conclude that the impact of the platforms and the pro­
posed separation and treatment facility on ambient air
quality will be very small. The labor force required to
DEVELOPMENT AND PRODUCTION PLANS NOT REQUIRING NEW ONSHORE FACILITIES

Development of the Pitas Point Unit

operate and monitor the operation of the proposed platforms and onshore facility can be met from within Union's present local labor force, so no impacts on population, housing, or public services are expected.

An EIR/EA is currently being prepared by the City of Oxnard, the U.S. Geological Survey, the State Lands Commission, the U.S. Army Corps of Engineers, the South Central Coastal Commission, and Ventura County, with technical assistance from Dames & Moore. This EIR/EA is expected to be out in May 1980, and a public information copy will be on file with the USGS Regional Office. The EIR/EA will closely examine the suitability of the Mandalay Beach site, as well as the three alternative sites and various pipeline configurations.

Platforms Gilda and Gina are now being fabricated in Japan. They are scheduled to be installed at the end of 1980, with the first production taking place in the late winter or early spring of 1981 (Gillen, 1980, oral commun.).

Of the current proposals for development and production of oil and gas from the Southern California OCS, one proposal will require no new or expanded onshore facilities: Texaco's development of a gas field in the Pitas Point Unit. Texaco will treat the gas to pipeline quality on its Pitas Point Platform and will send it through a 12-inch pipeline to Carpinteria, where it will be metered and will enter a Southern California Gas Company transmission line. Peak daily production will be approximately 60 million cubic feet of gas per day.

A Development Plan and accompanying Environmental Report for both the offshore and onshore aspects of this project have been filed with the Pacific OCS Regional Office of the USGS in Los Angeles. A copy of each is on file for public information in the Los Angeles office. The Environmental Report estimates that the part of the necessary labor force that cannot be filled by present Texaco employees will be hired from the local labor market, with the exception of five persons who will be brought in from outside the area.

Texaco hopes to go out for bids on fabrication of the Pitas Point Platform in April 1980. The company does not know where the platform might be fabricated, but it has had platforms built both in Oakland and in Seattle, Washington. Texaco expects to install the platform in late 1981 and begin drilling shortly thereafter. Drilling will continue for 3 years, with production expected to begin in the last quarter of 1981 (McCann, 1980, oral commun.).
An EIR/EA will be prepared on the project in accordance with the NEPA requirements of the Federal Government and the CEQA requirements of the State. Santa Barbara County has been designated the State lead agency. Other participating agencies will be the U.S. Geological Survey, the U.S. Bureau of Land Management, the U.S. Army Corps of Engineers, the California Coastal Commission, and the City of Carpinteria.

Chapters 1 through 4 of this initial Pacific Summary Report provide California and other interested parties with up-to-date planning information concerning offshore and onshore OCS oil and gas activities. The Outer Continental Shelf Oil and Gas Information Program (OCSIP) concludes that current and future OCS oil and gas exploration, development, and production in Southern California will have implications for offshore transportation and onshore facility siting. However, because of the long lead times required for planning and constructing new OCS-related facilities, it is unlikely that any additional platforms, pipelines, or onshore facilities other than those described in this Summary Report will affect Southern California during the next 6 to 12 months.

As noted in chapters 2 through 4, onshore effects from OCS oil and gas activities often vary due to the nature of the resources being produced (gas or heavy oil), the economic and technical aspects of transportation planning, and the onshore facilities necessary to process and distribute the oil and gas. Issues related to specific sites of oil and gas activity, both onshore and offshore, were identified.

During numerous consultation meetings with State and local planners, the OCSIP staff noted additional issues worthy of mention but not appropriate for inclusion in the body of the report as structurally specified in 30 CFR 252.4. These additional issues could affect magnitude and timing of development, transportation planning, and onshore facility siting in Southern California. Issues identified are as follows: (1) air quality regulations, (2) coastal management and Federal consistency, (3) the Channel Islands National Park, (4) proposed Lease Sale 53, and (5) proposed Lease Sale 68. These issues are discussed in appendix E.

Information presented in this report will be updated in 6 months by a memorandum. It should be noted that exploratory drilling now taking place in the Region could result in a major discovery at any time. If such an event should occur, causing reserve estimates to be substantially revised, a new Summary Report will be produced.
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Appendix A.
The Geologic Setting

Hydrocarbons are formed within the upper part of the earth's crust. Through the actions of heat and pressure, deposited organic matter is transformed into various mixtures of crude oil and natural gas. The time between deposition of organic material and the formation of hydrocarbons is on the order of millions of years (Tissot and Welte, 1978, p. 198).

The occurrence of hydrocarbon accumulations depends on many factors: (1) an adequate thickness of sedimentary rocks; (2) the presence of source beds (rocks containing relatively large amounts of organic matter); (3) a suitable environment for maturation of the organic matter into oil and/or gas; (4) porous and permeable reservoir rocks; (5) hydrodynamic conditions permitting the migration of hydrocarbons and their ultimate entrapment in reservoir rocks; (6) a thermal history that favors production and preservation of hydrocarbons in the area; (7) formation of adequate geologic traps for accumulation of the hydrocarbons; and (8) suitable timing of petroleum generation and migration to ensure the entrapment and preservation of the hydrocarbons (Miller and others, 1975, p.17).

In a prospective hydrocarbon province, geologists look for structural or stratigraphic traps, in which oil and gas can accumulate. Structural traps include anticlines, sediments draped over salt diapirs and other dome-like intrusions, and fault traps. Examples of stratigraphic traps are reefs and the truncated edges of porous strata. Traps may also be formed by a combination of structural and stratigraphic elements.
THE SOUTHERN CALIFORNIA OUTER CONTINENTAL SHELF

The Southern California OCS lies offshore from the structurally complex part of California that includes the Transverse Ranges province and the Peninsular Ranges province (see fig. 2). The geologic evolution of the OCS is attributed to tectonic instability of the continental margin along the boundary between the Pacific and North American plates. A network of ridge-and-basin structures developed as a result of right-lateral shear, which began along the plate boundary about 30 million years (m.y.) ago. Rapid erosion of the ridges and thick accumulation of sediment in the basins, accompanied by volcanism, began about 20 m.y. ago. Subsequent deformation in response to continued right shear, which resulted in the formation of local zones of folds and faults, began about 12 m.y. ago and is continuing today (Vedder and others, 1976, p.5).

The OCS is divided into two areas: the Santa Barbara Channel, and the basins and banks of the Borderland area to the south of it.

Santa Barbara Channel

The Santa Barbara Channel is located in the Transverse Ranges province, a diverse geologic terrain within which the predominant topographic and structural trends are oriented nearly east-west. At the eastern end of the province, the San Andreas fault system obliquely intersects the east-west structural grain. In the vicinity of the Channel, the Santa Ynez Mountains form the northern margin of the province. The Santa Monica Mountains and their seaward extension, the Channel Islands, form the southern margin. The most pronounced structures in the Transverse Ranges province are east-west faults and folds (e.g., the Santa Ynez fault, Santa Ynez Mountains, Rincon trend, Santa Ynez trend, and Montalvo trend).

Strata in the Santa Barbara Channel area range in age from early Cretaceous to Holocene and overlie, or are faulted against, basement rock that is chiefly pre-Cretaceous in age. The Cretaceous succession is 7,000 to 10,000 m (22,900 to 32,800 ft) thick in places, and the Cenozoic succession may be as much as 10,000 m (32,800 ft) thick in the northeastern part of the Channel. The distribution of basement rock in the Channel is not known but probably comprises rocks similar to the Franciscan complex in the northern portion and granitic and metamorphic crystalline rocks similar to those that outcrop in the Santa Monica Mountains. The data concerning precise thickness of the Tertiary and older rocks are equivocal, as the basement horizon has not been delineated. Stratigraphic thickness and sedimentology of these rocks are
inferred from on-land exposures in contiguous areas and from well data, both offshore and onshore.

In general, thick deep-sea clastic fan deposits comprise the Cretaceous and early Tertiary section. Late Eocene and Oligocene rocks are either nonmarine or shallow marine sands, silts, and shales. With deepening marine conditions, early Miocene rocks are generally marine shales and silts, with some sands. Middle Miocene rocks locally include volcanic rocks: Tranquillon volcanic rocks to the north and Santa Cruz Island volcanic rocks to the south. Late Miocene and Pliocene rocks are generally organic-rich mudstone, with increasing amounts of sand and silt in the younger section. A very thick sequence of alternating turbidite sand and mudstone is present in the eastern part of the Santa Barbara Channel. This sequence becomes thinner and more finely grained (siltier) toward the southwest (BLM, 1979b, p.56-57).

In terms of petroleum geology, the Santa Barbara Channel is the seaward extension of the Ventura basin, which is a major producer of onshore oil and gas. Over half of all production in the basin has come from the Rincon trend, an anticlinal feature more than 40 km (25 mi) long that includes the Ventura field on the east and the Dos Cuadras Offshore field in the west. (See fig. 8.) Most of the production from this structural trend comes from turbidite sandstone reservoirs of early and middle Pliocene age. The thickest and most productive Pliocene turbidite reservoirs occur in the eastern and northeastern parts of the Channel, in the Dos Cuadras field, and to the east. While production is planned from Pliocene reservoirs south of the Rincon trend, these sandstone zones thin rapidly to the southwest and may be poor prospects in the central and western parts of the Channel.

Reservoirs that produce from beneath the Oxnard Plain east of the Channel, chiefly sandstone beds in the nonmarine Sespe Formation of Oligocene age, are also potential reservoirs offshore, in the eastern end of the Channel. Other possible reservoirs are early Miocene sandstone zones, fractured fine-grained rocks of the Monterey Formation, and post-late Miocene sandstone zones. Eocene and older sandstone zones are probably also present.

In the Central Deep part of the Channel and to the west, potential reservoirs are expected to be similar to the late Miocene or older reservoirs in the Santa Ynez Unit. Fractured fine-grained rocks of the middle and late Miocene Monterey Formation comprise the main reservoir in the unit. Middle Miocene sandstones are also potential reservoirs, but indicated production potential to date from these is relatively minor.
When present, the early Miocene Vaqueros Formation usually is a significant sandstone reservoir in the Santa Barbara Channel. This transgression sandstone is generally relatively thin, but it is the main reservoir in most of the onshore and offshore fields along the northern coast of the Santa Barbara Channel. Additional production is planned from equivalent reservoirs in the southeastern part of the Channel. Oligocene sediments consist of nonmarine Sespe sandstones and shales in the east, which grade westward into a shallow marine facies. Potentially high-quality reservoirs may exist in either the marine or nonmarine sandstones. Production has occurred in numerous fields from these Oligocene reservoirs. Eocene and late Cretaceous turbidite sandstones are common in the Santa Barbara Channel. While intergranular porosity and permeability may be reduced, the presence of mobile fluids such as gas and high gravity liquids, as well as fracturing, may make these sandstones potential reservoirs.

The main source rocks are believed to be the fine-grained Miocene and early Pliocene sediments that are buried deeply enough over most of the basin to have become thermally mature. (Vedder and others, 1976, p. 21-24).

The Southern California Borderland has relatively uniform basin and ridge geomorphology. Within the area, there are 19 major topographic basins with water depths ranging from 400 to 3,000 m (1,300 to 9,840 ft). The structure of the basins and banks of the eastern Borderland is complex. Some folds near the mainland coast along the seaward extension of the Newport-Inglewood fault zone are comparatively small and steep-flanked, with faults occurring both as zones of en echelon breaks and as single traces. Other folds are large anticlinal structures, such as Coronado Bank, that are broad and nearly symmetrical, but little is known about their development. In general, the large anticlines trend northwest at angles oblique to the major fault zones, and at places they seem to be arranged en echelon. Several are very large and symmetrical and have low dips on their flanks.

The western part of the Borderland is diverse, both in terms of kinds of faulting and age of faults. The dominant trend is north-west, but there are zones where the faulting is east-west. The ages of movement include pre-Pliocene, but more commonly they are Pliocene and Quaternary. Pre-middle Miocene thrust faults are inferred in the basement rocks of Santa Catalina Island.
The distribution of rock units in the Borderland falls within three generalized terrains. The boundaries of these terrains are probably complex fault systems.

Within the eastern terrain, the strata include a high-pressure/low temperature basement rock (Catalina Schist) that is intruded by Miocene plutonic rocks and overlain by volcanic rocks. Overlying or buttressing these rock types are younger, late Mesozoic and Cenozoic clastic rocks.

Within the central terrain, the basement rock is unknown except for the basic plutonic rocks and greenstones of Santa Cruz Island. These rocks may be remnants of an ophiolite complex similar to that inferred to underlie the Great Valley Sequence of central and northern California. Cretaceous to Eocene rocks are locally overlain by marine and nonmarine Oligocene rocks, Miocene volcanic and sedimentary rocks, and younger clastic rocks.

The western geological terrain extends to the Patton Escarpment. Here the basement rock complex seems to bear similarities to the Coastal Belt facies of the Franciscan Complex (zeolite-bearing arenite and local ultramafic blocks). The occurrence and distribution of late Mesozoic and early Cenozoic sediments in this terrain are unknown. Early Miocene and younger clastic rocks fill sedimentary basins capping the older rocks (BLM, 1979b, p. 57-58).

Because there has been less exploratory drilling there, the petroleum geology of the Borderland is not as well understood as that of Santa Barbara Channel. Most Borderland drilling has been in the San Pedro Bay area, south of Los Angeles and Long Beach, and on the Tanner and Cortes Ridges south of San Nicholas Island. This area is an extension of the Los Angeles basin, the largest and most petroleum-productive of the California coastal basins, whose source of oil is believed to be the thick, organically rich Miocene and Pliocene strata that extend throughout much of it. Production occurs offshore in all or parts of six fields in the Los Angeles basin (exclusive of the Beta field). Four of these fields are located in the San Pedro Bay area. Production here is from deep-water turbidite sandstone sequences with a net sand thickness that may exceed 305 m (1,000 ft). All the large fields in the Los Angeles basin are structural traps, either anticlinal or homoclinal against major faults, and many are situated along regional structural highs such as the Newport-Inglewood trend. Some drilling in Santa Monica Bay suggests a thinning and shaling-out of these rocks in that area.
In the outer Borderland area, seaward of the Channel Islands, the deep stratigraphic test well at Cortes Bank and other recent exploratory wells have provided data that seem to suggest the presence of potential reservoirs. Deep-marine sandstone units here of Eocene, Oligocene, and early Miocene age have good porosities and are thick enough to be considered good potential reservoir rocks. Potential source rocks occur in strata of late Eocene and Miocene age. Organic matter in all analyzed Tertiary rocks is immature, but, if they were buried deep enough to have been subjected to high temperatures, the same rocks might have generated petroleum in adjacent basins. Upper Cretaceous strata are more than 1,500 m (5,000 ft) thick in the well at Cortes Bank, but reservoir-quality rocks are present only in the upper part, and the source-rock potential is low. The lower 900 m (3,000 ft) of section in the well, below an unconformity within the upper Cretaceous strata, was found to contain small amounts of mature organic matter. The distribution of potential reservoir sandstones seaward from Cortes Bank is uncertain (Vedder and others, 1976, p. 22-25).
Appendix B. Estimating Oil and Gas Resources

Before exploratory drilling, both the Federal Government and industry undertake analyses of geological basins to determine their oil and gas potential. The Government uses different methods of analysis depending on the purpose of the estimate and the availability and level of detail of the data. The database for resource estimation is regularly updated with new geologic and geophysical information, and as more data for a given area are gathered, processed, analyzed, and interpreted, the resource estimate is updated to reflect them.

Prior to a lease sale, the process of estimating the amount of oil and gas in a potential reservoir or lease sale area involves a high degree of uncertainty. The USGS makes these pre-sale estimates for a variety of purposes. Regionwide estimates are used to aid in the preparation of proposed lease sale schedules. More specific resource estimates are made for the lands tentatively selected to be offered for lease. Later estimates are made on a tract-by-tract basis to establish a dollar value for each tract offered. However, it should be reemphasized that estimates of undiscovered resources are extremely uncertain. The existence of resources cannot be confirmed until an area has been thoroughly explored by drilling.

In the early stages of exploration, when only gross interpretations of regional geology are possible, it is necessary to use expert judgment based on these minimal amounts of data to make resource estimates. As more data become available, the resource estimates and the methods used become more refined. When data are abundant and detailed, the choice of method used depends on the availability of the estimator's time and the purpose...
of the resource estimate. The quality of the estimate, however, depends on the quality of the geological and geophysical data and of the studies upon which it is based.

A number of estimation techniques are available for making regionwide or basin resource estimates. For an area that has not been extensively drilled, the most useful group of techniques may be classified as the volumetric-yield methods. In these methods, the volume of potentially hydrocarbon-producing rocks is calculated, and a yield of oil and/or gas based on known yields from geologically analogous basins or regions is derived. Other methods, more useful in regions that have experienced extensive exploratory drilling, are performance or behavioristic extrapolation methods. In these, various indices of past performance such as discovery rates, cumulative production, and productive capacity are fitted by various mathematical derivations into logistic or growth curves that are then projected into the future. In addition to these, more sophisticated methods involving geological, engineering, and statistical models may be used (Miller and others, 1975, p. 18).

Each tract selected for leasing for exploration and development of oil and gas resources must be evaluated prior to the lease sale. After the lease sale, resource estimates are periodically updated.

Resource evaluations of tracts consist of three parts: a geophysical and geological evaluation of potentially recoverable resources in possible hydrocarbon-bearing structures and stratigraphic traps underlying the tract; an assessment of the risk that, for whatever reason, hydrocarbons are not, in fact, present in the quantities foreseen by the geologic evaluation; and an engineering and economic evaluation of the monetary value of those resources, taking the assessed risk into account.

Data used for resource estimation are seismic records, well data, other geologic data, and production histories from wells and fields in or near the sale area. In the case of frontier areas, the drilling and production histories of geologically analogous petroleum-producing basins and fields are substituted. Once an area has been leased and exploratory drilling has commenced, the result of drilling may allow updating of resource estimates. Changes in exploratory drilling and production techniques and costs may also necessitate reevaluation.

The tract-specific resource estimates are derived by using a Monte Carlo discounted cash flow computer
program. In this program, geologic, engineering, and economic information is used to calculate recoverable resources and an economic value of the resources for each tract. Some parameters, such as tract size, are entered as fixed values. Others, such as pay thickness and production rates, are given a range of values. Each variable is assigned a range of possible values. The program then randomly selects values for each variable and combines them with the fixed parameters to calculate a resource estimate and economic value. The process is run many times, and eventually a mean resource estimate and economic value are determined.

A "risk factor" is used to discount the mean resource estimate. The risk factor represents the probability that a particular trap will not contain hydrocarbons in the quantities predicted by the geologic evaluation. The risk factor is a subjective appraisal by a geologist, geophysicist, and engineer based on the data available to them. It is determined through a knowledge of an area's (or an analogous area's) exploration history, together with an assessment of how strongly the data indicate the presence of a trap, of source rocks, and of other elements that make a good prospect.

Reserves are the portion of identified resources that can be economically extracted (Miller and others, 1975, p. 8). The techniques available for estimating reserves are similar to those used in making resource estimates, only in the case of reserves they are more refined and are based on more information.

In volumetric estimation of reserves, the bulk volume of a reservoir can be calculated from interpretation of seismic data and information gained by drilling. Porosity of the rock and the relative amounts of oil, gas, and water in its pore spaces can be interpreted from borehole logs and analyses of cores.

For reservoirs in which some production has taken place, the decline-curve method may also be used. In this method, future production is estimated by extrapolating plots of actual production rates and fluid percentages into the future. By adding past production to predicted future production, an estimate of original reserves can be obtained (Bird, 1980, p. 3-4).
Appendix C.
Intergovernmental Planning Program of the Bureau of Land Management

The Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities (IPP) was implemented to provide a formal coordination and planning mechanism for three major OCS program elements administered by the Bureau of Land Management (BLM). These elements are the Leasing Process, the Environmental Studies Program, and Transportation Planning. The latter element, Transportation Planning, was discussed in chapter 3. The other two elements will be presented in this appendix.

In each of the six OCS leasing regions, IPP establishes a Regional Technical Working Group (RTWG) Committee and, if a marketable discovery of oil or gas is made, a State Technical Working Group. The RTWG Committees are one of three types of committees comprising the National OCS Advisory Board.

The OCS Advisory Board provides advice to the Secretary of the Interior and to other offices in the Department of the Interior in the performance of discretionary functions of the OCS Lands Act as amended (43 U.S.C. 1331 et. seq.), including all aspects of leasing, exploration, development, and production of the resources of the outer continental shelf. The organization of the National OCS Advisory Board and its reporting structure are presented in figure 19.

Through the accumulation and evaluation of information, the Regional Technical Working Group provides guidance to the BLM and information to other bureaus within the Department of the Interior. Each RTWG is composed of representatives of the participating States, the BLM, the Fish and Wildlife Service, the Coast Guard, the Geological Survey, the Environmental Protection
Agency, the National Oceanic and Atmospheric Administration, the petroleum industry, and other special and private interests that exist in a leasing region. Every RTWG is co-chaired by a State representative, who is elected by all the State representatives on the group, and by a BLM employee. The State representative's term of service is determined by all the State representatives on the group.

The Pacific RTWG first met on October 30, 1979, in Los Angeles, California. The meeting familiarized RTWG
members with the organizational structures of the Department of the Interior, the Bureau of Land Management, its Outer Continental Shelf offices, and the BLM oil and gas leasing program; and the organization and functions of the National OCS Advisory Board and its component committees.

The second meeting of the Pacific RTWG took place on December 6 and 7, 1979, in Norfolk, Virginia, when the National OCS Advisory Board met in full session. The RTWG members discussed the preliminary draft of BLM's 1981 Environmental Studies Plan for the California area. They were provided with an overview of OCS leasing and development in the Pacific Region and an analysis of Union's Development and Production Plans for the Hueneme Offshore field. The Department of Energy's participation in the IPP was also discussed.

On the second day of the meeting in Norfolk, the BLM representatives outlined tasks to be addressed by the Pacific RTWG members, clarified funding responsibilities and RTWG recommendations as they apply to onshore transportation issues, and finished the meeting with a presentation of the RTWG in relation to the OCS bidding system.

The third RTWG meeting was held in Los Angeles, California, on March 27 and 28, 1980. The following topics were covered: transportation options and corridor siting criteria in California; the proposed Lease Sale 53 Draft Environmental Statement; the proposed Five-year Leasing Schedule; the 1981-1982 Regional Environmental Studies Plan; and tract selection for proposed Lease Sale 68. The current membership of the Pacific RTWG was given in table 12.

The three IPP activities identified above—leasing, environmental studies, and transportation planning—are interdependent. For ease of description, each is treated here as a separate component of the planning process, and they are discussed in greater detail in the following sections.

The leasing of OCS lands sets in motion a process that can affect interests at local, state, regional, and national levels. Many decisions are made in that process that determine the manner in which development will take place. The Leasing Process has been divided into four phases, discussed below and shown in figure 20.
FIGURE 20.—Relationship of the OCS oil and gas leasing process to the IPP (Rodgers, 1979).
Phase I

The objective of the BLM's Leasing Process efforts during Phase I is to assist in coordinating all activities leading up to a lease sale decision. This phase begins prior to the Call for Nominations and terminates with the Sale Decision. Most activities in Phase I concern the exchange and assessment of information for tract selection. Information needs related to the later preparation of Regional Study Plans and Transportation Management Plans are also a part of this Phase.

Phase I can last about 2 years. It is completed by the time of a sale decision. Lease Sale 53, tentatively scheduled for May 1981 and Lease Sale 68, tentatively scheduled for June 1982, are in the early stages of Phase I.

Phase II

Phase II of the IPP Leasing Process is formally implemented with the publication of the Proposed Notice of Sale in the Federal Register. During this Phase, each RTWG recommends site-specific and generic studies that should be included in a Regional Study Plan to be drawn up during Phase III. Other Federal, State, or local agencies may also identify and fund OCS-related studies independently of the IPP leasing process.

Phase II should be completed by the time a discovery of commercial quantities of oil and/or gas is made. Lease Sales 48 and 53 are currently in Phase II of IPP planning.

Phase III

Phase III of the IPP Leasing Process begins with the announcement of a discovery of hydrocarbons in marketable quantities in the region. At this time, a State Technical Working Group is formed to refine potential transportation corridors. The State Technical Working Group includes all Federal and private members of the RTWG as well as the State representatives of the affected States. Lease Sale 35 is in Phase III.

During Phase IV, a Regional Transportation Management Plan is developed. Phase IV begins as soon as transportation studies are complete and should either precede or coincide with the first Development Plan.

Phase IV

The Leasing Process is a long-range planning effort. While its actual timing varies from region to region, the estimated minimum time for completion of the four phases of the process is approximately 4½ to 5 years. However, the process could conceivably take as long as 9 years (BLM, 1979). Figure 20 shows the relationship between the Leasing Process, a Regional Technical Working Group, and a State Working Group. A summary of the OCS Leasing Process and its relations to the OCS Field Office and OCS Field Office IPP action is presented in table 19.
### TABLE 19.—The OCS Leasing Process

<table>
<thead>
<tr>
<th>OCS Lease Program activity</th>
<th>OCS Field Office action</th>
<th>OCS Field Office IPP action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of Call outlined</td>
<td>Letter to Federal and State Agencies.</td>
<td>IPP working group has an opportunity to review the Area of Call and to provide comments on any aspect of the area to BLM.</td>
</tr>
<tr>
<td>Resource Reports requested, received, and analyzed</td>
<td>2974 meeting with GS.</td>
<td>IPP working group has an opportunity to listen to and view the resource portrayals and to make its own recommendations on blocks to be deleted and those to be included for further consideration.</td>
</tr>
<tr>
<td>Call for Nominations and Comments issued</td>
<td>Notice of Call sent to the Federal Register. Nominations comments sent to BLM WO, GS, and OCS office.</td>
<td>IPP working group has an opportunity to listen to and view the resource portrayals and to make its own recommendations on blocks to be deleted and those to be included for further consideration.</td>
</tr>
<tr>
<td>Resource Portrayals for Tentative Tract Selection</td>
<td>EA and Operations staff prepare resource portrayals as one of four inputs to tract selection. Other inputs are: (1) resource estimates from GS, (2) nominations from industry, and (3) comments from concerned individuals, organizations, and governmental agencies.</td>
<td>IPP working group has an opportunity to listen to and view the resource portrayals and to make its own recommendations on blocks to be deleted and those to be included for further consideration.</td>
</tr>
<tr>
<td>Joint Tract Selection Meeting</td>
<td>2974 meeting to develop joint recommendations for tentative tract selection.</td>
<td>IPP working group has an opportunity to act as a &quot;technical public&quot; in identifying issues that need addressing in the EIS process, and to develop alternatives to the proposal.</td>
</tr>
<tr>
<td>Tentative Tract Selection</td>
<td>Joint tract selection memo prepared for transmittal to WO.</td>
<td>IPP working group has an opportunity to act as a &quot;technical public&quot; in identifying issues that need addressing in the EIS process, and to develop alternatives to the proposal.</td>
</tr>
<tr>
<td>Scoping</td>
<td>Meetings held and responses solicited from various publics, including communities adjacent to or affected by the proposed sale to solicit a listing of critical issues to be discussed in the EIS process, and to develop alternatives to the proposal.</td>
<td>IPP working group has an opportunity to act as a &quot;technical public&quot; in identifying issues that need addressing in the EIS process, and to develop alternatives to the proposal.</td>
</tr>
<tr>
<td>Development of Petroleum Development Scenarios for use in the EIS</td>
<td>BLM letter to GS asking for information on resources, the timing of resource development, methods and modes of OCS exploration and production, possible facility sites and facility types, pipelines if necessary, support activities, and locations and oil spill cleanup capability. BLM develops tentative scenarios for the EIS on which subsequent impacts are based. This includes the proposal as well as alternatives.</td>
<td>IPP working group has an opportunity to be involved in early planning stages by assisting in developing the scenarios. Important time to utilize local ad hoc members. Recommendations based on local CZM plans, land use and land status, and the most current information available. In addition, a look at what information is not available and what additional information will be needed. Recommendations could be in the form of potential facility sites needing further study as well as possible corridor routes.</td>
</tr>
<tr>
<td>Oil Spill Risk Analysis Model (OSRAM)</td>
<td>Letter from BLM to GS requesting that the OSRAM be run.</td>
<td>IPP may be contacted as a group or as individuals to support/assist in EIS preparation and review throughout.</td>
</tr>
<tr>
<td>Draft Environmental Impact Statement (DEIS)</td>
<td>Preparations of DEIS by EA with input from operations and studies.</td>
<td>IPP working group has an opportunity to comment on the proposed mitigation measures designed to reduce or eliminate problems that may occur when a lease area is developed, and on other aspects of the DEIS.</td>
</tr>
<tr>
<td>Review of DEIS</td>
<td>Public hearings held.</td>
<td>IPP working group has an opportunity to comment on the proposed mitigation measures designed to reduce or eliminate problems that may occur when a lease area is developed, and on other aspects of the DEIS.</td>
</tr>
<tr>
<td>Final Environmental Impact Statement</td>
<td>Rewrite based on comments.</td>
<td>IPP working group has an opportunity to comment on the proposed mitigation measures designed to reduce or eliminate problems that may occur when a lease area is developed, and on other aspects of the DEIS.</td>
</tr>
</tbody>
</table>
ENVIRONMENTAL STUDIES PROGRAM

The BLM's Environmental Studies Program was initiated in 1973 by the Secretary of the Interior through a commitment to perform investigations of certain environmental features of the Gulf of Mexico. From its original budget of $0.5 million for studies in the Gulf, the program has expanded to include the outer continental shelf of the entire United States. The program's budget during the past few years has averaged $35 million annually. The program was formalized in Section 20 of the Outer Continental Lands Act Amendments of 1978 (P.L. 95-372), which requires the Secretary to conduct a study of any area or region included in any oil and gas lease sale in order to establish information needed for assessment of the human, marine, and coastal environments of the outer continental shelf and the coastal areas that may be affected by oil and gas development there.

The Environmental Studies Program is currently included under the direction of the Bureau's Assistant Director, Energy and Mineral Resources. As of June 2, 1980, this position will be held by Dr. Irwin White. The program consists of an environmental studies group in each of the Bureau's OCS offices (New York, New Orleans, Los Angeles, and Anchorage) and the Branch of Offshore Studies in Washington, D.C. The OCS offices and the Washington office have different functions in the program. The OCS offices have the responsibility for developing statements of regional study needs (Regional Study Plans), preparing statements of work, and monitoring contractor performance on all approved regional studies. The Branch of Offshore Studies in Washington has the
overall management, planning, and budgeting responsibility for the studies program. The Chief of the Branch of Offshore Studies is responsible for the technical adequacy of the program and its component studies. The Branch of Offshore Studies prepares program guidance for the OCS offices to use in the preparation of Regional Study Plans, establishes national priorities, compiles the National Study Plan, and manages studies that are applicable to more than one leasing region.

The normal process of defining the National Study Plan usually begins with the Branch of Offshore Studies, through the Assistant Director, establishing the schedule for the OCS offices to prepare Regional Study Plans. These plans include statements of regional study needs, the regional perspective on the priorities of these needs, and a brief description of each proposed study. The Branch of Offshore Studies reviews draft Regional Study Plans from all four OCS offices for programmatic consistency, cost, use of ranking criteria, and relevance to issues of national interest, and the OCS offices revise their respective study plans accordingly. Following the submission of final study plans, the Branch of Offshore Studies compiles a preliminary National Study List.

The total cost of all studies nominated for funding during any fiscal year has historically exceeded available funds. As a result of this, the BLM devised a set of ranking criteria to establish the priority of studies on the National Study List. The current ranking criteria, developed jointly by the Bureau and the Office of Management and Budget, are as follows:

- importance of the information to the decision-maker;
- date of the decision for which the study is designed;
- generic applicability of results or techniques from the study;
- status of the information; and
- applicability of the study to issues of regional or programmatic concern.

Each proposed study is ranked by the nominating OCS office using these five criteria. The Branch of Offshore Studies then reviews each OCS office's use of the criteria and prepares a preliminary National Study List from the Regional Study Plans. The Branch may revise the regional priorities when the criteria are not
properly applied. The resulting list of studies is reviewed and approved by all four OCS managers, and then submitted to the Assistant Director for formal approval. Upon the Assistant Director's approval, each OCS office is formally notified of its list of approved studies and its studies allocation. Each OCS office then provides Washington with a schedule for procurement of the approved studies.

The OCS offices are required to procure the studies on the approved studies list unless a proposed change is approved by the BLM's Assistant Director. This permits the OCS offices to respond to unanticipated study needs that arise between compilation of study plans, and it also ensures the continuity of program initiatives.

The RTWG Committees are also involved in the development of regional study programs. These groups are involved in the determination of issues that require study and their importance to regional decision-makers. They may become involved in ranking the candidate studies using the BLM's criteria. The Working Groups review the draft Regional Study Plan. They are briefed on the status of regional studies on the national list and may be involved in preparing the final draft of the Regional Study Plans. The Working Groups are advised of studies that are approved for funding, and they compile the plans for the following year's Regional Study Plan based upon this information. The Working Groups may also be involved in the design of approved studies. This involvement may include suggesting study techniques, defining critical products and the schedule of their delivery, establishing the study scope, and suggesting an appropriate level of funding.

The environmental studies of the IPP are reviewed by the Scientific Committee of the OCS Advisory Board. This committee has the responsibility to review the appropriateness, feasibility, and scientific merit of the program's component studies. The committee may comment on any study in the program, including those nominated by the RTWG's. The Scientific Committee may institute a change in any study's scope, techniques, or cost. Unlike the regional groups, the Scientific Committee has access to any technical and management information critical to its function.

The current structure of the Environmental Studies Program is complex. It contains checks and balances designed to support both regional and national needs. Although the system is still in an evolutionary phase, the results to date are encouraging.
The IPP's third element, Transportation Planning, was discussed in chapter 3. Together the three elements—the Leasing Process, Environmental Studies, and Transportation Planning—make up the entire Intergovernmental Planning Program for OCS Oil and Gas Leasing, Transportation and Related Facilities. Members of the Pacific RTWG will be actively involved in each element, providing input and participation at specified steps in the process.
Appendix D.
Federal, State, and Local Studies

FEDERAL STUDIES

Bureau of Land Management

The Pacific OCS Office of the U.S. Department of the Interior, Bureau of Land Management, carries on an Environmental Studies Program to provide information for the OCS minerals management decision-making process. Appendix C describes this program. A number of studies of the Pacific OCS off Southern California are under way or have already been completed, and additional studies are planned for fiscal years 1980 and 1981. These are listed below. Some of the studies were conducted by other agencies within the DOI as a part of the BLM's Environmental Studies Program.

Completed Studies


In three volumes, this report presents the findings of a comprehensive literature survey to identify the available information on the Southern California Bight (the Southern California Region). The report describes the physical, biological, and socioeconomic environment of the Region and identifies data gaps in the body of information existing at the time of the survey. A master bibliography is included at the end of each volume.


The report presents the findings of a geological and geophysical survey of the Tanner and Cortes Banks off Southern California.

Southern California Academy of Sciences, 1975, Proceedings—recommendations for baseline research in Southern California relative to offshore resource development: Los Angeles, Calif. Available from Pacific OCS Office, 1340 West Sixth Street, Los Angeles, CA 90017, $4.00.

This publication presents the proceedings of a BLM-sponsored conference/workshop that developed recommendations for scientific studies.
of the OCS. It describes the views and attitudes of the Southern California scientific community. The proposed recommendations included a strong concern for a well-managed, coordinated, and cost-effective baseline studies program. Additional concern focused on the need to provide an integrated scientific program, including all pertinent disciplines, to study the area of the Southern California Bight from Point Conception to the U.S.-Mexico boundary and seaward 160 km (100 mi).


This document assesses the potential air quality impact of oil and gas development activities related to Lease Sale 48 off Southern California. Air quality levels are calculated through diffusion modeling within two defined scenarios: (1) all transport conducted by tanker/barge and (2) the combination of tanker/barge and pipeline movement. Impacts resulting from possible accidents such as spills and blowouts are also modeled, along with projected air quality levels during the estimated year of peak production.


This search of published and unpublished literature documents issues related to the preservation of the archeological and cultural resources associated with OCS Lease Sales 35 and 48. It includes file data concerning total cultural resources, related geology and geomorphology of the Late Quaternary Period, and the paleontological resources of the study area. Significant cultural and paleontological data gaps are also identified and discussed. Volume II (appendices) contains a master bibliography, prehistoric terrestrial and underwater site data, and a glossary of archeological, geological, and nautical terms.

The report presents the findings of a study of rocky intertidal, sandy beach, slough, and subtidal biological habitats to determine community composition, biogeographical and seasonal variation, and community recovery. It delineates kelp bed distributions and their seasonal variation for the shallow areas along the mainland coast and around the offshore islands; presents sediment and biota samples from mainland, island, and subtidal sites for selected trace metal and hydrocarbon characteristics; and describes geographical patterns, seasonal variations and intra-site variations. The innovative approaches necessary to conduct this study made significant advances in chemical and biological methodology and interpretation.


This study presents the findings of an investigation of bottom sediment transportation in the San Pedro Shelf. It also models sediment transport paths and fluxes from the continental shelf.

University of California, 1978, Final report: first year marine mammal and seabird study, Southern California: Santa Cruz, Calif. 3 vols., approximately 1,500 p. Available from NTIS, 5285 Port Royal Road, Springfield, VA 22161, vol. II, $12.00 (PB295931/AS); vol. III, book 1, $15.00 (PB295932/AS); vol. III, book 2, $11.75 (PB295933/AS); vol. III, book 3, $14.50 (PB295934/AS); complete set, $50.00 (PB295930/AS).

Volume I of this three-volume report is an executive summary of the first year of a three-year study of the marine mammals and seabirds of the Southern California Bight. Volume II synthesizes the significant findings of the first-year study and presents an overview of the study area, the species present, and the oil/animal interface. The movements, seasonality, and reproductive status of the marine mammals and seabirds are also discussed. Volume III consists of three books of Principal Investigators' Reports. Book one details pinnipeds, cetacea, and parasites. Book two describes seabirds, and book three contains the appendices and literature citations for Volume III.
This study characterizes the biota communities' composition, sedimentological characterization, and related trace metal and hydrocarbon concentrations for locations within or adjacent to leased or the then proposed Lease 48 tracts.


This report presents the results of the third year of the intertidal study of the Southern California Bight.


This report presents the findings of a biological and geological reconnaissance and characterization survey of the Tanner and Cortes Banks.

**Ongoing Studies**


This study will result in the development of a productive computer model to analyze the dispersion of formation water discharges from an oil platform.


The study consists of an aerial survey of the intertidal biological habitats along the Southern California mainland.


This report is a compilation of aerial flight and cruise reports. The results of data analysis for this study are presented in the third year final report, described below.


The report details the findings of the second and third year of the marine mammal and seabird study. It also presents a summary of the findings of the first year of the study (described in the first section above).


This study involved a geological and geophysical survey along portions of the Southern California Bight shelf and offshore ridges. It complements the earlier work over the Tanner and Cortes Banks and furthers the knowledge about geological hazards.

The primary purpose of this study is to identify and derive data which will enhance the quality of subsequent air quality modeling and oil spill trajectory efforts. The study includes a climatology and oceanographic analysis of the California Pacific OCS.


The purpose of this study is to analyze the potential offshore and onshore space use conflicts between the commercial and sports fishing industry and the OCS oil and gas industry on the East and West Coasts.


The purpose of this study is to determine the effects of oil upon the behavior and physiology of cetaceans. The New York OCS office will also coordinate a study on the effects of OCS-induced sound upon cetaceans, which will be conducted by the U.S. Navy through an interagency agreement.

FY 1980 Studies in Procurement

Southern California air quality trajectory model.

Southern California air quality model validation study.

California seabird-oil spill behavior study.

California commercial and sports fish oil toxicity study.

Study Topics Proposed for FY 1981 Funding

Air quality trajectory modeling and evaluation of major impacts for various sale development scenarios (Sale 73).

Santa Barbara Channel circulation study.

California seabird-oil spill behavior study, year II.

Santa Barbara Channel marine mammal and seabird risk analysis.

California commercial and sport fish study, year II.

Recreational usage and aesthetic impacts from offshore oil and gas development in Southern California.

Southern California geohazard risk assessment.

Fish and Wildlife Service


This report presents an overview of the status of offshore oil and gas activities and impacts for the State of California. It is organized into five major sections: past and present OCS production, OCS development and future potential, effects on living resources, socioeconomic impacts, and regional information analysis. The report is one of five regional status
reports sponsored by the U.S. Fish and Wildlife Service, Office of Biological Services.

Environmental Protection Agency


The report presents the findings of a study undertaken for the purpose of evaluating the risk of oil spills and the costs associated with alternative modes of transporting oil from the Sale 35 leasing area to onshore facilities in Southern California. The objective of the study was to assess oil transport risks and costs for specific hypothetical production sites in order to provide policymakers with appropriate development options.

From an economic perspective, the results of the study are as follows: for the Santa Rosa-Cortes North site, the shallow-water pipeline is the least costly alternative at both the high and low estimates of reserves; for the Santa Barbara-Santa Catalina site, the pipeline alternative is the most cost-effective alternative at both the high and low estimates of reserves; and for the Santa Rosa-Cortes South site, the tanker is the most cost-effective at both the low and high estimates of reserves.

Other Studies


Ecomar, Inc., conducted a monitoring program from January through March 1977 for the Shell Oil Company, which was seeking a permit to drill on lease OCS P-0277. The study was designed to determine the fate and potential effects of discharged drill mud and cuttings resulting from typical offshore exploratory drilling. The Bureau of Land Management required Shell to perform this study because Shell bid on a tract in the Tanner Bank that had been designated a "unique biological area," where lease operations are subject to stipulations prohibiting discharges of drill mud and cuttings. As a result of this study, the Bureau of Land Management waived the no discharge stipulation.

STATE STUDIES


The report presents a detailed study of specific effects of OCS oil and gas development in Southern California. It examines localized adverse effects and recommends changes in existing Federal, State, and local institutional arrangements that would lessen or eliminate those effects. The report also examines the potential for development and makes recommendations concerning Lease Sale 48.


The purpose of this study is to estimate what changes will be required in California refineries between now and 1985 for twenty different scenarios. Using 1978 as the base year, the study assumes changes in crude supply (heavy California crude, Alaska North Slope crude, and light, sweet foreign crude), changes in demand for petroleum products, and changes in
environmental specifications for petroleum products. Three kinds of results are generated for each scenario: types of equipment required, capital investment required, and the resulting emissions from the equipment required. The refining industry is disaggregated into toppers, hydroskimmers, and complex refiners.

LOCAL STUDIES

The Coastal Energy Impact Program (CEIP), administered by the Office of Coastal Zone Management within the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce, provides Federal loans and grants to help coastal states plan for and mitigate or prevent the adverse effects of coastal energy development, including OCS-related energy development. The California Coastal Commission is the agency responsible for allocating these Federal funds to finance projects around the State. The Commission has awarded CEIP grants to the projects described below. For information regarding any of these studies, contact the California Coastal Commission, 631 Howard Street, San Francisco, CA 94105.

**Resources (Consultants in Resource Management Policy), 1978, Santa Barbara Channel marine sanctuary management information: Venice, Calif.**

This report was prepared for the County of Santa Barbara Department of Environmental Resources. It is an expanded version of the Santa Barbara Channel Marine Sanctuary Nomination by Santa Barbara County, California. The report contains information on the following values for which the Channel has been nominated: geophysical characteristics, uniqueness, habitats, species, recreation, and research. In addition, the report presents information on the threats and potentials for damage from ongoing and proposed projects, which include OCS oil and gas activities. The data described in the report are intended for use in the environmental assessment of the sanctuary designation and for the design of a management program.

**City of Huntington Beach, Department of Planning and Environmental Resources, 1979, Local coastal plan (LCP) energy section.**

This project augmented the LCP by adding an Energy Section that evaluates the environmental impacts of energy development, reviews plans for expansion of energy facilities, and amplifies the land use plan with respect to energy.

**City of Laguna Beach, Planning Department, 1979, Oil spill contingency planning.**

The City of Laguna Beach developed an interagency task force to define the roles of local agencies for participation in potential oil spill events occurring off Orange County due to OCS drilling and tanker traffic.

**City of San Buenaventura, 1979, Local coastal plan (LCP) energy section.**

This project undertook an energy siting and impact analysis of existing and potential local energy facilities such as the Santa Barbara Channel pipeline under consideration, its potential effect on two local terminals, and the proposed Union oil processing facility at Oxnard.

**County of San Diego, Air Pollution Control District, 1979, OCS air quality impacts study.**

The purpose of this project was to evaluate air quality impacts of offshore energy development and to integrate these findings with local and
regional air quality, coastal zone, and other land use planning efforts. Regarded as a model program, this study has been used by State and local government agencies in evaluating impacts of the San Diego coastline leases during the Lease Sale 48 review process. It is also used in developing standardized methodologies for determining air emission factors for OCS facilities and activities and in developing an accurate regional oxidant model for predicting emission levels.

County of San Luis Obispo, Planning Department, 1979, Local coastal plan (LCP) energy section.

In conjunction with the LCP, this project encompassed two major activities: an inventory of existing and anticipated energy facilities and facility sites, and an evaluation of social, economic, and environmental factors associated with existing and potential energy development.

County of Santa Barbara, Department of Environmental Resources, 1979, Air quality maintenance plan, Channel oil operations impacts.

The project involved projecting offshore air emissions resulting from OCS development and from tanker traffic and incorporating these projections into the draft Air Quality Maintenance Plan (AQMP).

County of Santa Barbara, Department of Environmental Resources, 1979, Channel monitoring network.

The purpose of the project was to analyze existing and proposed monitoring networks that provide air and water quality data on the Santa Barbara Channel.

County of Santa Barbara, Planning Department, 1979, Local coastal plan (LCP) energy section.

The Santa Barbara County Planning Department completed a land use plan on energy facility siting. The grant was augmented for site-specific follow-up studies.

Joint Industry/Government Pipeline Working Group, May 1979, Santa Barbara Channel onshore oil pipeline feasibility study, draft report.

The report presented the findings of a two-year study to determine the feasibility of a proposed onshore pipeline to transport Santa Barbara Channel crude oil production to a refining facility. It addressed the transportation of crude oil from the eastern and western portions of the Channel.

Because this report included policy recommendations extending beyond the "feasibility determination" charge of the Pipeline Working Group, it has been withdrawn.

Joint Industry/Government Pipeline Working Group, October 1979, Santa Barbara Channel onshore oil pipeline finding of technical feasibility.

This document established the technical feasibility of constructing a land pipeline from Santa Barbara to refineries in the Los Angeles area. It replaced the earlier draft report (May 1979).

Based on speculated production profiles, crude oil characteristics, and information developed by Hallanger Engineers and the Pipeline Working Group, the Working Group found that a land pipeline to carry 117,300 bpd, at peak production levels, of heavy and
light crude to Los Angeles is technically feasible; a land pipeline to carry 44,000 bpd peak production from Las Flores Canyon and Elwood to Rincon, where it would join the existing pipeline system to Los Angeles, is technically feasible; and interim tanker transportation should be continued using improved control technologies as available. The document also recommends that a continuing effort be made toward tanker vapor recovery systems.

County of Ventura, Air Pollution Control District, 1979, OCS air quality impact assessment.

The purposes of this project were to evaluate the impacts on air quality of the alternative means for transporting oil from the Santa Barbara Channel and to provide data for the County's Air Quality Maintenance Plan. Already contributing to air quality analysis for the Joint Industry/Government Pipeline Working Group, the project included an analysis of air quality impacts associated with the development of OCS leases in the Santa Barbara Channel.

California Maritime Academy, 1980, Tanker oil transfer simulator.

The purpose of this project was to provide needed technical improvements to the California Maritime Academy's Tanker Cargo and Ballast Operations Simulator, a pilot training program now in operation at the Academy's Vallejo campus. Since the simulator trains tanker officers responsible for petroleum, transfer operators, the improvements should result in safer oil and ballast transfer operations.

County of Los Angeles, Department of Beaches, 1980, Oil spill contingency planning.

The objective of this project was to protect coastal resources by defining measures that could be taken by the County to increase oil spill response effectiveness.

Port of Long Beach, Harbor Department, Risk management plan (Phase I), completion expected December 1979.

This project was instituted to develop a plan and implementation mechanism to improve safety in the Port of Long Beach.

City of Los Angeles, Harbor Department, Safety enhancement study (Phase I), completion was expected March 1980.

The Los Angeles Harbor Department is studying the means for improving safety in the Port.

City of Redondo Beach, Planning Department, Local coastal plan (LCP) energy section, completion expected April 1980.

This project focuses on the industrial development and energy facilities element in the LCP: specifically, on analysis of impacts from a local power generation plant and its potential expansion.

City of Los Angeles, Harbor Department, Energy terminal study, completion expected June 1980.

The purpose of this project is to develop plans for an outer harbor energy terminal to consolidate present and future petroleum berths. The energy facility inventory work will be integrated with the work of the Safety
Enhancement Program to provide a sound data base for future plans and decisions.

City of Port Hueneme/Oxnard Harbor District, Coastal energy development plan, completion expected June 1980.

The purpose of the project is to develop specific plans to resolve critical land use conflicts and issues affecting the future development of Port Hueneme and Oxnard Harbor District.

County of Los Angeles, Santa Catalina resource management plan, completion expected June 1980.

The purpose of the project is to prepare a resource management plan to protect, enhance, and manage the island's natural resources and to respond to increasing recreational demands there. This small, primarily undeveloped island provides major recreational opportunities for the highly urbanized Los Angeles area and is located 32 km (20 mi) west of San Pedro Bay and the Ports of Long Beach and Los Angeles, where the bulk of California and foreign oil is transported and refined.

County of Santa Barbara, Guadalupe Dunes resource inventory, completion expected June 1980.

The objective of this project is to provide adequate information for a resource management plan for Guadalupe Dunes that would assure compatibility of anticipated energy development with this valuable coastal resource area. The project will become part of the local coastal program.

County of Santa Barbara, Air Pollution Control District, Channel air quality monitoring, completion expected June 1980.

This project establishes an air quality monitoring station at El Capitan State Beach to collect baseline measurements of air pollutants, particularly in western Santa Barbara Channel, and to monitor air emissions associated with Exxon's Platform Hondo and its proposed offshore oil storage and treating facility.

County of Ventura, Air Pollution Control District, Air monitoring of OCS activity, completion expected June 1980.

This project will establish an offshore air quality monitoring station on Anacapa Island to provide direct meteorological and air emissions baseline measurements in the eastern Santa Barbara Channel, as well as measurements of expected emission increases due to expanded OCS lease development and tanker activity.


The purposes of this project are to carry out a comprehensive planning and impact assessment program for coastal energy development; to integrate and coordinate existing and proposed energy planning elements into land use element plans; and to improve energy facility siting decisions. Three major work tasks performed during the first year have been Lease Sale 48 participation, impact analysis of a new and expanded power plant at Ormond Beach, and impact analysis of development of existing OCS leases in the Santa Barbara Channel.


The purpose of this project is to investigate a public trust boundary determination in areas where existing or potential energy facilities are or could
be located. This information is needed for power plant and oil and gas facility siting and for the mitigation of resulting impacts in LCPS. The areas to be investigated include Elkhorn Slough, Morro Bay, Goleta Slough, Carpinteria, El Estero, Ballona and Cerritos Wetland, Santa Ana River Mouth, Agua Hedionda Lagoon, and Tia Juana Estuary.

**County of Ventura, Air Pollution Control District, Air quality impact of OCS oil development on Ventura County, completion expected October 1980.**

The objective of this project is to determine the impact of OCS development activities on the air quality control strategy set forth in the County's Air Quality Management Plan. The project will also provide documentation for air quality analysis of OCS exploration or development and production plans as part of the consistency determinations to be made by the Coastal Commission.

**National Maritime Research Center, Risk management program for Santa Barbara Channel, completion expected October 1980.**

This project involves the development of a cooperative program for minimizing the potential adverse effects of an increased number of offshore oil platforms and drilling rigs in terms of continued large vessel traffic through the Channel. The output of the risk management program will be the specific identification of mitigation hardware and operational procedures necessary or recommended for the Channel or for vessels using the Channel.

**State of California Lands Commission, Assessment and delineation of oil and gas seeps in the Santa Barbara Channel, completion expected February 1981.**

The purpose of this study is to identify the nature and extent of oil and gas seeps in the Santa Barbara Channel. The major objective of the project is to provide sufficient verified physical data upon which engineering considerations and designs may be based to confine each seep at its source and to facilitate the transportation and processing of gathered oil and gas through existing or new offshore and onshore facilities.

**Port of Long Beach, Harbor Department, Risk management plan (Phase II), completion expected February 1981.**

This study represents the second phase of the two preceding studies. The purposes of the study are to assess the risks and safety problems associated with petroleum products and other hazardous materials identified during the first phases and to develop strategies and techniques to minimize those risks.

**State of California Lands Commission, Pipeline feasibility study, completion expected November 1980.**

The purpose of this study is to assess the needs for new intrastate pipelines for offshore and Kern County oil production.
Appendix E.
Other OCS–Related Planning Issues

The U.S. Geological Survey has issued final national air quality regulations for oil and gas and sulfur operations in the OCS (Federal Register, March 7, 1980). Under these regulations, all Exploration Plans and Development and Production Plans submitted on or after June 2, 1980, must include the information required to make air quality findings. The Director may also review any Exploration Plan or Development and Production Plan submitted or approved prior to June 2, 1980, to determine whether any facility should be subject to an air quality review if the facility has the potential to significantly affect the air quality of an onshore area. In making this determination, the Director must consider the distance of the facility from shore, the size of the facility, the number and operational status of air pollution sources planned for the facility and the air quality status of the onshore area.

State and local officials in California are concerned that cumulative air quality impacts of OCS development might hinder their efforts to meet air quality standards. Because of this concern, the Geological Survey also issued proposed air quality rules in the March 7, 1980, Federal Register that incorporate a separate set of exemption formulas and significance levels for application to OCS facilities located in areas adjacent to the State of California. Comments and recommendations regarding the more stringent air quality standards for California were requested by June 20.

The California Coastal Commission (CCC) has recently adopted a resolution concerning offshore activities subject to National Pollutant Discharge Elimination System (NPDES) regulation of the U.S. Environmental Protection Agency. It was resolved that discharges that occur during exploratory drilling more than 1,000 m (3,300
ft) beyond the 3-statute-mile limit will not measurably affect California's coastal zone. Under the conditions described above, the CCC will not require submission of a certification of consistency with California's CZM program by NPDES applicants, nor will it require subsequent consistency review by the Commission.

Another matter involving consistency was the mediation effort undertaken by the Secretary of Commerce to resolve a serious disagreement that the CCC has with the Department of the Interior (DOI) regarding consistency and DOI's OCS prelease activities. The Coastal Zone Management Act (CZMA) provides that Federal agencies conducting or supporting activities "directly affecting" the coastal zone of a State must conduct or support those activities in a manner that is, to the maximum extent practicable, consistent with approved State management programs (Sec. 307(c)(1)). As with any other Federal activity, the DOI is required by CZMA Federal consistency regulations to conduct an assessment of its OCS prelease activities.

For Lease Sale 48, the DOI's analysis led to the conclusion that OCS prelease activities did not directly affect the coastal zone and that no consistency determination was required. The CCC took the position that certain activities conducted prior to the OCS lease sale, including selection of tracts to be offered and choice of lease stipulations, directly affected the State's coastal zone and therefore required a determination of consistency with California's CZM program.

These diverse positions on OCS prelease activities were subsequently addressed under the Department of Commerce's mediation procedures as set forth in 15 CFR 930.110. On February 27, 1980, the Secretary of Commerce determined that the mediation effort had failed to resolve the disagreement. As a separate action, the Secretary requested that the National Oceanic and Atmospheric Administration (NOAA), through rulemaking, clarify the term "directly affecting" (Klutznick, 1980, p. 2-3).

This action by the Secretary of Commerce complemented an interagency agreement made in late January 1980 in developing the Administration's bill to amend the Coastal Zone Management Act. The agreement is that the Office of Management and Budget will oversee interagency review of NOAA's rulemaking to define the term "directly affecting." How this new definition will affect the outcome of this disagreement and the consistency issue for future lease sales is not known at present.
On March 5, 1980, President Carter signed Public Law 96-199, which authorized the Secretary of the Interior to acquire lands, waters, or interests in San Miguel, Prince, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands. Concern had been expressed that passage of this bill might raise the air quality standards from class 2 to class 1, which would be more difficult for Channel oil and gas operators to meet. A change in air quality classification was not part of the bill. The Secretary of the Interior was directed, however, to develop, in cooperation and consultation with the Secretary of Commerce, the State of California, and various knowledgeable Federal and private entities, a natural resource study report to include what actions should be considered that would better protect the national resources of the park. The report is to be submitted to Congress within 2 complete fiscal years from the enactment of this bill.

The Federal Office of Coastal Zone Management (OCZM) is proposing the creation of a marine sanctuary in the Santa Barbara Channel and is now preparing a Final EIS on the proposal. OCZM's preferred alternative is to designate as a sanctuary all the waters within 11 km (6 nautical miles) of the Channel Islands and of Santa Barbara Island. Hydrocarbon exploration and exploitation would be permitted on existing leases in the proposed sanctuary, but such activities would be prohibited on leases executed on or after the effective date of the proposed regulation (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management, 1980, p. F-60).

Lease Sale 53 is proposed for May 1981. A Draft Environmental Statement (DES) covering 243 tentative tracts or 520,000 hectares (1.3 million acres) in areas of the Central and Northern California OCS was issued in April 1980. The areas studied in the DES are shown in figure 21. The DES is available from the BLM Pacific OCS Office in Los Angeles. Public hearings are scheduled for June 1980 throughout the proposed lease sale area, and a final environmental statement is to be issued in October 1980. When this sale occurs, a revised Summary Report will be prepared concerning tracts actually leased.

The Secretary of the Interior issued a Call for Nominations of areas in the Southern California OCS for possible oil and gas leasing and also requested comments on possible environmental impacts and potential use conflicts in specified areas (Federal Register, vol. 44, no. 250, December 28, 1979). Lease Sale 68 is tentatively scheduled for May 1982. Nominations and comments were to be submitted no later than February 28, 1980.
Proposed Tracts Lease Sale 53


Tracts proposed for Lease Sale 53

On May 29, 1980, the Secretary of the Interior selected 221 tracts, approximately 457,000 hectares (1.13 million acres), offshore Southern California for intensive environmental study for proposed OCS Lease Sale 68, tentatively scheduled for June 1982. Figure 22 shows tracts selected for analysis. These tracts will be studied during the environmental statement process which commences with Tentative Tract Selection.

In consultation meetings with Santa Barbara, Ventura, and Los Angeles Counties, several specific issues were raised concerning Proposed Lease Sale 68.

**Santa Catalina Island.** Los Angeles County is concerned about the onshore impacts of offshore oil and gas development on Santa Catalina Island. Of interest to the County will be the relationship between the tracts tentatively selected for study and the planning now under way for development and approval of a Local Coastal Program for Santa Catalina Island. In particular, analyses of potential use conflicts at Two Harbors and Avalon may need to be evaluated.

**OIL SPILL PLANNING AND CLEAN-UP.** There are presently three oil spill clean-up cooperatives in Southern California: Clean Seas in Santa Barbara, Clean Coastal Waters in Long Beach, and Southern California Petroleum Contingency Organization in San Pedro. If Lease Sales 53 and 68 are held, it is possible that additional clean-up sites may be necessary.

Other issues suggested for investigation are as follows:

- **Environmental impacts** from potential offshore oil and gas operations in the offshore Laguna Beach area.

- **Recreational impacts to Santa Monica Bay** from potential offshore oil and gas operations.

- **Environmental issues related to deepwater exploration and development technology.**
FIGURE 22.—Proposed tracts, Lease Sale 68 (BLM press release, 1980).
Glossary

Definitions presented in the Glossary describe terms as they have been used in this Summary Report. The Glossary is intended for general reference only; for detailed descriptions of technical or specialized terms, the reader should seek a reference in the field of particular interest.

Sources used in compiling this glossary were the Pacific Summary Report itself; the Mid-Atlantic Summary Report; the OCSIP Atlantic, Pacific, Gulf of Mexico, and Alaska Indices; the NERBC-RALI Factbook; Webster's Third New International Dictionary; the American Geological Institute's Dictionary of Geological Terms; Langenkamp's Handbook of Oil Industry Terms and Phrases (2d ed.); the U.S. Department of the Interior, Fish and Wildlife Service's Steam Electric Power Plant Review Manual and Hydroelectric Power Plant Review Manual; the Encyclopedic Dictionary of Exploration Geophysics; and USGS et al., 1978, Shell OCS Beta Unit EIR-EA.

Anticline - An upfold or arch of stratified rock in which the beds or layers bend downward in opposite directions from the crest or axis of the fold.

APCD - Air Pollution Control District.

API gravity - Gravity (weight per unit of volume) of crude oil or other liquid hydrocarbon measured by a system recommended by the American Petroleum Institute.

Arenite - Consolidated rock having the texture of sand irrespective of composition.

Basement horizon - Basement rocks.

Basement rock - Rock in the earth's crust beneath all sedimentary rocks.

Basin - A depression of the earth in which sedimentary materials accumulate or have accumulated, usually characterized by continuous deposition over a long period of time; a broad area of the earth beneath which the strata dip, usually from the sides toward the center.

Bed - A rock mass, usually of large horizontal extent compared to vertical or near-vertical thickness, bounded (especially on its upper side) by material with different physical properties.

Bight Shelf - The outer continental shelf off southern California.


Blowout - An uncontrolled flow of gas, oil, and other fluids from a well to the atmosphere. A well blows out when formation pressure exceeds pressure applied to the well by the column of drilling fluid.
Borderland - The geomorphic province encompassing the coast and offshore area of Southern California from the Santa Monica Mountains south to the Mexican border.

bpd - Barrels per day.

Btu - British thermal unit.

Calcareaous - Containing calcium or any calcium compound; consisting of calcium carbonate.

Casing - Steel pipe used in oil wells to seal off fluids in the rocks from the bore hole and to prevent the walls of the hole from sloughing off or caving.

CEIP - Coastal Energy Impact Program, administered by the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Central Deep - The deepest part of the Santa Barbara Channel.

cfd - Cubic feet per day.

Clastic - Consisting of fragments of rocks or organic structures that have been moved individually from their places of origin.

Continental margin - A zone separating the emergent continents from the deep sea bottom.

Continental shelf - A broad, gently sloping, shallow feature extending from the shore to the continental slope.

Continental slope - A relatively steep, narrow feature paralleling the continental shelf; the region in which the steepest descent to the ocean bottom occurs.

COST - Continental Offshore Stratigraphic Test.

Development - Activities that take place following exploration for, discovery of, and delineation of minerals in commercially attractive quantities, including but not limited to geophysical activity, drilling, platform construction, and operation of all directly related onshore support facilities; and that are for the purpose of ultimately producing the minerals discovered.

Development and Production Plan - A plan describing the specific work to be performed, including all development and production activities that the lessee(s) propose(s) to undertake during the time period covered by the plan and all actions to be undertaken up to and including the commencement of sustained production. The plan also includes descriptions of facilities and operations to be used; well locations; current geological and geophysical information; environmental safeguards; safety standards and features; time schedules; and other relevant information. Under 30 CFR 250.34-2, all lease operators are required to formulate and obtain approval of such plans by the Director of the U.S. Geological Survey before development and production activities may commence.

Diapir - A piercing fold; an anticlinal fold in which a mobile core, such as salt, has broken through the more brittle overlying rocks.

Discovery - The initial find of significant quantities of fluid hydrocarbons on a given field on a given lease.

Distal - Far from the point of origin.

Dome - A roughly symmetrical upfold, the beds dipping in all directions, more or less equally, from a point; any structural deformation characterized by local uplift approximately circular in outline, e.g., the salt domes of Louisiana and Texas.

Drill pipe - Heavy, thick-walled steel pipe used in rotary drilling to turn the drill bit and to provide a conduit for the drilling mud.
Drill ship - A self-propelled, self-contained vessel equipped with a derrick amidships for drilling wells in deep water.

Drilling mud - A special mixture of clay, water, or refined oil, and chemical additives pumped downhole through the drill pipe and drill bit. The mud cools the rapidly rotating bit; lubricates the drill pipe as it turns in the well bore; carries rock cuttings to the surface; serves as a plaster to prevent the wall of the bore hole from crumbling or collapsing; and provides the weight or hydrostatic head to prevent extraneous fluids from entering the well bore and to control downhole pressures that may be encountered.

EA - Environmental Assessment.

Economically recoverable resource estimate - An assessment of the hydrocarbon potential that takes into account (1) physical and technological constraints on production and (2) the influence of costs of exploration and development and market price on industry investment in OCS exploration and production.

EIR - Environmental Impact Report.

EIS - Environmental Impact Statement.

En echelon - Faults having parallel but step-like trends.

Environmental impact statement - A statement required by the National Environmental Policy Act of 1969 (NEPA) or similar State law in relation to any action significantly affecting the environment.

Erosion/scour - A loosening or dissolution of the seabed by high-velocity bottom currents, particularly those due to storms. Erosion and scour can mobilize sand and result in significant horizontal crest and trough displacements. Lateral migration of the crest can "strand" platform supports or wellhead plumbing by eroding the surrounding support materials.

Exploration - The process of searching for minerals. Exploration activities include (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the geologic conditions conducive to the accumulation of such minerals and (2) any drilling, except development drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling of any additional well after such a discovery that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

Exploration Plan - A plan based on all available relevant information about a leased area that identifies, to the maximum extent possible, all the potential hydrocarbon accumulations and wells that the lessee(s) propose(s) to drill to evaluate the accumulations within the entire area of the lease(s) covered by the plan. Under 30 CFR 250.34-1, all lease operators are required to formulate and obtain approval of such plans by the Director of the U.S. Geological Survey before exploration activities may commence.

Facies - A lateral subdivision based on lithologic differences of a stratigraphic unit.

Fan - An accumulation of sediment transported downward in a relatively high-energy, constricted environment and debouching onto a low-energy, unconstricted surface, forming a widespread deposit of low relief.

Fault - A fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.

Feedstock - Crude oil or other hydrocarbons that are the basic materials for a refining or manufacturing process.
Field - An area within which hydrocarbons have been concentrated and trapped in economically producible quantities in one or more structural or stratigraphically related reservoirs.

Geochemical - Of or relating to the science dealing with the chemical composition of and the actual or possible chemical changes in the crust of the earth.

Geologic hazard - A feature or condition that, if unmitigated, may seriously jeopardize offshore oil and gas exploration and development activities. Mitigation may necessitate special engineering procedures or relocation of a well.

Geologic trap - An arrangement of rock strata, involving their structural relations or varied lithology and texture, that favors the accumulation of oil and gas.

Geomorphic - Of or pertaining to surface landforms.

Geomorphic - Of or pertaining to surface landforms and their interpretation on the basis of geology and climate.

Geophysical - Of or relating to the physics of the earth, especially the measurement and interpretation of geophysical properties of the rocks in an area.

Geophysical survey - The exploration of an area in which geophysical properties and relationships unique to the area are measured by one or more geophysical methods.

Greenstones - Altered basic igneous rocks taking their color from chlorite, hornblende, and epidote.

Growth curve - A graphic representation of the relative growth of a population during a sequence of similar-length periods.

Homoclinal - Characterized by beds dipping uniformly in one direction.

Hydrocarbon - Any of a large class of organic compounds containing primarily carbon and hydrogen, comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons, and occurring in many cases in petroleum, natural gas, coal, and bitumens.

Hydroskimmer - A topping plant (see topper) that employs an efficient, low-temperature process using hydrogen and a catalyst.

Intrusion - A body of igneous rock resulting from solidification of the intruding magma; the plastic injection of masses of salt or shale into overlying rocks; magma, shale, or salt injected into overlying rocks.


Jack-up - A bargelike, floating platform with legs at each corner that can be lowered to the sea bottom to raise the platform above the water.

Lagoon - A shallow sound, channel, pond, or lake near or communicating with the sea or with a larger lake or a river.

Land use - The function for which people employ an area of land.

Lease - A contract authorizing exploration for and development and production of minerals; the land covered by such a contract.

Lease sale - The public opening of sealed bids made after competitive auction for leases granting companies or individuals the right to explore for and develop certain minerals within a defined period of time.

Lease term - For oil and gas leases, a period of five years or up to and not to
exceed ten years, where a longer period is necessary to encourage exploration and development in areas because of unusually deep water or other unusually adverse conditions (see primary term).

Lighter - A barge or small tanker used to move cargo from a large ship to port; also, to transport by lighter.

Logistic curve - A curve representing a function involving an exponential and shaped like the letter S.

Mass movement - Unit movement of a portion of the land surface. Mass movement, or slumping, can occur where unconsolidated sediments are distributed over a steep gradient.

Mudstone - The lithified equivalent of mud, similar to shale but more massive and less indurated.

m.y. - Million years.

NPDES - National Pollutant Discharge Elimination System.

OCS - Outer Continental Shelf.

OCSIP - Outer Continental Shelf Oil and Gas Information Program.

Offshore monobuoy - A buoy system at which a tanker may anchor, discharge, or load petroleum products.

Offshore storage and treating vessel (OS&T) - A converted tanker anchored by a platform and used to remove natural gas, water, and other impurities from crude oil and to store the treated product until it is off-loaded by a shuttle tanker.

Opholite - Basic igneous rock associated with geosynclinal sediments.

Organic matter - Material derived from living plant or animal organisms.

OS&T - Offshore storage and treating vessel.

Outer Continental Shelf (OCS) - All submerged lands that comprise the continental margin adjacent to the U.S. and seaward of State offshore lands. The OCS remains subject to Federal jurisdiction and control after enactment of the Submerged Lands Act (43 USC 1301 and 1302).

Permeability - The ability to transmit fluids.

Permeable - Capable of transmitting fluids.

Petroleum - An oily, flammable bituminous liquid that occurs in many places in the upper strata of the earth, either in seepages or in reservoirs; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances (as natural gas or shale oil) similar in composition to petroleum.

Platform - A steel or concrete structure from which offshore wells are drilled.

Platform jacket - A supporting structure for an offshore platform consisting of large-diameter pipe welded together with pipe braces to form a four-legged stool-like structure. The jacket is secured to the ocean floor by pilings driven through the legs. The four-legged platform is then fitted into the jacket and secured.

Plutonic - Relating to igneous rock formed beneath the earth's surface by consolidation from magma.

POPCO - Pacific Offshore Pipeline Company.

Porosity - The capability to contain fluids within void spaces in rock.

Porous - Containing void spaces that may be occupied by fluids.
**Primary term** - The initial period of oil and gas leases, normally five years (see *lease term*).

**Production** - Activities that take place after the successful completion of any means for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and work overdrilling.

**Production curve** - A curve plotted to show the relation between quantities produced during definite consecutive time intervals.

**Proprietary information** - Geologic and geophysical data and immediate derivatives thereof that cannot be released to the general public because of Federal law, regulations, or statutes, or because of contractual requirements.

**Province** - An area throughout which geological conditions have been similar or that is characterized by particular structural, petrographic, or physiographic features.

**Recoverable resource estimate** - An assessment of oil and gas resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface.

**Refining** - Fractional distillation, usually followed by other processing (as cracking).

**Relief** - The elevations or inequalities of a land surface.

**Reserve estimate** - An assessment of the portion of the identified oil or gas resource that can be economically extracted.

**Reserves** - Portion of the identified oil or gas resource that can be economically extracted.

**Reservoir** - An accumulation of hydrocarbons that is separated from any other such accumulation.

**Resource** - Concentration of naturally occurring solid, liquid, or gaseous materials in or on the earth's crust.

**Rig** - Equipment used for drilling an oil or gas well.

**Risked resource estimate** - An assessment of oil or gas resources that has been modified to take into account the uncertainty of the estimate and to account for the possibility that economically recoverable resources may not be found within the area of interest.

**Risked, economically recoverable resource estimate** - An assessment of oil or gas resources that has been modified to take into account (1) physical and technological constraints on production; (2) the influence of the costs of exploration and development and market price on industry investment in OCS exploration and production; and (3) the uncertainty of the estimate and to account for the possibility that economically recoverable resources may not be found within the area of interest.

**Roustabout** - Manual laborer on or around a drilling rig.

**SALM** - Single-anchor-leg mooring system.

**Sandstone** - A sedimentary rock made up of sand-size grains that usually consist of quartz more or less firmly united by some cement (as silica, iron oxide, or calcium carbonate).

**Sediment** - Material or a mass of material deposited (as by water, wind, or glaciers).

**Sedimentary rocks** - Rock formed of mechanical, chemical, or organic sediment.
Seismic - Pertaining to, characteristic of, or produced by earthquakes or earth vibration; having to do with elastic waves in the earth.

Shale - An indurated rock that is formed by the consolidation of clay or mud, has a finely stratified or laminated structure parallel to the bedding, and is composed of minerals that have been essentially unaltered since deposition.

Shear - A stress causing two adjacent parts of a solid to slide past each other parallel to the plane of contact; also, the application of such a stress.

Siliceous - Of, pertaining to, or containing silica or quartz.

Single-anchor-leg mooring (SALM) - A semi-rigid anchored mooring used to connect vessels to storage tanks or production platforms.

Slot - A guide on a drilling platform through which a well is drilled.

Slumping - (See mass movement).

Source bed - Rocks containing relatively large amounts of organic matter that is transformed into hydrocarbons.

Stratum (pl., strata) - A tabular mass or thin sheet of sedimentary rock formed by natural causes and made up usually of a series of layers lying between beds of other kinds.

Stratigraphic trap - A geologic feature that includes a reservoir, capable of holding oil or gas, that is formed from a change in the character of the reservoir rock. Such a trap is harder to locate than a structural trap because it is not dependent on structural closure and is thus not readily revealed by geological or geophysical surveys.

Structural trap - A geologic feature that includes a reservoir, capable of holding oil or gas, that is formed from crustal movements in the earth that fold or fracture rock strata in such a manner that oil or gas accumulating in the strata are sealed off and cannot escape. In some cases "structure" may be synonymous with structural trap.

Subsea completion - A self-contained unit to carry men from a tender to the ocean bottom and enable them to install, repair, or adjust wellhead connections in a dry, normal atmosphere.

Subsidence - Movement in which there is no free side and surface material is displaced vertically downward with little or no horizontal component; a sinking of a large part of the earth's crust.

Subsurface geology - The study of structure, thickness, facies, correlation, etc. of rock formations beneath land or seafloor surfaces by means of drilling for oil or water, core drilling, and geophysical prospecting.

Summary Report - Document prepared by the Department of the Interior pursuant to 30 CFR 252.4 that is intended to inform affected State and local governments as to current OCS reserve estimates, projections of magnitude and timing of development, transportation planning, and general location and nature of nearshore and onshore facilities.

Supply boat - Vessel that ferries food, water, fuel, and drilling supplies and equipment to a rig and returns to land with refuse that cannot be disposed of at sea.

Surge tank - A vessel on a flow line whose function is to receive and neutralize sudden transient rises or surges in the stream of liquid.

TBtu - Trillion Btu.

Tectonic - Of or pertaining to the rock structure and external forms resulting from the deformation of the earth's crust.
Thrust fault - A reverse fault having a low angle of inclination with reference to a horizontal plane.

Topper - An oil refinery designed to remove and finish only lighter constituents of crude oil, such as gasoline and kerosene.

Tract - The geographic and legal extent of a single lease area; a convenient way of numbering blocks offered for sale so that they can be sequentially numbered in the process of offering.

Trap - A geologic feature that permits the accumulation and prevents the escape of accumulated fluids (hydrocarbons) from the reservoir.

Truncated - Terminated abruptly as if cut or broken off.

Turbidite - Sediments deposited by a turbidity current.

Ultramafic - Ultrabasic; rocks containing virtually no feldspar or quartz and composed essentially of ferromagnesian silicates, metallic oxides and sulfides, and/or native metals.

Undiscovered resources - Quantities of oil and gas estimated to exist outside known fields.

Unit - Administrative consolidation of OCS leases held by two or more companies but explored, developed, and/or produced by one operator for purposes of conservation, eliminating duplication of operations, and/or maximizing resources recovered.

Unitization - A process by which two or more lease holders allow one company to serve as the operator for exploration, development, and/or production of the affected leases.


Vapor balance recovery system - A system to recover the vapor displaced from production tanks or the hold of a vessel being filled with a liquid hydrocarbon.

Volcanism - Volcanic activity.

Well stream - Continuous flow of oil from a well.

Zeolite - Generic term for a group of hydrous alumino-silicates.