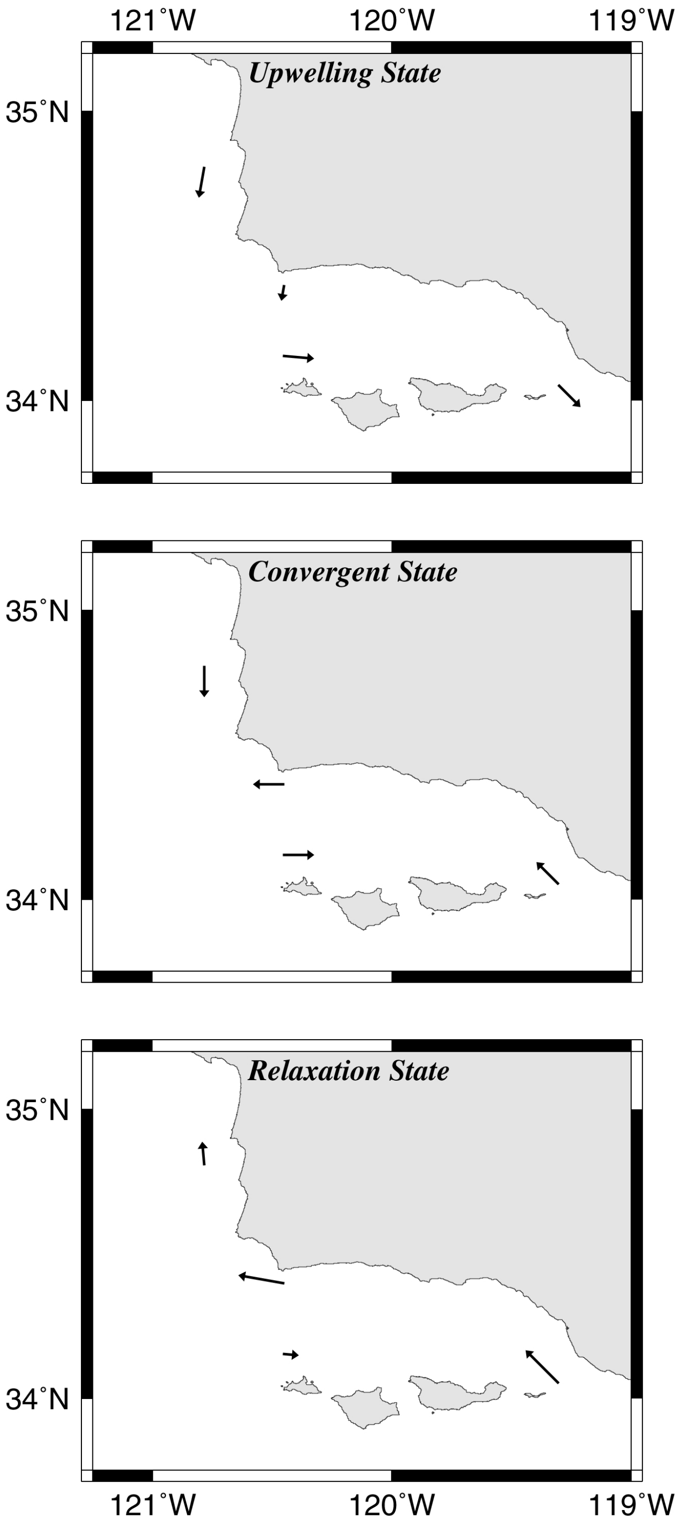

Figure 4.4-15. Suface current vectors located at the present MMS-SCRIPPS monitoring program current mooring sites depicting the current flow at these locations during the (a) upwelling, (b) convergent, and (c) relaxation flow regimes (Dever 2000).

Table 4.4-2. Five year monthly frequency of the upwelling, convergent, and relaxation flow regimes. The columns are month (1-12 is Jan.-Dec.), total days of observations within each month, percent (%) upwelling, (%) convergence, (%) relaxation, (%) other, total days for each of the twelve months where upwelling, convergence, relaxation and "other" occurred. The total days of observations within each month are the number of days for each month between Dec. 1993 and Nov. 1999 when SMIN, ANMI, and PAIN all returned good velocity data (Dever 2000, Browne 2001).

		Percentage of Five Years of Each Calendar Month				Total Days of Five Years of Each Calendar Month			
Month	Days	% Upwell	% Conv	% Relax	% Other	Upwell	Conv	Relax	Other
1.0000	155.0000	30.1613	26.1290	37.4194	6.2903	46.75	40.50	58.00	9.75
2.0000	141.0000	51.7730	26.0638	19.1489	3.0142	73.00	36.75	27.00	4.25
3.0000	154.5000	53.0744	33.9806	2.4272	10.5178	82.00	52.50	3.75	16.25
4.0000	150.0000	86.0000	8.8333	2.6667	2.5000	129.00	13.25	4.00	3.75
5.0000	155.0000	47.7419	32.0968	14.6774	5.4839	74.00	49.75	22.75	8.50
6.0000	150.0000	44.6667	32.8333	17.3333	5.1667	67.00	49.25	26.00	7.75
7.0000	155.0000	22.4194	32.0968	32.9032	12.5806	34.75	49.75	51.00	19.50
8.0000	155.0000	28.8710	35.3226	27.5806	8.2258	44.75	54.75	42.75	12.75
9.0000	152.0000	20.0658	36.3487	37.9934	5.5921	30.50	55.25	57.75	8.50
10.0000	155.0000	19.0323	41.9355	32.7419	6.2903	29.50	65.00	50.75	9.75
11.0000	135.0000	5.3704	33.5185	53.1481	7.9630	7.25	45.25	71.75	10.75
12.0000	146.5000	9.2150	34.3003	49.3174	7.1672	13.50	50.25	72.25	10.50
Total	1804.00					632.00	562.25	487.75	122.00

gime by the total number of days of observations, 1804 days, which is approximately 5 years of data. From this relatively strong data set we see that the:

- Upwelling Synoptic Flow Regime occurs 35.0 % of the year,
- Convergent Synoptic Flow Regime occurs 31.2 % of the year,
- Relaxation Synoptic Flow Regime occurs 27.0 % of the year, and
- transitional or "other" flows occur 6.8 % of the year.

Understanding the monthly, seasonal, and annual frequency of these flow regimes helps to read the real-time monitoring data from the MMS/Scripps website in proper context" (Browne 2001).

4.4.5 WAVE CLIMATE OF THE SOUTHERN CALIFORNIA BIGHT

Discussion of the wave climate of the Southern California Bight is exclusively taken from Hickey 1993 and USDI, MMS 1991. Local wind driven waves and long period swell formed by distant tropical storms dominate the wave environment in the Southern California Bight. The Southern California Bight's offshore islands and ridges serve as a shelter for the coast from the effects of deep ocean gravity waves. Much of that energy is dissipated in island surf zones or reflected back offshore.

The restricted fetches within the Southern California Bight allow only the development of locally wind driven waves with relatively small amplitudes, short periods, and short wavelengths. Also, because the important winds are the sea breezes, the duration is normally less than 10 hours. It is only when gale winds blow from the west at 17 m/sec (38 mph) or more that high waves are formed in the local region and travel over the shelf. These are most common in the San Pedro Channel where waves as high as 7.6 m (24.9 ft) have been encountered.

The sheltering effect of the Northern and Southern Channel Islands is dramatically illustrated in data collected at Begg Rock (located north of San Nicolas Island) and Sunset Beach (located just south of Palos Verdes) wave monitoring sites. Spectral amplitudes are an order of magnitude smaller at Sunset Beach than they are at Begg Rock.

The dominant swell period at Begg Rock varies from 14-18 seconds in winter to 5-10 seconds in summer. Long period swell can be generated from the north, west, or south, but most long period winter swell is generated by North Pacific storms. The summer wave spectra at Sunset Beach are dominated by 16-18 second long period swell coming from the southern hemisphere. Begg Rock is sheltered from swell coming from the south.

Wave spectra during a major winter storm period are an order of magnitude greater than that of waves occurring during a typical winter period. Severe waves such as these are usually generated from storms that develop between Hawaii and the Pacific coast. The dominant wave period is about 16 seconds. The amplitudes of these waves are significantly reduced at the coast. Typically, waves impinging on the Southern California Bight coastline generate a net southeastward alongshore drift in the coastal surf zone. This alongshore drift is responsible for much of the sediment movement along the coast.

"The coastal area between Point Conception and Ventura is the most protected from swell. Except at Pt. Conception itself, swell cannot reach the area without considerable reduction by the Channel Islands or extreme refraction over the mainland shelf. From Ventura to Pt. Hueneme, swell cannot reach the area without considerable reduction by the Channel Islands or extreme refraction over the mainland shelf. From Ventura to Pt. Hueneme, swell approaching from the west arrives unchanged and has sometimes caused substantial destruction along the shore. From Long Beach to Newport significant swells arrive from the west and south. From Newport to Oceanside, only swell from the south arrives unchanged. The coast near San Diego is the most exposed, especially to swell from the south, which arrives without significant modification.

Swell from the north boundary of the Pacific High: This occurs when the high elongates and migrates to the south, most commonly in winter. Because of lower wind velocities swell from this source is moderate.

Swell from Hawaiian lows: The source of these swells is the low pressure centers developing in the expanse of the Pacific Ocean north of Hawaii. These develop most commonly in the spring and the height of this swell is normally moderate, usually less than 2.5 m (8.2 ft).

Swell from storms in the Southern Hemisphere: This swell is probably present about two-thirds of the time but is so low that is masked by swell from other areas. The effect is greatest in summer when storms in the Southern Hemisphere are most intense and follow tracks which are further to the north.

Swell from tropical hurricanes: Very rarely, tropical storms which develop off the coast of Costa Rica may reach the waters off Southern California and cause extensive damage. These storms usually dissipate long before that, but swell may arrive from the areas where the storms develop. It is estimated that heavy swell from this source may reach the Southern California every four to five years, although more frequent occurrence is possible.

Waves and Swell from Local Cold Front Passages: These waves are characterized by their choppiness and are always accompanied by strong winds. Since the swells are generated in nearby surrounding areas, the sheltering effects of points, headlands, and islands is considerably reduced.

Tsunamis: The highest water levels along the California coast are produced by tsunamis: long gravity waves which are generally produced by intense submarine earthquakes. Tsunamis occur very infrequently and the damage is usually not extensive to properly designed structures. Hazards from tsunamis include a variation in water level from 1.5 to about 4.5 m (4.5 to 13.5 ft) and possible high current velocities in shallow or restricted waters" (USDI 1991).

Tides: The tides are mixed with a semi-diurnal constituent being more dominant than the diurnal constituent. The time between successive highs or lows vary between 10 and 14 hours. The barotropic tidal wave advances towards the Southern California coastline from the southeast along the coastline reaching Pt. Conception ½ hour after it arrived at San Diego.

Both cross-shelf and along-shelf tidal current velocities within the Southern California Bight (including the Santa Barbara Channel) are on the order of 10 cm/sec. Cross-shelf tidal currents are predominantly baroclinic (depth and density dependent) whereas along-shelf tidal currents tend to be more barotropic (depth dependent only). Maximum velocities along the vertical profile of these currents tend to be at the surface and bottom boundary layers. Tidal currents are larger in the upper 100m over the shelf edges, slopes and open basins (15 – 20 cm/sec) than they are over the shelf. Tidal currents in the island passages of the Santa Barbara Channel tend to exhibit velocities four times greater reaching 50 cm/sec during strong ebbs.

4.5 WATER QUALITY

REGULATORY SETTING

In 1972, Congress passed the Federal Water Pollution Control Act, which was reauthorized in 1977, 1981, 1987, and 2000 as the Clean Water Act (Pew Oceans Commission (POC), 2001). The goal of the law was to eliminate pollution in the nation's waters by imposing uniform standards on all municipal and industrial wastewater sources based on the best available technology. Facilities discharging wastes at discernable, or point, sources, were required to obtain permits from the U. S. Environmental Protection Agency (EPA) in the form of National Pollutant Discharge Elimination System (NPDES) permits. Overall, the NPDES program has resulted in dramatic reductions in the amount of pollutants entering U. S. waters, including coastal waters (POC, 2001). The Southern California Bight (SCB), in particular, has seen great reductions in pollutants over the past 25 years, including 50 percent for suspended solids, 90 percent of combined trace metals, and more than 99 percent for chlorinated hydrocarbons. Measurements of sediments, fish and marine mammals all show decreasing contamination This has occurred despite great increases in population and volumes of discharged wastewater (Schiff et al., 2000). This reduction as accomplished through source control, pretreatment of industrial wastes, reclamation and treatment plant upgrades.

In August, 1999, a California Coastal Commission letter to the MMS raised seven issues of concern. Amongst these was a question regarding changes in water quality regulations and anticipated further changes in these regulations. The following discussion addresses this concern.

While offshore oil and gas does contribute to the pollution of the ocean, effluent parameters are limited according to the limitations of the appropriate NPDES permit issued by the EPA, Region 9[1]. At present, two types of permits exist to regulate effluents from the 23 offshore oil and gas facilities. One type is a General permit and the other is a series of Individual permits The General permit (referred to hereafter as the "1984 General permit") was issued in 1983, reissued in January 1984, and expired in June 1984 with no new General permit to take its place. This permit covers 14 platforms in the Pacific OCS Region. The remaining nine platforms are presently covered by Individual permits. However, two of the Individual permits were issued in 1977 and have never been updated, while the permits for the remaining seven platforms were all applied after the 1984 General permit had expired. All the newer Individual permits are more stringent and cover a wider array of effluents than the 1984 General permit.. Of the 23 platforms, only four facilities are operating under permits that contain the more stringent effluent guidelines for the Offshore subcategory of the Oil and Gas Extraction Point Source Category promulgated on March 4, 1993 (58FR12454). At this time, all facilities are operating under expired individual or general permits, that have been administratively extended pursuant to the 40 CFR 122.6.

To rectify this inequitable permit situation, EPA, Region 9 began, in October 1996, the process of issuing a new General permit (referred to hereafter as the "new General permit. In January 2001, the new General permit received California Coastal Commission (CCC) Consistency Certification, albeit with conditions[2]. At present, EPA is considering how to handle the conditions and how to reissue the changed permit. There is no anticipated date of reissuance.

In general, the new General permit is more stringent than either the 1984 General permit or any of the Individual permits. Table 4.5-1 illustrates this by comparing the 1984 General permit with the draft limitations of the new General permit. The Individual permits are by and large more stringent than the 1984 General permit by decreasing limits on some components of produced water, requiring more frequent monitoring, and monitoring an increased total number of effluents. In part, the greater number of effluents is a reflection of the increased sophistication of offshore oil and gas activities. As can be seen, the current General permit regulated 12 discharges while the new draft permit will regulate those and 10 others.

A key aspect of the regulatory regime for water quality is compliance monitoring. In 1989, MMS, Pacific OCS Region and EPA, Region 9 signed a Memorandum of Agreement (MOA) detailing the role each agency would play in conducting NPDES inspections and sampling at the offshore oil and gas platforms.

[1] EPA's Region 9, with offices located in San Francisco, covers California, Nevada, Arizona, Hawaii, and the Trust Territories. See Region 9's website at: http://www.epa.gov/region09/reg9bck.html. Also, for more information on EPA's nation-wide NPDES program see the website at: http://www.epa.gov/owm/npdes.htm#top.

[2] The CCC conditions are as follows: (1) Include effluent standards for produced water based on the more stringent of EPA criteria or California Ocean Plan criteria; (2) Revise the maximum feasibility mitigation study requirement in the permit; and (3) Inclusion in the fact sheet of a description of EPA's commitment concerning third party monitoring.

The centerpiece of the MOA is the workplan, created annually by EPA and MMS. The workplan gives the details of the inspection and sampling efforts and includes the number, location, and type of samples to be taken. Which platforms are to be sampled for the year is closely held since all inspections and sampling are unannounced.

Violations of any permit limit can be treated in several ways by EPA. The most common is for EPA and the operator to determine the cause of the violation and to take steps to avoid future occurrences. Further actions by EPA, such as fines or other sanctions, would be determined at EPA's discretion depending on the specific aspects of the event.

The State of California developed a comprehensive water quality pollution control plan in 1972 called the California Ocean Plan (California State Water Resources Control Board, 1997). It is required that the plan undergo a triennial review. The plan was last issued in 1997, thus, the plan is currently undergoing review. The plan, which covers any facility that discharges into California State waters, up to 3 miles from shore contains several categories including Effluent Limitations, Water Quality Objectives, and Objectives for Protection of Human Health (Non-carcinogens and Carcinogens). Combined, these catego ries apply limits to 84 pollutants.

The U. S. Coast Guard (USCG) also regulates offshore oil and gas platforms in several ways, including when pollution events occur. For example, an oil sheen, a violation of USCG regulations, could result in an enforcement action. The USCG does regulate the spillage of oil in the Federal OCS (and State waters), although it is not regulated under NPDES regulations or permits.

<u>Regional Setting</u>: This section describes the water quality in the area potentially impacted by the proposed action (delineation drilling) and, in addition, includes a description of resources in a larger area that could potentially be affected by oil spills resulting from the development of the 36 undeveloped leases.

Water pollution has existed along the Pacific coast since urban centers and industrial complexes were built along the shores and rivers. Regulated pollution sources primarily include treated sewage outfalls and heated water outfalls from power plants (chlorine is sometimes used in these to reduce fouling). Nonregulated pollutant sources include storm drains, rivers, and other nonpoint source runoff sources. Pollutants from these sources have included chemicals, such as pesticides and manufacturing wastes, oil and rubber from vehicles, general trash and garbage and many other types of materials. In addition, agriculturally-based materials from rural areas, including animals wastes, pesticides and herbicides and soil can be washed into nearby streams and rivers and the oceans.

The 1975-1978 BLM-sponsored baseline studies in the Southern California Bight (SCB) indicated that most of the metal and hydrocarbon loads of the four basins examined (Santa Barbara Channel, San Pedro, Santa Monica, and San Nicolas) were derived from industrial and municipal wastes, entering the marine environment through direct discharge, indirect runoff and atmospheric transport, all centering around the Los Angeles metropolitan area (BLM, 1979).

Lead was the only metal that reached the Santa Barbara Channel Basin in anything but natural amounts (BLM, 1979). Lead, apparently, is more susceptible to atmospheric transport, and was thus carried to the far reaches of the SCB from the sources (primarily industry and automobile gasoline exhaust). Age-dated box cores revealed that rates of lead deposition in the Santa Barbara Channel Basin is decreasing (as of 1978). This, despite the fact that this Basin has the greatest sedimentation rate of any of the four basins examined (San Pedro, Santa Monica and San Nicolas are the other three).

Analysis of hydrocarbons in the SCB showed significant increases over the last 50 years (as ascertained using age-dated box cores). In part, this increase was due to pulses of natural seepage, however, the majority was attributed to man-related combustion and sewage outfall sources. BLM (1979) noted that the degree of anthropogenic input to the Santa Barbara Channel Basin is relatively constant in recent years. Relative contributions from natural seepage were the highest for the Santa Barbara Channel Basin and least for the San Nicolas Basin, while combustion-derived sources were the most for the San Nicolas Basin, followed by the San Pedro and Santa Monica Basins and the least for the Santa Barbara Channel Basin.

Sources of pollution to the sea from offshore include shipping (for example, bilge and tank cleaning and treated sewage), recreational boating (such as oil, diesel, and general garbage) and oil and gas facilities, albeit under the limitations of NPDES permits (see regulatory setting discussion, above).

Standard water quality parameters for the study area, including temperature, salinity, dissolved oxygen, pH, nutrient concentrations, turbidity, and organic material, have previously been described in Dames and Moore (1982), SAI (1984), Arthur D. Little (1984), and Chambers Group 1987 (a, b). These parameters and some basic characteristics are given in table 4.5-3.

Water quality in the study area may be generally divided into two subregions:

- Point Lobos to the western entrance of the Santa Barbara Channel; and
- The northern Southern California Bight (SCB): Santa Barbara Channel to Point Fermin, including the offshore islands.

Table 4.5-1. Comparison of effluent limitations between the old (1984) general permit and the new proposed general permit.

Effluent	Current General Permit Limits	Draft General Permit Limits
001 Drilling Discharges (mud and cuttings)	Once/mud system toxicity test if unapproved mud are discharged[1] Monthly volume estimate Continuous constituent and additive inventory No discharge of oil-based drilling mud Annual report of heavy metal contaminants in barite Use of generic mud Daily visual sheen observation	End-of-well toxicity test Volume limits applied to each platform Continuous constituent and additive inventory No discharge of oil-based drilling mud or mud contaminated with diesel Limits on cadmium and mercury in barite Use of generic mud Static sheen test
002 Produced Water	Monthly oil and grease samples Monthly flow estimate (daily max = 72 mg/l) Yearly metals and phenols analysis	Weekly oil and grease samples (29 mg/l monthly average; 42 mg/l daily max.) Flow limits applied for each platform Quarterly monitoring of metals and other parameters Whole effluent toxicity (chronic)
003 Well Treatment, Completion and Workover Fluids	Volume monitoring No discharge of free oil monitored by visual observations	Volume monitoring No discharge of free oil monitored by static sheen test Once per job oil and grease samples (29 mg/l monthly average; 42 mg/l daily max.)
004 Deck Drainage	Volume monitoring No discharge of free oil monitored by visual observations	Volume monitoring No discharge of free oil monitored by visual observations
005 Sanitary and Domestic Wastes	Flow rate Residual chlorine (not needed for facilities permanently manned by less than 10 persons)	Sanitary Wastes (For facilities with less than 10 persons): Flow rate Observation of floating solids. (For facilities with 10 or more persons): Flow rate Total Residual Chlorine (minimum of 1 mg/l, (as close as possible); maximum concentration of 10 mg/l. Domestic wastes Foam
006 Blow-out Preventer Fluid	No free oil in the receiving water	No free oil in the receiving water Floating solids and foam
007 Desalination Unit Discharge	No free oil in the receiving water	Floating solids and foam
008 Fire Control System Test Water	No free oil in the receiving water	Chemical inventory Chlorine (for antifouling) Floating solids and foam
009 Noncontact Cooling Water	No free oil in the receiving water	Flow rate Chemical inventory (if chemicals are used in the effluent) Chlorine (for antifouling) Floating solids and foam
010 Ballast and Storage Displacement Water	No free oil in the receiving water	Flow rate No free oil in the receiving water Floating solids and foam

Table 4.5-1. Comparison of effluent limitations between the old (1984) general permit and the new proposed general permit (continued).

011 Bilge Water	No free oil in the receiving water	Flow rate No free oil in the receiving water Floating solids and foam
012 Boiler Blowdown	Not in permit	Floating solids and foam
013 Test Fluids	Not in permit	Flow rate No free oil in the receiving water Chemical inventory Floating solids and foam
014 Diatomaceous Earth Filter Media	Not in permit	No free oil in the receiving water Floating solids and foam
015 Bulk Transfer Material Overflow	Not in permit	Floating solids and foam
016 Uncontaminated Water	Not in permit	Floating solids and foam
017 Water flooding	Not in permit	No free oil in the receiving water Chemical inventory Floating solids and foam
018 Laboratory wastes	Not in permit	No free oil in the receiving water Floating solids and foam
019 Excess Cement Slurry	No free oil in the receiving water	Flow rate No free oil in the receiving water Floating solids and foam
020 Muds, Cuttings and Cement at Seafloor	Not in permit	No free oil in the receiving water Floating solids and foam
021 Hydrotest water	Not in permit	Flow rate No free oil in the receiving water Chemical inventory Chlorine Floating solids and foam
022 H_2S Gas Processing Waste Water	Not in permit	Flow rate No free oil in the receiving water Floating solids and foam

[1]Operators commonly conduct toxicity tests on drilling mud whenever they are discharged into the sea.

Table 4.5-2. Relevant studies examining water quality in the study area.

Area of Study	Citation
Southern California	Anderson, J. W., D. J. Reish, R. B. Spies, M. E. Brady, and E. W. Segelhorst. 1993. Human impacts on the Southern California Bight. Chapter 12, in, M.D. Dailey, D. J. Reish, and D. W. Anderson (eds.), Ecology of the Southern California Bight: A synthesis and interpretation.
Northern Santa Barbara County	Arthur D. Little (ADL). 1985. Union Oil Project/Exxon Project Shamrock and Central Santa Maria Area Study EIS/EIR (and appendices). Prepared for County of Santa Barbara, Minerals Management Service, California State Lands Commission, California Coastal Commission, and California Office of Offshore Development.
Santa Barbara County	ADL. 1984a. Point Arguello Field and Gaviota Processing Facility Area Study and Chevron/Texaco Development Plans EIR/EIS. Final Report. Prepared for: County of Santa Barbara, U.S. Minerals Management Service, California State Lands Commission, California Coastal Commission, California Secretary of Environmental Affairs.
Santa Barbara County	ADL. 1984b. Point Arguello Field and Gaviota Processing Facility Area Study and Chevron/Texaco Development Plans EIR/EIS. Appendix H. Marine Water Resources. Prepared for: County of Santa Barbara, U.S. Minerals Management Service, California State Lands Commission, California Coastal Commission, California Secretary of Environmental Affairs.
Southern California	Bureau of Land Management (BLM). 1979. Natural and Anthropogenic Fluxes of Chemicals into the Southern California Bight as Related to the Potential Impacts of Offshore Drilling. Southern California Baseline Study, Benthic, Year Two, Volume II, Report 24.0. Robert F. Shokes and Paul J. Mankiewicz (authors), Science Applications, Inc., La Jolla, California. BLM/DOI Contract No. AA550-CT6-40.
Southern California	BLM. 1978. 1975/1976 Southern California Baseline Study and Analysis. Vol. II, Integrated Summary Report. Robert F. Shokes and Richard A. Callahan (authors), Science Applications, Inc., La Jolla, California. BLM/DOI Contract No. 08550-CT5-52
Santa Barbara County –Santa Barbara Channel	Chambers Group, Inc. 1987a. Final Supplemental Environmental Impact Report for the Exxon Santa Ynez Unit Offshore Oil Development Proposal. Prepared for: California State Lands Commission.
Santa Barbara County –Santa Barbara Channel	Chambers Group, Inc. 1987b. Finalizing Addendum. Final Supplemental Environmental Impact Report of the Exxon Santa Ynez Unit Offshore Oil Development Proposal. Prepared for: California State Lands Commission
Southern California	Minerals Management Service. 1996. Outer Continental Shelf Offshore Oil and Gas Leasing Program: 1997 -–2002. Final Environmental Impact Statement. August 1996. 2 Vols.
General	National Research Council. 1983. Drilling Discharges in the Marine Environment
Santa Barbara County –Santa Barbara Channel	Science Applications, Inc. 1984. Final Environmental Impact Statement/Report. Technical Appendix 12: Marine Water Quality for the Santa Ynez Unit/Las Flores Canyon Development and Production Plan
Southern California	Valerie Raco-Rands. 1996. Characteristics of Effluents from Small Municipal Wastewater Treatment Facilities in 1995 (in SCCWRP, 1996)
Southern California	Valerie Raco-Rands. 1998. Characteristics of Effluents from Large Municipal Wastewater Treatment Facilities in 1996 (in SCCWRP, 1998)
General	James P. Ray and F. Rainer Engelhardt (eds.). 1992. Proceedings of the 1992 International Produced Water Symposium. February 4-7, 1992, San Diego, California.

Table 4.5-2. Relevant studies examining water quality in the study area.

Area of Study	Citation
Northern Santa Barbara County	URS Company. 1986. San Miguel Project and Northern Santa Maria Basin Area Study Final EIS/EIR (and appendices), Cities Service Oil and Gas Corporation and Celeron Pipeline Company of California. Prepared for County of San Luis Obispo County, County of Santa Barbara, Minerals Management Service, California State Lands Commission, California Coastal Commission, and California Office of Offshore Development.

These subregions are loosely based on the level of activity that is occurring both onshore and offshore. For example, traveling from north to south, population, shipping traffic, nonpoint pollution sources, and on- and offshore oil and gas activities increase, while river runoff generally decreases. These factors result in a general increase in pollution. The Point Sal, Purisima, and Bonito Units can be considered to be in the first subregion, above, although the Bonito Unit, located west of Point Conception, can be considered to be in a transition zone from the Santa Maria Basin and to the Santa Barbara Channel proper. The Gato Canyon Unit is in the north-central Santa Barbara Channel; thus, in the second subregion, above.

Point Lobos to the western entrance of the Santa Barbara Channel. The California coast south of Point Lobos is, relative to southern California urban centers, sparsely inhabited with little industrial development and more agriculture and ranching (MMS, 1996). Only two Publicly-Owned Treatment Works (POTWs), or sewage treatment plants, discharge directly into the Pacific Ocean in San Luis Obispo County (table 4.5-4). Three others discharge into local rivers discharge into the ocean. All the dischargers are small, according to EPA criteria (less than 25 million gallons per day [mgd]).

The Santa Maria River, on the border of Santa Barbara and San Luis Obispo Counties, and the Santa Ynez River, which flows into the ocean between Points Purisima and Arguello, are the major sources of pollution that could exist in the San Luis Obispo/northern Santa Barbara County area. Contaminants and nutrients in runoff from rivers are influenced by three factors (NRC, 2001):

- Land uses (for example, whether the primary use of the land is forested, agricultural, industrial or urban;
- Human activities that involve the application of fertilizers, pesticides and the generation of wastes;
- Natural phenomena and land-use decisions that affect water infiltration, groundwater movement, runoff, and transport in streams and rivers.

Pollutants that could be associated with these rivers are predominantly agriculturally based and may include dairy and ranching-related pollutants (for example, animal wastes) and pesticides. During winter, high runoff periods associated with storm and rain conditions followed by upwelling-favorable winds have driven these river plumes south past Point Conception and to the vicinity of San Miguel Island (Hickey and Kaschel, unpubl.).

The paradox of these plumes is that the higher the flow, the greater the dilution. Additionally, the only time the plumes would reach to the vicinity of the outer continental shelf would be during times of high flow. Thus, pollutants carried by the plume would be well-diluted, but perhaps still detectable, in the offshore area.

For most of the central California coast, there are no oil and gas activities. Marine terminals at Morro Bay, Avila Beach and Gaviota have all been removed. The most northern marine terminal, and the only one in the Santa Barbara Channel is at Ellwood. The most northern offshore oil and gas facility is Platform Irene, located just northwest of Point Arguello. There may also be natural oil and gas seeps along the central California coast, but there is little information on these. The primary seepage zones are all found at Point Conception and south (see below).

There is little information regarding the fate of pollutants that are discharged into this subregion, in part due to the overall lack of pollution. For this subregion, there is no evidence for such mechanisms as uptake and bioaccumulation of some anthropogenic-based materials such as mercury and certain pesticides, and DDT to occur.

Thus, due to the low population density, lack of major industries and intermittent high-flow river runoff, the Santa Maria Basin area and points north has good water quality.

Santa Barbara Channel to Point Fermin. Pollution in the Santa Barbara Channel and south, along the Malibu coastline, is probably greater than north of Point Conception, although no studies have been conducted to quantitatively ascertain this. Nevertheless, increases in population and pollution sources would indicate that this statement is true qualitatively. Overall, there are 24 discrete sources of pollution from Point Conception to Point Fermin including six sewage dischargers, two power plants, six industrial waste dischargers and 10 sources of runoff (Anderson et al., 1993). The largest fresh water inputs are the Santa Clara and Ventura Rivers and the Oxnard municipal wastewater treatment plant (MMS, 1996).

In general, water column particulates and benthic sediments in the southern California OCS reflect the chemistries of their source materials (BLM, 1978). Surface waters located in the inshore areas usually contain only fine-grained materials mixed with planktonic organisms while the near-bottom waters can hold a various assortment of materials in suspension from downslope transport processes (for example, turbidity flows). These inshore waters were found to have a preponderance of land-derived materials whose metal contents have been influenced by anthropogenic sources (BLM, 1978).

Indicators of Pollution. The Natural Resources Defense Council (NRDC) published its 10th Annual report entitled, "Testing the Waters 2000: A Guide to Water Quality at Vacation Beaches" on August 3, 2000 (NRDC, 2000; Los Angeles Times, 2000). This report listed the number of nationwide beach closures due to pollution for 1999. The data were collected by EPA as part of its BEACH (Beaches Environmental Assessment, Closure and Health) program and was based on responses from over 100 agencies to EPA's questionnaire. Of the six southern California counties from San Luis Obispo to Los Angeles, Santa Barbara County had the largest number of closings, 1392 days; followed by Los Angeles, 460; Ventura, 257; and San Luis Obispo, 4. The closings were commonly posted due to high bacteria counts (fecal coliform). The majority of these closings were attributed to pollutants brought to the coast by river runoff.

The National Oceanic and Atmospheric Administration's National Status and Trends Program (NS&T) has conducted monitoring of the U.S. coastline since 1984. Data from this database (see the website http://state-of-coast.noaa.gov/bulletins/html/ccom_05/ccom.html) indicate that levels of pollutants are generally decreasing along the southern California coast (Catalina Island to San Luis Obispo). Areas of 50 percent or more occurrences of "high" concentrations of particular contaminants are all located south of Point Dume. A site is said to have a high level of any particular contaminant if it fell within the top 15 percent of all levels for all sites. The monitored points north of Point Dume include Point Santa Barbara, Santa Cruz Island, Point Conception and San Luis Obispo; none of these sites exhibited high levels of any contaminant.

Table 4.5-3. Key water quality parameters, typical units of measure and characteristics.

Parameter (Units)	Characteristics
Temperature (°C)	Ocean surface temperatures minimums of 12-13 °C in April and maximums of 15-19 °C in July-October
Salinity (°/oo)	Typically 33.2-34.3 °/oo (parts per thousand)
Dissolved oxygen (DO) (mg/L or ml/L)	Maximum values of 5-6 ml/l at the surface, decreasing with depth; nearshore values at 200 m depth about 2 ml/l; at depths below 350 m, values as low as 1 ml/l; upwelling can brings oxygen-poor water to the nearshore surface waters, especially in May-July
pH (unitless)	pH values range from about 7.8 to 8.1. pH increases with increased CO_2 consumption, via photosynthetic activity, and with increasing salinity; pH decreases slightly with increasing depth and decreasing temperature.
Nutrients (µg-atoms/l)	Nutrients limiting primary production include nitrogen, phosphorus, and silicon (nitrogen more than phosphorus); micronutrients include iron (Fe), manganese (Mn), Zn, Cu, cobalt (Co), molybdenum (Mo), vanadium (V), vitamin B12, thiamin and biotin. Concentrations in the water column show depletion near the surface, increasing with depth.
Turbidity (mg/L)	Suspended sediment concentrations average near 1 mg/L, but can range from 0.93 – 1.5 mg/L in the nearshore, surface waters (BLM, 1978). Higher levels are found near the bottom sediments (mean of 0.4 mg/L and a range of 0.1 to 1.4 mg/L) while lower levels are found in the offshore regions (mean of 0.15 mg/L and a range of 0.07 – 0.32 mg/L). Periods of highest turbidity correspond to periods of highest upwelling, highest primary production and river runoff. Turbidity controls the depth of the euphotic zone, has applications for (absorbed) pollutant transport and is of aesthetic concern.
Organics materials (µg/l)	Naturally-occurring organic materials include a wide variety of molecules ranging from hydrocarbons to biogenic-based substances. They may enter the marine environment via natural processes or from anthropogenic sources.

Table 4.5-4. Dischargers in San Luis Obisbo county, the level of treatment and flow.

Discharger	Receiving water	Treatment Level	Flow (mgd)
City of Lompoc	Santa Ynez River	Secondary	3.72
San Luis Obispo	San Luis Obispo Creek	Tertiary	4.53
Pismo Beach	Pacific Ocean	Secondary	1.11
Avila Beach	San Luis Obispo Creek	Secondary	0.025
Tosco refinery	Pacific Ocean	Secondary	0.435

Source: Mike Higgins, Central Coast Regional Water Quality Control Board (pers. comm, 2001)

The Southern California Bight Pilot Project (SCBPP), a collaboration of 12 government organizations, conducted a 261-site comprehensive regional monitoring survey in 1994. The primary objective was to assess the spatial extent and magnitude of ecological disturbances on the mainland continental shelf of the SCB and to describe relative conditions among different regions of the Bight (Southern California Coastal Water Research Project (SCCWRP), 1998).

The survey found water quality to be good throughout the SCB. Almost all of the surface waters were fully saturated with oxygen, and more than 99 percent of the SCB met California Ocean Plan water-quality objectives for dissolved oxygen and water clarity. Areas of reduced water clarity through the Bight were mostly located in shallow water and probably resulted from the natural resuspension of bottom sediments.

Trace metals, especially from anthropogenic sources, are of concern throughout the Southern California Bight. Table 4.5-5 shows some values collected during the 1976-1978 BLM-sponsored baseline studies. Inner shelves and basins are those associated either with the mainland or islands as opposed to those located south of the Channel Islands towards and including Tanner and Cortez Banks.

Publicly-owned Treatment Works. There are six POTWs that discharge treated effluent to the Channel (table 4.5-6). They are all small dischargers (less than 25 million gallons/day) whose effluents are at a mixed primary/secondary level of treatment (SCCWRP, 1996). Although secondary treatment of municipal sewage removes at least 85 percent of the organic material and suspended solids in wastewater, only one-third of the nitrogen and phosphorus is eliminated (National Research Council (NRC), 1993; 2000). Generally, eutrification, or the over-abundant presence of nutrients, is not generally a problem in the open-ocean, high energy environment that characterizes the coastline of the study area. However, there are advanced treatment technologies that can remove up to 97 and 99 percent of nitrogen and phosphorus, respectively. There are very few other point sources of pollution along the shorelines of the Channel with few industrially-based outfalls. Several power plants spaced along the Santa Barbara, Ventura and northern Los Angeles County coastlines do discharge heated water, and some chlorine is used to prevent fouling of heat exchangers; however, effects from these effluents are limited spatially.

Storm drains. Storm-water runoff is the largest source of unregulated pollution to the waterways and coastal areas of the United States (CCC, 2000). Because runoff is an untreated pollution source, it has the potential to be a source of increased health risks to swimmers near storm drains, higher concentrations of metals in harbor and ocean sediments and increases in toxicity to aquatic life. However, storm drain-associated pollution would be confined to the near-coastal vicinity since, even during high runoff periods, the volume would not be enough to carry pollutants very far offshore.

The two major rivers, the Santa Clara and Ventura, are both in Ventura County and drain largely agricultural lands, although the urban areas of Ojai, Ventura, Oxnard/Port Hueneme and Camarillo contribute pollutants via storm drains and other nonpoint source runoff. Also, the plumes do cross the Channel and can reach as far as the Northern Channel Islands National Marine Sanctuary waters (Hickey and Kaschel, unpubl.). However, as discussed above, most of this untreated runoff occurs only during the rainy season.

Past and Present OCS Oil and Gas Activities. OCS oil and gas activities began off southern California in the late 1960's (Galloway, 1997). Section 3 provides information on current offshore infrastructure and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on physical, biological, and socioeconomic resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995, 1997; MMS, 1996.

During the period of the 1950's and 1960's, regulation of discharges was less stringent that those of today. No records of what and how much was discharged exists from that period. In addition, six platforms and several piers, which support oil wells in the Santa Barbara Channel, in State waters have been decommissioned. Data from these platforms and piers is similarly nonexistent (pers. comm., Michael Higgins, Central Coast Water Resources Control Board, December, 2000). Of a total of 42 leases in State waters, there are currently 18 producing leases, including five offshore Ventura County and two offshore Santa Barbara County (California State Lands Commission (CSLC), 2000).

The major discharges from oil and gas activities have been described above and in table 4.5-1 along with the 17 other potential oil and gas-related effluents. Each of the facilities that could discharge these effluents are regulated by NPDES permits issued by EPA. For facilities (including nonoil and gas) onshore and in State waters, the local Water Resources Control Board has been delegated by EPA to oversee compliance with NPDES permits.

Oil and gas activities in the Channel currently consist of 16 oil and gas platforms: 15 in Federal waters and one in State waters (for purposes of this discussion, the three oil and gas platforms west of Point Conception – Harvest, Hidalgo and Hermosa – are considered to be in the western Santa Barbara Channel). Only the facilities located in Federal waters discharge any effluents; no discharges are allowed from facilities located in State waters. While all platforms have the potential to discharge drilling muds and cuttings, only Exxon's Platform Heritage is conducting a drilling program at present, although Exxon is using a both water- and oil-based drilling muds for these extended-reach wells. Since oil-based muds cannot be discharged, the amount of water-based muds being discharged for these wells is probably less than for the other occasional wells that have been drilled at the other platforms during the past 6 to 8 years. Ten of the 16 platforms discharge produced water, while all the platforms discharge deck drainage, treated sewage, well completion and workover fluids, and other effluents (table 4.5-1). The five most-common discharges, described in more detail below, contribute the most pollution and undergo the most treatment but may not comprise the most volume (this could come from noncontact cooling water or firewater overpressure, both of which are sea water with no treatment).

Drilling Fluids. Water-based drilling fluids (also known as drilling muds), which are the only type permitted for discharge, is a fresh or sea water slurry of clay (attapulgite or bentonite and sometimes others) or natural organic polymer, barium or iron sulfate, lignosulfonate, lignite and sodium hydroxide, plus several minor additives (NRC, 1983). Oil-based drilling fluids may contain up to 10 percent mineral oil, as well as water, and similar additives. Drilling muds are not treated. If they become contaminated with a material that exceeds oil and grease or toxicity limitations, they can be reinjected downhole or retained and shipped to shore for disposal.

There is no evidence that past routine discharges from offshore oil and gas facilities have no more than temporarily degraded the water quality. While they probably contributed to the overall pollutant load, these discharges have been shown to dilute to below detection fairly rapidly. For example Ayers et al. (1980a) found that suspended solids concentrations from discharged muds and cuttings reached background concentration at distances of 0.3 to 0.6 km (9,600 to 19,200 ft) while Ayers et al. (1980b) found

Table 4.5-5. Selected trace metals found in sediments in the Southern California Bight.

Metal	Average (ppm) Inner Shelves	Average (ppm) Inner Basins	Range (ppm) All Sampled Areas
Barium	835	686	43 – 1899
Cadmium	0.57	0.93	0.2 – 5.5
Chromium	56	119	12 – 370
Lead	17	25	4.2 – 69
Zinc	54	101	12 – 227

Source: BLM, 1978.

that suspended solids and particular trace metals reached background levels in 0.5 to 1.0 km (16,000 to 32,000 ft). Houghton et al. (1980) found dilution rates of 10,000 to 1 with 100 m (320 ft) of the discharge point. Ray and Meek (1980), in a study in the high energy environment of the Tanner Banks, offshore California, found that suspended solids and trace metals concentrations approached background levels at a distance of 0.2 km (6,400 ft) from the exploratory drilling rig. For all of these studies, once the discharge ceased, parameters for water quality returned to normal. In addition, Jenkins et al. (1988) found that barium levels resulting from drilling muds discharges from an exploratory well reached background within 1,500 meters (4,800 ft) and ,more recently, tracers of barium that was associated with drilling mud discharges from development wells offshore Point Conception, California, were detectable up to 6.8 km (21,760 ft) from the discharging platforms.

Produced water. Produced water contains a suite of components, including metals and dissolved hydrocarbons, that must be reduced as much as possible in the effluent before it is discharged into the sea. These components include, water-soluble organics such as light aromatics (benzene, toluene and xylene); a variety of other aromatic and aliphatic compounds; and metals such as barium (Ba), chromium (Cr), cadmium (Cd), copper (Cu), zinc (Zn), mercury (Hg), lead (Pb), silver (Ag), and nickel (Ni) (Unpubl. data, EPA, Region 9). Treatment of produced water is accomplished by various mechanical (such as heat, corrugated plates, and electrostatic) and chemical means. All facilities that discharge produced water have a sampling point installed in the pipe that discharges to the ocean where samples for chemical and toxicity analyses are collected. This is the point where both the operator and government inspectors can collect samples to ensure that the produce water stream is meeting the limits for the NPDES permit in effect at that facility (see above regulatory setting discussion).

MMS has compiled an Excel spreadsheet for produced water discharges from 1988 to present (Panzer, unpubl.). The data are based on the Discharge Monitoring Reports (DMRs) that each operator's NPDES permit require them to submit to the EPA. The spreadsheet also has data from compliance sampling conducted by EPA and MMS since 1990. Records of discharges prior to 1988 are spotty at best and, in most cases, include only a few records from a few platforms. The data since 1988 generally indicate that operators have met the terms of the permits (Panzer, 1999). Few exceedances have been reported or detected by compliance monitoring. Operators are required, by the terms of their permits, to report exceedences within 24 hours of the event. If this is not done, the operators are subject to penalties.

Produced water studies have shown dilutions of up to 1500 to 1, which is similar to that cited in mod-

Table 4.5-6. Publicly-owned treatment works that discharge into the Southern California Bight (within the study area).

POTW Name	Location	Level of Treatment	Volume Discharging (mgd)
Goleta	Santa Barbara Channel	Primary/Secondary	5.2
Santa Barbara	Santa Barbara Channel	Secondary	8.1
Montecito	Santa Barbara Channel	Secondary	1.1
Summerland	Santa Barbara Channel	Tertiary	0.17
Carpinteria	Santa Barbara Channel	Secondary	1.5
Oxnard	Santa Barbara Channel	Secondary	19.5
Hyperion Treatment Plant	Los Angeles	Advanced Primary/ Secondary*	202/145
Joint Water Pollution Control Plant (Los Angeles County)	Los Angeles	Advanced Primary/ Secondary*	144/188
Terminal Island	Los Angeles	Secondary	16.9
Catalina Island (Avalon)	Los Angeles	Secondary	0.67
San Clemente Island	Los Angeles	Secondary	0.028

Source: SCCWRP (1996; 1997)

els developed to calculate dilution for the purpose of determining compliance with NPDES permits (EPA, 2000a). Osenberg et al. (1992) studied a produced water outfall offshore Carpinteria, California. This outfall, located in shallow water (about 10 to 12 m (32 to 40 ft water depth)) in an open-coast environment, was shutoff in 1986. In general the researchers found that outplanted mussel performance (as measured by shell growth) increased with distance from the outfall. However, the last two stations were 100 m and 1,000 m (320 and 3,200 ft, respectively) from the outfall. The researchers note that there was still some detectable affect in mussel performance at 1,000 m (3,200 ft) however, due to the lack of a station between 100 and 1,000 m, (320 to 3,200 ft) and their inability to detect the physical signal of produced water past 100 m, they were unable to draw any firm conclusions. Similarly, there was no evidence on the competency of red abalone larvae settling past 500 m (1,600 feet) from the outfall (Raimondi and Schmitt, 1992). The series of studies, cited above, resulted from a study site in shallow water. No studies on produced water discharges from OCS oil and gas facilities have been conducted in deeper water. More detailed information on this effluent can be found in section 5.3.4.2(1).

Treated sewage. Sewage, treated with chlorine to kill fecal coliform bacteria, is discharged from all platforms. Generally, the sewage and the "gray" water from showers, sinks and the galley is co-mingled after the sewage is treated and both are discharged via the same outfall. Volumes discharged are calculated by assuming a factor of about 35 gallons per person per day aboard a platform or drilling vessel. Manning ranges from three to over 100 persons depending on the size of the facility and the amount of activity (for example, whether drilling is occurring).

Deck drainage. Deck drains capture various fluids and other materials that are spilled or washed onto the decks of the platforms. All platforms have 4" (minimum required height) kick plates which prevent such spills from entering the sea. Deck drains are generally plumbed to a settling tank where oily liquids are skimmed off and the water treated with the produced water stream. On some facilities, deck drains are commingled with the produced oil and treated, discharged, and regulated with the produced water.

Well treatment and completion fluids. These materials can be discharged when existing production wells need down-hole work, such as pump replacement or any of a variety of well production enhancement efforts. Any fluids emanating from these process can be discharged provided they do not exceed oil and grease limits or cause a sheen or other visible pollution on the sea surface. Most often, operators combine any fluids from the wells with the produced water stream (pers. comm., David Panzer, MMS); the commingled stream then becomes subject to permit limitations for the produced water effluent.

The various other effluents that can come from facilities operating in the OCS are all subject to limitations but little treatment (table 4.5-1).

Natural seeps. Natural oil and gas seeps contribute significant amounts of hydrocarbon to the marine environment. Most known seeps occur on the mainland shelf, although others have been reported around the Channel islands and offshore banks and ridges (MMS, 1996). The four main seepage zones on the mainland shelf are at Point Conception, Coal Oil Point, Santa Barbara/Rincon in the Santa Barbara channel and in the Santa Monica Bay (Anderson et al., 1993). One of the world's largest natural oil and gas seeps lies offshore Goleta, just west of Santa Barbara. This seep was partially tented in the early 1980's by Arco, the owner at the time of the State leases on which the seeps exist. Estimates of the amount of oil an gas collected by the tents in the mid-1990's were 150 bbl of oil and 230 MMSCF of gas per day (MMS, 1996). These and other seeps, occurring in the SCB, contribute locally elevated hydrocarbons to the water column and can form substantial slicks on the sea surface.

The fate of pollutants discharged into the waters of this subregion can be many. For example, onshore-based pollutants from POTWs, storm drains and other nonpoint sources can be taken-up by intertidal animals, such as mussels or other bivalves. However, mussels have been shown to be able to depurate their body burdens when exposed to clean water after an episode of pollution exposure (Neff, 1987; 1997). Mussels are harvested from some offshore platforms in the Santa Barbara Channel. These are collected by scraping from the platform legs and taken to fresh sea water for depuration and sold to local restaurants, as well as to overseas markets.

Overall, water quality in the Santa Barbara Channel area is relatively good. This is due to the lack of major point- or nonpoint pollution sources such as major sewage outfalls, urban-associated storm drains, and major river outflow. Although river plumes do impinge on the Santa Barbara Channel during periods of high outflow, the pollution associated with this phenomenon becomes well-diluted as it spread across the Channel. Additionally, pollution indicators, such as beach closings, that show potential, coastally dependent pollution are somewhat contrasted with mussel watch data showing little land-based pollution problems.

High molecular weight petroleum aromatic hydrocarbons (PAHs) are one example of an anthropogenic-based pollutant. Offshore waters of the Southern California Bight receive this pollutant in the form of soot from various combustion sources. Soot-associated PAHs are delivered to the Bight primarily in aerial fallout, treated domestic waste discharges and urban runoff. Petroleum aromatic hydrocarbons associated with soot are tightly bound to the particles and are not readily bioavailable to marine organisms. These compounds are not accumulated efficiently from the food and are biodegraded rapidly in the tissues of most marine animals; therefore, they do not biomagnify in marine food webs and do not pose a potential hazard to fish that consume biofouling organisms from submerged platform structures.

Another example of a sink, in which pollutants may bioaccumulate or biomagnify, is Santa Monica Bay. Years of disposal of DDT, primarily via a sewage outfall, and other chlorinated hydrocarbons resulted in contamination of the sediments. Bottom-feeding fish, such as white croaker, became contaminated, resulting in public notices advising against eating these and other fish caught in the Santa Monica Bay area. Similarly, sewage sludge was discharged via an outfall in the same area. This discharge ceased in the mid-1980's but the problem remained in terms of contamination of fish and other organisms that inhabit the sea floor.

Effects on water quality from oil spills, can range from a few days, to several weeks or months, depending on the size of the spill type of oil. Effects on the water column could occur in the top 10 to 20 m (32 to 64 ft) of the water column, depending on sea state and the type of oil. Specifically, the effects could include turbidity, biological and chemical oxygen demand and release of hydrocarbons, such as BETX (benzene, ethylbenzene, toluene and xylene) and naphthalene. The slick would be affected by several factors including, wind and wave action, dissolution and volatilization losses. The dissolved components (BETX and others) make up about 20 to 50 percent of crude oils and would be subject to dispersion, dilution and volatilization, as well as to degradation via photolysis and microbial processes. The majority of these low molecular weight aromatic compounds will be lost to volatilization within 24 to 48 hours (Jordan and Payne, 1980). Clean-up actions would also contribute to the minimization of impacts to water quality.

4.6 BIOLOGICAL RESOURCES

4.6.1 ROCKY AND SANDY BEACH HABITATS

Rocky beach habitat in this section refers to the rocky tidepool habitat and its resident algal and invertebrate communities. Sandy beach habitat refers to the habitat and the communities found on the surface and inhabiting the sand. Birds, mammals and fishes present or visiting these habitats are discussed in those specific sections in the EIS.

The Coastal Act of 1976 regulates development in the coastal zone that includes sandy and rocky beach habitats. Sandy and rocky beach habitats are protected through local, State and Federal regulations and programs. County Local Coastal Plans provide specific protection for sensitive habitats in their County, limiting development activities that impact these areas. The California Department of Fish and Game manages marine resources in the intertidal zone, including commercial species such as abalone. The U.S. Fish and Wildlife Service is the Trustee for the resources under OPA 90 and would be responsible for evaluating potential impacts in the event of an oil spill, along with the California Department of Fish and Game. MMS protects rocky and sandy beaches from oil and gas activities through lease stipulations, regulations, inspection procedures and mitigation measures designed to prevent oil from reaching and impacting the shoreline, and to minimize beach impacts during pipeline installation.

REGIONAL SETTING

Approximately half of the shoreline from Point Conception north along the coastline of California is rocky, forming either broad benches or cliffs (Woodward and Clyde, 1982; Dugan et al., 1998, unpublished). Boulder and cobble beaches are patchily distributed within this same area (Dames and Moore, 1983; Woodward and Clyde, 1982). Within sandy beach areas between Point Conception and the Santa Ynez River, dune-backed and bluff-backed beaches are evenly represented (Dugan et al, 1998, unpublished). North of Point Conception, where strong and constant wave action prevails, sandy beaches are found in the lee of each point due to depositional patterns (NOAA, 1998, unpublished). Along the central coast, rocky shorelines form high cliffs and steep rocky benches.

South of Point Conception, over three-fourths of the shoreline is sandy (Dugan et. al., 1998, unpublished). Wave exposure changes dramatically south of Point Conception with wave heights roughly half the size of those found to the north, primarily