4.3 AIR QUALITY

4.3.1 EXISTING AIR QUALITY

The Federal government has established ambient air quality standards to protect public health (primary standards) and, in addition, has established secondary standards to protect public welfare known as the National Ambient Air Quality Standards (NAAQS). National primary standards establish the levels of air quality necessary, with an adequate margin of safety to protect the public health. National secondary standards are the level of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

The State of California has established separate, more stringent ambient air quality standards to protect human health and welfare (CAAQS). California and National standards have been established for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), suspended particulate matter 10 microns (PM_{10}), suspended particulate matter 2.5 microns ($PM_{2.5}$) and lead (Pb). These are commonly referred to as the criteria pollutants. In addition, California has standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility reducing particles.

National standards, other than O_3 and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one. Once the federal 1-hour ozone standard is attained, it will be revoked and replaced by the 8-hour standard. California standards for O_3, CO, 1 hour SO_2, NO_2 and PM_{10} and visibility reducing particles are all values that are not to be exceeded. The 24-hour SO_2, sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. The current CAAQS and NAAQS are listed in Table 4.3-1.

Air quality is determined by measuring ambient concentrations at various monitoring sites within the county and comparing those concentrations to the health-based standards. The ambient air quality within the region depends upon the extent and orientation of emission sources, and the characteristics of the receptors as well as the time of exposure to a given pollutant. Table 4.3-2 shows a summary of ozone monitoring concentrations for representative monitoring sites in Santa Barbara and Ventura Counties. The results of the monitored data indicate that the ambient air quality is mostly within the applicable ambient air quality standards, with the exception of ozone and fine particulates (PM_{10}).

4.3.2. AIR POLLUTANTS

Photochemical Pollutants. Ozone (O_3) is the principal compound of a group of secondary pollutants that are formed in the atmosphere through a series of complex photochemical reactions involving nitrogen oxides (NOx) and reactive hydrocarbons (ROC). A secondary pollutant is not directly emitted into the atmosphere, but is formed as a result of photochemical reactions with primary pollutants. As these photochemical reactions may take several hours to occur, peak ozone levels are often found downwind of major source areas and have a more regional distribution. The 1996 ROC estimated annual emission inventory in tons per day for Santa Barbara County is presented by category in Figure 4.3-1.

Both the CAAQS and the NAAQS for ozone have been historically exceeded in the South Coast Air Basin, with both Santa Barbara and Ventura Counties designated as non-attainment for the State and Federal Standards. Due to aggressive emission control strategies and favorable meteorology, peak ozone concentrations have declined during the 1990s. Santa Barbara County is presently classified as a "serious" non-attainment designation for the 1 hour ozone standard. However, the Environmental Protection Agency (EPA) has proposed a reclassification to an attainment

Figure 4.3-1. Reactive Hydrocarbon Inventory by Category

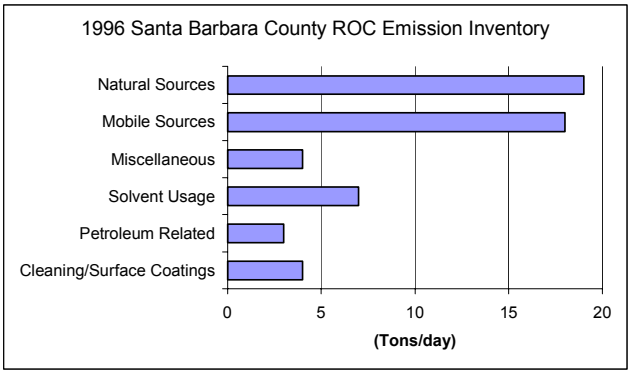
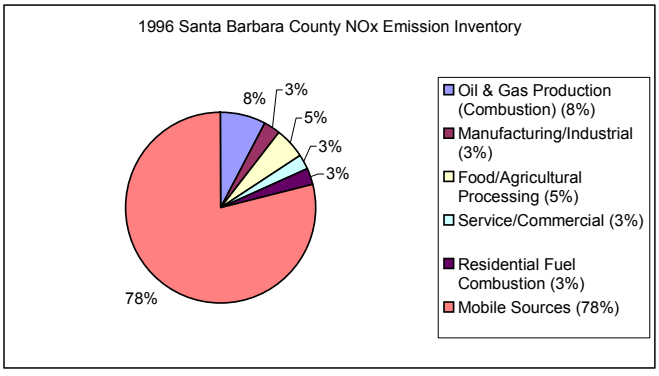


Figure 4.3-2. NOx Emission Inventory by Major Category



area for the one hour ozone standard, based on ozone levels registered during 1997-1999. Ventura is presently classified as a "severe" non-attainment designation for the 1- hour ozone standard.

Inert Pollutants. State and Federal ambient air standards for the primary (inert) air pollutants - CO, NO_2, SO_2, PM_{10}, and lead - are contained in Table 4.3-1. Sulfates and H_2S levels are also summarized. Elevated levels of the primary pollutants are generally a localized phenomenon found in the vicinity of major sources. Therefore, elevated concentrations of the primary pollutants are generally dependent upon the proximity of the ambient monitoring station to major pollutant sources.

Carbon monoxide (CO) is a gas formed primarily by the incomplete combustion of fuels. The primary source of CO emissions in the Santa Barbara area is motor vehicles. Santa Barbara County is considered to be in attainment of both the California and National 1-hour CO standards. CO concentrations tend to be greater during the winter months due to limited dispersion and colder surface temperatures than during the summer months when increased mixing is more prevalent.

Nitric oxide (NO) emissions are formed during combustion processes which through oxidation rapidly forms into nitrogen oxide (NO_2). Nitrogen oxides are a primary precursor to the formation of ozone pollution. High nitrogen dioxide levels are generally measured in urbanized areas with heavy traffic. NO_2 emissions have been historically below both the California and National standards and there have been no exceedences of the 1-hour standard during the past 15 years. Nitrogen dioxide may additionally react in the atmosphere with water forming nitric acid that is a constituent of acid rain. The 1996 NOx emission inventory for Santa Barbara County is presented by percent contribution by category in Figure 4.3-2.

Sulfur dioxide (SO_2) is primarily formed through combustion processes by stationary and mobile sources utilizing sulfur fuels. SO_2 concentrations have been historically low due to the lack of major sulfur dioxide sources in the region and Santa Barbara is considered in attainment of the State and National standards.

Atmospheric particulates are made up of finely suspended solids or liquids such as wind-blown dust, aerosols, and wildfires. California and National standards have been devised for PM_{10} (particulate matter 10 microns or less) and California standards for $PM_{2.5}$ (particulate matter 2.5 microns or less). The primary sources of PM_{10} emissions originate from miscellaneous process such as road dusts, construction and demolition operations, and farming operations. PM_{10} emissions may additionally result from NOx and SOx emissions acting as precursors in particulate formation. Particulate matter acts as a respiratory irritant that may affect children and other individuals susceptible to respiratory problems. Large particles are effectively filtered in the upper respiratory tract, however, small particles (under 10 microns) can cause serious health effects. Santa Barbara is considered in attainment of the National annual PM_{10} standard but exceed both the California annual and 24-hour standards. $PM_{2.5}$ is not currently being monitored in Santa Barbara County.

Lead is a heavy metal whose particles in the atmosphere primarily result form motor vehicles. Primary sources of atmospheric lead are automotive emissions and lead processing. Lead emissions have been nominal since the phase out of leaded fuels and the County is in attainment of both California and National standards.

Sulfates are aerosols that result when sulfur oxide particles combine with moist air. The primary source of sulfate is the combustion of fuels containing sulfur. Sulfates may act to aggravate respiratory diseases and are also a corrosive agent. The last exceedence of the California sulfate standard occurred in 1984 and Santa Barbara County is currently in attainment of the California sulfate standard.

Hydrogen sulfide (H_2S) is an odorless, toxic gas that can be detected by humans at very low concentrations. Higher concentrations can damage the ner-

Table 4.3-3. Attainment Status in the South Central Coast Air Basin

South Central Coast Air Basin County	O_3		CO		NO_2		SO_2		PM_{10}	
	State	Fed.	State	Fed.	State	Fed.	State	Fed.	State	Fed.
Ventura	N	A	A	U/A	A	U/A	A	U/A	N	U
Santa Barbara	N	U/A	A	U/A	A	U/A	A	U/A	N	U
San Luis Obispo	N	N	A	U/A	A	U/A	A	U/A	N	U

Source: California Air Resources Board

Note: A = Attainment N = Non-Attainment P = Partial Attainment
U = Unclassified U/A = Unclassified/Attainment

vous system and be fatal. H_2S is produced during the decay of organic material and is found naturally in petroleum. Santa Barbara County has been in attainment of the California standard since 1993.

Toxic Air Contaminants. Toxic Air Contaminants (TAC) are hazardous air pollutants that are suspected or known to cause cancer, genetic mutations, birth defects, or other serious illnesses. TACs are considered to be inert pollutants that preserve their chemical composition and are generally site specific to industrial facilities, chrome plating facilities and other industrial operations utilizing solvents. In 1990, the California Air Resources Board identified vinyl chloride as TAC and determined there was not sufficient available scientific evidence to support the identification of a threshold exposure level. This determination allows the implementation of health-protective control measures at levels below the 0.010 ppm ambient concentration specified in the 1978 standard.

Greenhouse Gases. There is a growing concern regarding the potential effects of greenhouse gases on global climate. The primary greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), water vapor (H_2O), and chlorofluorocarbons (CFCs). Greenhouse gases are largely transparent to solar radiation, but they do absorb long wave radiation emitted by the earth's surface and reradiate a portion of the energy back down to earth. This process results in a net warming effect to the lower layers of the atmosphere. Methodology is presently not available which will allow a determination of the project contribution to the probability, extent, or imminence of global climate change.

REGULATORY SETTING

The proposed exploration projects are all located adjacent to Santa Barbara County within the South Central Coast Air Basin. The Federal attainment status of Santa Barbara County is found in 40 CFR 81.305. Currently, Santa Barbara County is in attainment of all the National Ambient Air Quality Standards with the exception of the 1-hour ozone standard. Santa Barbara County is presently classified as a "serious" non-attainment designation for the ozone standard. However, the Environmental Protection Agency (EPA) has proposed a reclassification to an attainment area for the one hour ozone standard, based on ozone levels registered during 1997-1999. Santa Barbara County is also considered non-attainment for both the California ozone and 24-hour PM_{10} air quality standards. A summary of the attainment status of the South Central Coast Air Basin is listed in Table 4.3-3.

Section 328 of the 1990 Clean Air Act Amendments (CAAA) transfers authority for air quality on the OCS to the EPA. On September 4, 1992, the EPA Administrator promulgated requirements (40 CFR Part 55) to control air pollution from OCS sources to attain and maintain Federal and State air quality standards and to comply with CAAA provisions for the Prevention of Significant Deterioration. The promulgated regulations require OCS sources to comply with applicable onshore air quality rules in the corresponding onshore area (COA). EPA delegated authority to the SBCAPCD on November 5, 1993 to implement and enforce the requirements of 40 CFR Part 55. The full transfer of authority to SBCAPCD to regulate OCS air emissions pursuant to 40 CFR Part 55 transpired on September 4, 1994.

FEDERAL AND CALIFORNIA REGULATIONS

National, state, and regional agencies have established standards and regulations that affect the Proposed Project. The following National and State regulatory considerations apply to the project and to all alternatives:

- Federal Clean Air Act of 1970 directs the attainment and maintenance of National Ambient Air Quality Standards (NAAQS). The 1990 Amendments to this Act affect attainment and maintenance of NAAQS (Title I), motor vehicles and fuel reformulation (Title II), hazardous air pollutants (Title III), acid deposition (Title IV), facility operating permits (Title V), stratospheric ozone protection (Title VI), and enforcement (Title VII).
- The U.S. Environmental Protection Agency (EPA) implements the Federal Clean Air Act (CAA) and established the NAAQS for criteria pollutants.
- EPA instituted final rules for determining general conformity of federal actions with state and federal air quality implementation plans on November 30, 1993.
- California Air Resources Board (CARB) has established the California Ambient Air Quality Standard (CAAQS), which determine State attainment status for criteria pollutants.
- The California Clean Air Act (CCAA) went into effect on January 1, 1989 and was amended in 1992. The CCAA mandates achieving the health-based CAAQS at the earliest practicable date.

- Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) requires an inventory of air toxics emissions from individual facilities, an assessment of health risk, and a notification of potential significant health risk.

- The Calderon Bill (SB 1731) alters AB 2588. The bill sets forth changes in the following four areas: providing guidelines to identify a more realistic health risk, requiring high risk facilities to submit an air toxic emission reduction plan, holding air pollution control districts accountable for ensuring that the plans will achieve their objectives, and requiring high risk facilities to achieve their planned emissions reduction.

- The new Tanner Bill (AB 2728) amends the existing Tanner Bill (AB 1807) by setting forth provisions to implement the National program for hazardous air pollutants.

LOCAL REGULATIONS

The Santa Barbara County Air Pollution Control District (SBCAPCD) has jurisdiction over air quality attainment in the Santa Barbara County portion of the South Central Coast Air Basin and offshore sources as delegated by the USEPA. The SBCAPCD was the principal author of the 1991 Air Quality Attainment Plan (AQAP), the 1993 Rate of Progress Plan (ROP), and the 1994 Clean Air Plan (CAP) which contains strategies for locally attaining State and National ozone standards. The 1998 Clean Air Plan is the most recent strategy for attaining State and National ozone standards in Santa Barbara County, including portions of the OCS adjacent to the County.

The SBCAPCD (District) has 12 regulations, each of which includes a number of rules designed for the control of stationary sources of air pollution. The primary regulations affecting the proposed project are contained in Regulation II, which establishes air permit requirements, and Regulation VII, regarding the review of new or modified air pollution sources.

Regulation II (Permits). Regulation II establishes the County's permit system applicable to all stationary sources of air pollution. The construction and modification of sources of air contaminants are required to obtain (1) an Authority to Construct permit (ATC) prior to initiating construction or modification of a source; and (2) a Permit to Operate (PTO) prior to commencing operations. Regulation II codifies:

- Permits for activities that emit or affect air pollutants.
- Designates the permit and exemption criteria for air pollution sources.
- Describes the required permit application information.
- Establishes the standards for granting permits.

Rule 202, provides the general provisions and exemption criteria adopted by SBCAPCD to determine whether certain operations or activities are subject to a District Authority to Construct or Permit to Operate. Section F.6 of the Rule states, *"A permit shall not be required for drilling equipment used in state waters or in the outer continental shelf provided the emissions from such equipment are less than 25 tons per stationary source of any affected pollutant during any consecutive 12 month period."* Drilling equipment includes drill rig, workover rig and exploratory rig engines. Temporary engines that are ancillary to the drilling rig or workover operation - such as wireline unit engines, nitrogen skid unit engines, pump skid engines - are considered drilling equipment. Emissions from platform engines such as crane engines and well-kill pump engines are not included in the drilling equipment exemption.

Thus, the proposed delineation drilling projects will be subject to a 25 ton exemption threshold as denoted in Rule 202 and projects demonstrating drilling equipment emission potentials less than 25 tons shall

Table 4.3-4. Santa Barbara County APCD BACT, AQIA and Emission Offset Requirements

BACT Requirements	$\geq$ 25 lbs/day for any non-attainment pollutant (except CO) $\geq$ 150 lbs/day for CO
AQIA Requirements	$\geq$ 120 lbs/day for any non-attainment pollutant (except CO and PM_{10}) $\geq$ 550 lbs/day for CO; $\geq$ 80 lbs/day for PM_{10}
Offsets Requirements	$\geq$ 55 lbs/day or $\geq$10 tons/yr for any non-attainment pollutant (except CO and PM_{10}) $\geq$ 150 lbs/day or $\geq$25 tons/yr for CO; $\geq$ 80 lbs/day or $\geq$10 tons/yr for PM_{10}

Table 4.3-5. Santa Barbara Channel Emissions (tons/day)

OCS Source	NOx	ROC
Exploratory Drilling	0.27	0.01
Development Drilling	0.26	0.02
Production Operations	2.15	2.06
Tankering	0.42	0.35
Support Craft	2.47	0.27
Ships	26.95	0.96
Total	32.52	3.67

Source: Joint Interagency Modeling Study (JIMS) (SAI, 1986)

have those emissions exempted from SBCAPCD permit requirements. Emission sources other than drilling equipment will be subject to the permit provisions contained in Regulation II.

Regulation VII (New Source Review). Regulation VII, commonly referred to as New Source Review (NSR) establishes criteria for new or modified source of air pollution in the County. The objective of Regulation VII is to:

- Ensure that new or modified sources of air pollution prevent the degradation of air quality.
- Ensure that new or modified sources of air pollution do not interfere with the attainment and maintenance of air quality standards.
- Establish threshold levels of air emissions requiring Best Available Control Technology (BACT), emission offsets, and air quality impact analysis (AQIA).
- Specifies how increases in both non-attainment and attainment pollutants are permitted.

Table 4.3-4 provides a summation of SBCAPCD threshold requirements relating to the application of Best Available Control Technology (BACT), air quality impact analysis (AQIA), and emission offsets.

The SBCAPCD has additionally adopted Rule 331 to control emissions of fugitive hydrocarbons from oil extraction, processing, and pipeline facilities. Operators must make visual inspections of pumps and compressors every eight hours of operation. In addition, quarterly inspections of all components, including flanges, fittings, and valves, are also required. Inspection of these components is intended to reduce fugitive ROC emissions that result from oil and gas leakage.

EFFECTS OF PAST OFFSHORE OIL AND GAS ACTIVITIES

Regional air quality are affected by emissions from all direct and support activities for oil and gas operations occurring on the OCS. These emissions may result from oil and gas activities including exploratory drilling, construction, oil and gas development and production operations, and support craft activities. To date, a total of 23 offshore structures and 1 offshore storage and transfer facility have been installed on the OCS from 1968 through 1993. 16 structures have been emplaced offshore of Santa Barbara County, 4 offshore of Ventura County, and 4 struc tures offshore of Long Beach. Of the total of 16 structures offshore Santa Barbara County, the Offshore Storage and Treatment (OS&T) facility was removed in 1994 leaving 15 structures presently in place of the County.

A cooperative air quality study for the Santa Barbara Channel was conducted to assess the impacts of emissions from direct and indirect OCS activities on ozone concentrations on Santa Barbara and Ventura Counties. The Joint Interagency Modeling Study (JIMS) (SAI, 1986), was a cooperative study between MMS, Santa Barbara and Ventura APCDs, the EPA, and the California Air Resources Board (CARB). Three distinct meteorological scenarios that were highly conducive to ozone formation entailing site specific emissions data were utilized. The JIMS study established that the maximum onshore concentrations from existing OCS facilities were less than 1 part per hundred million for ozone. By comparison, the NAAQS for ozone is 12 parts per hundred million. In addition, the subsequent transfer of air regulatory authority to EPA and delegation to local APCDs has further minimized potential onshore air quality impacts from OCS related activities. Table 4.3-5 provides an estimate of Santa Barbara Channel emissions including the OCS operations that was determined by SAI for the JIMS study.

Drilling Operations. The emissions associated with both exploration and delineation drilling operations are primarily combustion related and the pollutant of concern with these operations are NOx. The primary sources of emissions from exploration operations occur from the Drilling Vessels' main engines, cranes and flare. Additional support craft servicing the drilling operations are an additional source

of NOx emissions. Initial production well drilling emission sources are the turbines generating the power requirements, cranes and the flare. Drilling emissions are generally of short duration lasting on average between 80-120 days for a typical exploratory well.

Construction Operations. Construction operations generally result in the most emission intensive phase of offshore operations. As construction operations are particularly combustion intensive, the highest peak-hour emissions of offshore operations are usually associated with this phase. Due to the high peak-hour emissions over a relatively short duration of time, potential violations of hourly ambient air standards are of concern during this phase. The platform jacket installation is the largest source of construction related emissions associated with platform construction. Additional sources of platform construction emissions are hookup and platform commissioning, pipeline installation, and power cable installation. Support vessels are an additional source of NOx emissions during construction operations.

Platform decommissioning operations are an additional source of construction emissions due to their short duration and combustion intensive nature. Decommissioning phases which could result in NOx emissions are 1) pre-abandonment operations, 2) topside removal, 3) jacket removal, 4) debris removal, and 5) pipeline and power cable removal.

Production Operations. Production operations result in the majority of emissions associated with offshore operations over the lifetime of the platform. While day to day emissions are relatively low, the total emissions are additive over the approximate 30 year life of the platform. The primary sources of NOx emissions during oil & gas production are turbines, cranes, flares, and auxiliary generators. The primary ROC evaporative sources associated with construction are fugitive emissions from the multitude of valves, flanges and connectors as well as storage vessels.

Support vessels servicing platform operations are also a primary source of NOx emissions. The bulk of support craft emissions are from the supply and crew boats main engines and auxiliary generators. Helicopters are an additional source of emissions.

4.4 PHYSICAL OCEANOGRAPHY

4.4.1 INTRODUCTION

There has been a tremendous amount of physical oceanographic research done in the Southern California Bight over the last two decades. Extensive research was done concerning the deep circulation south of the Santa Barbara Channel in the 1980's and the surface circulation in the Santa Barbara Channel and the Santa Maria Basin in the 1990's and early 2000's . The latter research was conducted as part of the 1991 Cooperative Agreement between the MMS and the Scripps Institution of Oceanography, University of California, San Diego. This Cooperative Agreement was brought about in response to recommendations made by the National Research Council (NRC 1989 and 1990), and by the findings of two scientific panels who met in the fall of 1990 in two separate workshops held in La Jolla, CA. These scientific panels met to discuss the numerical modeling and physical oceanographic research requirements necessary to obtain the information needed to effectively support OCS oil and gas decision-making in the Southern California Bight and offshore the southern central California coast. While this document will summarize the 1980's research in the Southern California Bight, emphasis will be placed on the surface circulation in the Santa Barbara Channel and Santa Maria Basin because of its direct pertinence to the objectives of the Mobile Offshore Drilling Unit (MODU) Environmental Impact Statement.

4.4.2 SOUTHERN CALIFORNIA BIGHT MORPHOLOGY

The Southern California Bight (Fig. 4.4-1) is bounded to the north and east by the California coast, from Point Arguello to the U.S./Mexican international border. It is bounded offshore to the west by the Santa Rosa-Cortes ridge. Within the Bight are submarine valleys and mountains, the peaks of which form the various offshore islands. The ridges and troughs generally run northwest to southeast, with the exception of the Santa Barbara Channel, which runs east to west. The oceanic circulation in Southern California Bight owes its complexity principally to the Bight's composite bottom topography. Any water flow entering the 12 basins making up the Southern California Bight at depths below 250 m must do so from the southeast along the San Diego Trough and into the Santa Monica – San Pedro basins. The Santa Monica – San Pedro basins act as a conduit for water flow into the rest of the Bight, opening up to the southeast at 737 m, to the northwest into the Santa Barbara Basin at 250 m, and to the west into the Santa Cruz Basin at 650 m. Together, the Santa Monica-San Pedro Basins are 100 km long, 40 km wide, and 900 m deep at the deepest point (Browne 1994).

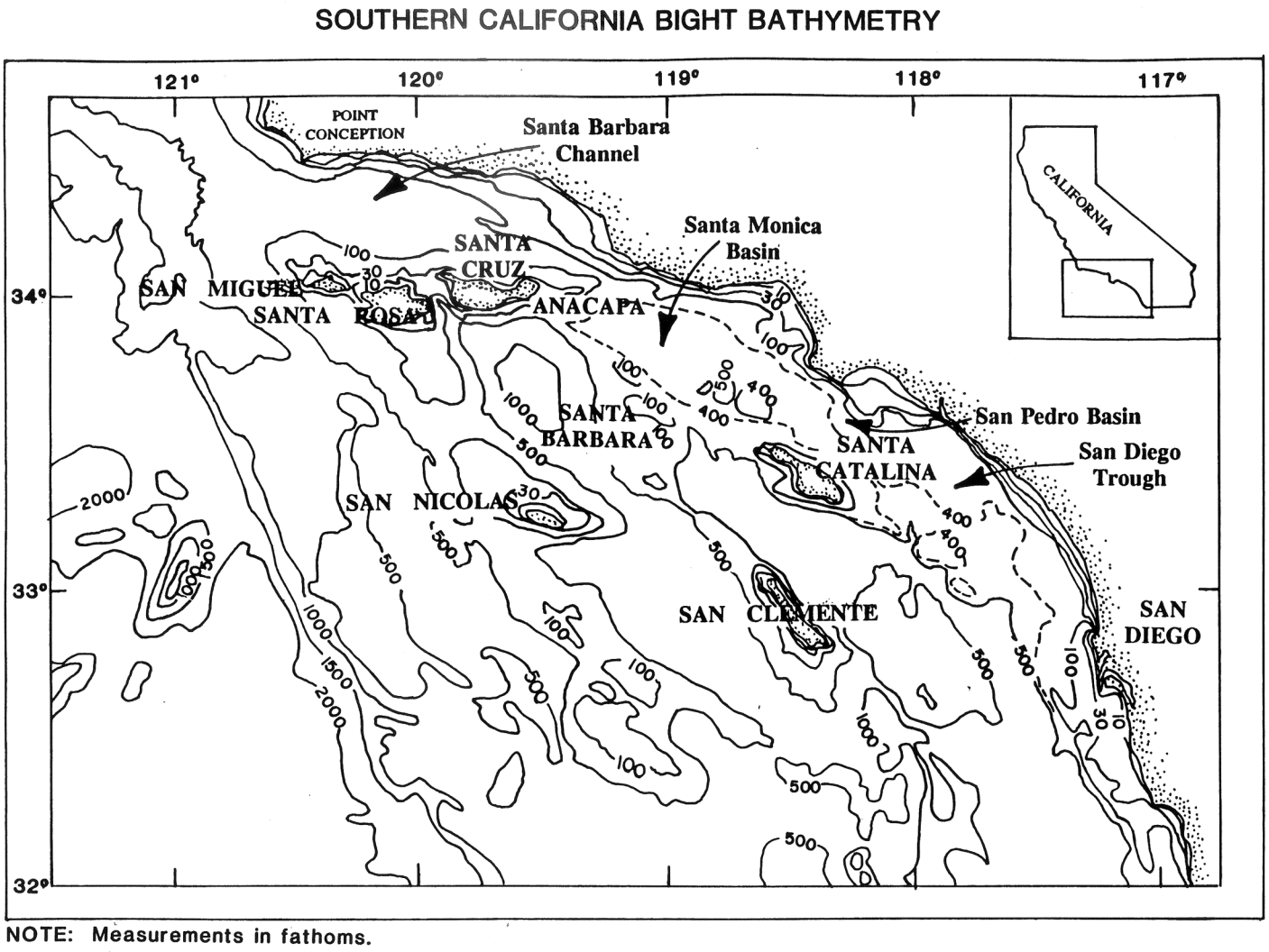


Figure 4.4-1. Southern California Bight bathymetry (Hickey 1992).

4.4.3 OCEANIC CIRCULATION IN THE SOUTHERN CALIFORNIA BIGHT

The circulation patterns in the Southern California Bight were successfully approximated by a number of investigators in the 1960's and 1970's performing geostrophic (resultant movement from balance between forces caused by pressure gradients and the earth's rotation) calculations using temperature and salinity data obtained in the California Cooperative Oceanic Fisheries Investigations. These patterns were later verified by Barbara Hickey of the University of Washington (Hickey 1992). It is her investigations of the currents in the Santa Monica and San Pedro basins from 1987 to 1990 that give us the detail of the poleward flow in the Southern California Bight, and also provide some surprising revelations for biologists concerning the overturning of bottom basin water.

The wind pattern along the west coast of the United States is typically strong, alternating in direction between the northwest and the southeast in the northern part of the coast and becoming more polarized toward the southeast in the southern region, especially off the California coast around Points Sal, Arguello, and Conception. This polarization of the winds toward the southeast off the entire coast of California is most prominent during the late spring to early fall. These winds are called upwelling favorable winds because their consistent southeast direction moves surface waters offshore. This gives rise to upwelling of cold, nutrient-rich, bottom water at the coast that, in turn, moves this water mass offshore in a continual cycle. The Santa Ynez mountains at the northern part of the Southern California Bight shield bight waters from this strong wind pattern, causing the winds inside the bight to be moderate and directed east to southeast throughout the year.

The sources of ocean water in the Southern California Bight (Fig. 4.4-2) are (1) cold, low salinity, highly oxygenated sub-arctic water brought in by the California Current, and ultimately the California Counter-Current; (2) the moderate, saline, central north Pacific water advecting into the Bight from the west; and (3) the warm, highly saline, low oxygen content