FERC/EIS—0002F

Western LNG Project

VOL. II-CP 75-83-2

Final Environmental Impact Statement

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF PIPELINE
AND PRODUCER REGULATION

FERC/EIS-0002F

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF PIPELINE AND PRODUCER REGULATION
WASHINGTON, D.C. 20426

WESTERN LNG PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

VOLUME II

CONSTRUCTION AND OPERATION OF AN LNG RECEIVING TERMINAL AT POINT CONCEPTION, CALIFORNIA

Pacific Alaska LNG Associates
Docket No. CP75-83-2

October 1978

TABLE OF CONTENTS
VOLUME II

	Page
Table of Contents	i
List of Figures	iii
List of Tables	v
Abbreviations and Acronyms	vii
A. DESCRIPTION OF THE PROPOSED ACTION	1
1. Introduction, Purpose, Location	1
2. Proposed Facilities	3
3. Construction Procedures	11
4. Operation, Maintenance, and Emergency Procedures	14
5. Future Plans and Abandonment	17
B. DESCRIPTION OF THE EXISTING ENVIRONMENT	19
1. Climate	19
2. Topography	30
3. Geology	35
4. Soils	53
5. Water Resources	61
6. Vegetation	91
7. Wildlife	103
8. Socioeconomic Considerations	119
9. Land Use, Recreation, and Aesthetics	129
10. Archaeological and Historical Resources	137
11. Air and Noise Quality	149
C. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION	157
1. Climate	157
2. Topography	157
3. Geology	157
4. Soils	164
5. Hydrology	173
6. Vegetation	202
7. Wildlife	210
8. Socioeconomic Considerations	225
9. Land Use, Recreation, and Aesthetics	229
10. Archaeological and Historical Resources	233
11. Air and Noise Quality	234
12. Analysis of Public Safety	253

TABLE OF CONTENTS (cont.)

		Page
D.	MEASURES TO ENHANCE THE ENVIRONMENT OR TO AVOID OR MITIGATE ADVERSE ENVIRONMENTAL EFFECTS	263
	1. LNG Terminal	263
	2. Marine Trestle and Berth	280
	3. Pipeline	284
E.	UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACT	289
F.	RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY	295
G.	IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES	297
H.	ALTERNATIVES TO THE PROPOSED ACTION	299
	1. Alternative Pipeline Routes	299
	2. Alternative West Coast LNG Sites	309
	3. Alternative Access Roads	404
	4. Alternate Dredge Spoil Disposal Sites	416
	5. Alternative of No Action	418
I.	CONCLUSIONS AND RECOMMENDATIONS	419
References		437

LIST OF FIGURES

			Page
Figure	1	Location of Facilities	4
	2	Plot Plan	5
	3	Marine Terminal--Single Berth	7
	4	Typical Profile of an LNG Storage Tank	8
	5	Project Schedule	12
	6	LNG Terminal Flow Diagram	16
	7	Annual Average Frequency of Winds	26
	8	Topography and Bathymetry Adjacent to the Proposed Point Conception Site	31
	9	Natural Provinces and Major Faults--Southwestern California	32
	10	Major Faults Along the Proposed Point Conception Pipeline	36
	11	Fault Map of Project Area	37
	12	Geologic Structure: Northwestern Santa Barbara Shelf and Onsite Faults	38
	13	Earthquake Epicenters Map of Project Region	47
	14	Soil Map of the Proposed LNG Terminal Site	57
	15	Drainage Map	62
	16	Drainage Regions--Point Conception Pipeline Route	66
	17	Wave Hindcast Stations Near Point Conception	72
	18	Wave Roses--Offshore Point Conception Station 5	75
	19	Wave Roses--Santa Barbara Channel Station 6	76
	20	Monthly Frequency of Selected Significant Wave Height	77
	21	Measurement Locations	81
	22	Surface Circulation--Southern California Bight	85
	23	Surf Temperature at Gaviota and Avila	87
	24	Surface Salinity at Avila	90
	25	Vegetation Map--Point Conception LNG Plant Site	92
	26	Transect A--Plant and Animal Distribution	98
	27	Transect B--Plant and Animal Distribution	99
	28	Transect C--Plant and Animal Distribution	100
	29	Kelp Bed Density: Point Conception to Gaviota	101
	30	Properties Sold and Developed in Site Area	131

LIST OF FIGURES (cont.)

			Page
Figure	31	Hollister and Bixby Ranch Property Boundaries	132
	32	Location of Noise Sampling Locations of Existing Residences	154
	33	Potential Offshore Dredge Material Disposal Sites	182
	34	Seawater Outfall Discharge	186
	35	Mooring Pattern	192
	36	Allowable Wave Heights as a Function of Relative Angle	195
	37	Allowable Wave Heights as a Function of Wave Period	196
	38	Allowable Wave Heights as a Function of Wave Period	197
	39	Point Conception Berth Availability by Month	198
	40	Kelp Distribution	207
	41	Sunken-Silo Inground Tank Containment System	277
	42	Conceptual Design of Trestle Crossing Under Railroad Tracks	281
	43	Location of Proposed and Alternative Pipeline Routes	302
	44	Offshore LNG Terminal Sites	313
	45	Initial Sites in Washington	327
	46	Initial Sites in Oregon	328
	47	Initial Sites in Northern California	329
	48	Initial Sites in Southern California	330
	49	Location of Alternative LNG Site at Rattlesnake Canyon	335
	50	Location of Proposed LNG Site at Point Conception	336
	51	Location of Alternative LNG Sites in Dos Pueblos Ranch Area	337
	52	Location of Alternative Site at Oxnard	338
	53	Average Annual Percentage Frequency of Wave Heights Greater Than or Equal to Six Feet off the Calfornia Coast	341
	54	Archaeological and Historical Resources Near the Rattlesnake Canyon Site	350
	55	Location of Rattlesnake-Kettleman Pipeline	380
	56	Cross Section of Proposed Access Road	408
	57	Proposed and Alternative Access Routes and Corridors	410

LIST OF TABLES

			Page
Table	1	Percent Frequency of Wind Speed vs. Wind Direction--Point Arguello	21
	2	Percent Frequency of Wind Speed vs. Wind Direction--Point Conception	23
	3	Percent Frequency of Wind Speed vs. Wind Direction--Point Arguello	24
	4	Percent of Reduced Visability	25
	5	Extreme Winds	29
	6	Topography of Proposed Pipeline Route	34
	~~7~~	~~Active or Potentially Active Faults~~	~~48~~
	8	Types of Agricultural Lands to be Affected by Pipeline Construction	54
	9	Soil Series of the Proposed Point Conception LNG Terminal Site	56
	10	Selected Soil Characteristics of the Soil Associations Crossed by the Proposed Pipeline	58
	11	Mean Annual Rainfall--Runoff Relation for Santa Brabara County	64
	12	Calculated Peak Streamflow	65
	13	Drainage Basin Information	68
	14	Astronomical Tide Data	74
	15	Percent Frequency of Waves off California Coast	80
	16	Percent Frequency of Waves at Point Conception Berth	82
	17	Major Tsunami Heights at Selected Stations	84
	18	Median Seasonal Temperatures at Station 3	88
	19	Approximate Distances in Each Vegetational Community That Would be Traversed by the Proposed Route	95
	20	Rare and Endangered Animals, etc.	108
	21	Percent Coverage by Intertidal Reef Rocks	113
	22	Dominant Southern Californai Nearshore Macrozooplankton	115
	23	Microzooplankton Biomass, Point Conception	116
	24	Phytoplankton of the Point Conception Region	117
	25	Historic and Projected Population--Santa Barbara County	120
	26	Santa Barbara County Construction Activity	122
	27	Santa Barbara County Labor Force--August 1976	124
	28	Percentage of Existing Land Uses Traversed by Proposed Pipeline	133
	29	Historic Properties At or Near the Proposed Channel Coast Facilities	138

LIST OF TABLES (cont.)

		Page
Table 30	Historic Properties Identified by the Applicant's Literature Search and Fieldwork	144
31	Historic Properties On or Near the Proposed Pipeline Route	145
32	National and Californai Ambient Air Quality Standards	150
33	1976 Ambient Air Quality Data--Santa Barbara County	151
34	Background Noise Levels--Proposed LNG Plant Site	155
35	Limitations of Soil Features	166
36	Siltation and Erosion Potential at Proposed Stream Crossings	175
37	Chlorination-Chemical Input and Output	189
38	Movement or Force Limits of the Recommended Mooring Arrangement	193
39	Percent of Berth Downtime by Month	199
40	Construction Labor Force Requirements in Santa Barbara County	226
41	Projected Annual Property Taxes on Completed Facility	228
42	Air Pollutant Emissions During Construction of LNG Plant and Marine Terminal	235
43	Air Pollutant Emissions--Operational Phase	237
44	Annual Project Emissions	239
45	Maximum Ambient Pollutant Increases	242
46	Air Pollution Emission Increment	245
47	Alternative Vaporization and Electric Utility Systems	249
48	Effects of Ambient Noise Levels	253
49	Noise Impacts--Point Conception LNG Plant	254
50	Comparison of Proposed and Alternative Pipeline Routes	301
51	Possible Configurations for LNG Tanker Berth and Storage and Regasification Facilities	317
52	Site Identification Criteria	319
53	Initial Sites Selected for Potential LNG	325
54	Potential LNG Sites Remaining After Initial Elimination Process	331
55	Ranking of Alternative Sites by Environmental Impact	402

ABBREVIATIONS AND ACRONYMS

ADT--average daily traffic count

API--American Petroleum Institute

BACT--best available control technology

bbl--barrel

Bcfd--billion cubic feet per day

BD--beach development

CalCOFI--California Cooperative Oceanic Fisheries Investigations

cc/1000 m^3--cubic centimeters per thousand cubic meters

CCC--California Coastal Commission

cfd--cubic feet per day

cfs--cubic feet per second

CLE--contingency level earthquake

CO--carbon dioxide

CPUC--California Public Utilities Commission

dBA--decibels on the A-weighted scale

DEIS--draft environmental impact statement

Delft--Delft Hydraulics Laboratory

DO--dissolved oxygen

DOE--Department of Energy

DOT--Department of Transportation

EIS--environmental impact statement

EPA--U.S. Environmental Protection Agency

ERA--Economic Regulatory Administration

FEIS--final environmental impact statement

FERC--Federal Energy Regulatory Commission

Fluor--Fluor Engineers and Constructors, Inc.

FPC--Federal Power Commission

fps--feet per second

g--gravity

gpm--gallons per minute

HC--hydrocarbons

IAS--Interagency Archaeological Services

Intersea--Intersea Research Corporation

ITP--intermodal transfer point

kv--kilovolt

kw--kilowatt

LFL--lower flammable limit

Little--Arthur D. Little, Inc.

McMullen--John J. McMullen Associates, Inc.

mw--megawatt

mg/l--milligrams per liter

mg/m^3--milligrams per cubic meter

MLLW--mean lower low water

MP--mileposts

MWH--megawatt hours

$\mu g/m^3$--micrograms per cubic meter

NFPA--National Fire Protection Association

NMHC/NO_x--nonmethane hydrocarbons/nitrogen oxides

NO_x--nitrogen oxides

NO_2--nitrogen dioxide

OBGS--Ormond Beach Generating Station

OSI--Oceanographic Services, Inc.

PG&E--Pacific Gas and Electric Company

PLSC--Pacific Lighting Service Company

PM--particulate matter

PMT--Pacific Motor Trucking Company

PO_x--photochemical oxidants

ppm--parts per million

PSD--prevention of significant deterioration

psia--pounds per square inch, atmosphere

psig--pounds per square inch, gauge

RLE--reliability level earthquake

SCAQMD--South Coast Air Quality Management District

SCE--Southern California Edison Company

SO_2--sulphur dioxide

SoCal--Southern California Gas Company

TSP--total suspended particulates

UCLA--University of California at Los Angeles Archaeological Survey

USGS--U.S. Geological Survey

UV--ultraviolet

Western--Western LNG Terminal Associates

Western Terminal--Western LNG Terminal Company

A. DESCRIPTION OF THE PROPOSED ACTION 1/

1. Introduction, Purpose, Location

On September 17, 1974, Western LNG Terminal Company (Western Terminal) 2/ filed an application in Docket No. CP75-83 for a certificate of public convenience and necessity to construct and operate three LNG receiving, storage, revaporization, and sendout facilities at Point Conception, Los Angeles, and Oxnard, California. Each proposed facility would have an ultimate development capacility of 4 billion cubic feet per day (cfd) of natural gas.

On March 3, 1975, Western Terminal filed three supplements to its application, providing additional specific information about its proposed projects. The supplements to Western Terminal's original application in Docket No. CP75-83 were numbered CP75-83-1 for Point Conception, CP75-83-2 for Los Angeles Harbor, and CP75-83-3 for Oxnard. The Point Conception site was to receive volumes of gas by ship from Alaska's North Slope (El Paso Alaska Company, Docket No. CP75-96 *et al.*); the Los Angeles Harbor site was to receive volumes of gas by ship from south Alaska's Cook Inlet area (Pacific Alaska LNG Company, Docket No. CP75-140 *et al.*); and the Oxnard site was to receive volumes of gas imported by ship from the Republic of Indonesia (Pacific Indonesia LNG Company, Docket No. CP74-160). Final Environmental Impact Statements (FEIS) were prepared by the Federal Power Commission (FPC) staff, now incorporated under the Federal Energy Regulatory Commission (FERC) in the new Department of Energy (DOE) for Docket Nos. CP75-83-1 and CP75-83-3 and circulated in November 1975 and December 1976, respectively, and a Draft Environmental Impact Statement (DEIS) was prepared by the FPC for Docket No. CP75-83-2 and circulated in September 1976.

1/ The following description is compiled from applications, pleadings, workpapers submitted in response to data requests, and other materials furnished by the applicant.

2/ By notice of amendment filed May 17, 1976, Western Terminal (a subsidiary of Pacific Lighting Corporation) and Pacific Gas LNG Terminal Company (a subsidiary of Pacific Gas and Electric Company) would cosponsor the Western Terminal project as the applicant under a contemplated partnership, Western LNG Terminal Associates (Western).

From the time these early applications were filed, several years of studies, hearings, and legal proceedings have occurred, culminating in a new version of these past projects, which is the subject of this environmental impact statement (EIS). Initially, volumes of gas ranging from 130 million cfd to 700 million cfd would be transported by ship from the Republic of Indonesia and/or Alaska's Cook Inlet area to the Point Conception site. In the new project's second stage, the average plant output would be 900 million cfd--500 million cfd Indonesian gas and 400 million cfd Alaskan gas. Peaking capacity could increase the plant's sendout capacity by an additional 300 million cfd. Thus, unless otherwise noted, this EIS will generally consider a 1.0 billion cfd average baseload case. The volumes of gas initially considered to be transported by El Paso Alaska Company are no longer proposed, and the three-terminal concept appears to be moot.

It should be noted at the onset of this EIS that there are several past decisions/recommendations outstanding in the decisionmaking process which could affect the outcome of this project:

(1) The FPC (now FERC) staff has consistently in three past EIS's and hearings recommended that LNG facilities not be constructed at Point Conception but rather at Oxnard. Two FPC administrative law judges have agreed on the acceptability of the Oxnard site. A past FPC Commission had also stated that should the El Paso Alaska Company volumes be transported by ship to California, the receiving site should be at Oxnard rather than Point Conception, as proposed.

(2) The State of California has passed legislation entitled "Liquefied Natural Gas Terminal Act of 1977," which sets limits of population densities within 4 miles of an LNG terminal and the route traversed by an LNG ship.

(3) Since the time the state legislation was passed, Administrator David Bardin of the Economic Regulatory Administration (ERA) of DOE has approved the importation of the proposed volumes of gas from the Republic of Indonesia into Oxnard as originally ~~proposed. The applicant has petitioned ERA for~~ rehearing on the matter.

(4) On July 31, 1978, the California Public Utilities Commission (CPUC) issued a decision authorizing a conditional permit for the Point Conception LNG facilities. Further CPUC hearings are necessary before a final CPUC decision is made.

(5) There are numerous jurisdictional questions among Federal and state agencies which still require resolution.

The new project proposed before FERC and ERA would unload, store, revaporize, and send out LNG delivered by oceangoing tankers to Point Conception from Pacific Alaska LNG Company's proposed liquefaction and storage facility near Kenai, Alaska, ~~as well as tankers from the Republic of Indonesia for Pacific~~ Indonesia LNG Company. Western Terminal proposes to construct and operate two 550,000-barrel LNG storage tanks, nine seawater vaporizers, three gas-fired peaking vaporizers, a marine terminal capable of berthing and unloading LNG tankers with a capacity up to 130,000 cubic meters (equivalent to 817,700 barrels of LNG or 2.84 billion cubic feet of gas), 1/ and other appurtenant facilities. The proposed Point Conception facility would revaporize LNG at an average plant output rate of 900 million cfd, with additional peaking capacity of 300 million cfd. Revaporized gas would be transported through a proposed 112.4-mile long, 34-inch diameter pipeline to Gosford, near Bakersfield, where the pipeline would join with existing gas transmission facilities owned and operated by Pacific Gas and Electric Company (PG&E). The total estimated cost of the project would be $696,567,000. 2/

2. Proposed Facilities

a) LNG Terminal

Western Terminal's proposed Point Conception LNG terminal facility would be situated on a 209-acre site located 120 miles northwest of Los Angeles and 4 miles east of Point Conception, California, as shown in figure 1. A plot plan which identifies the locations of the major facilities is shown in figure 2.

The marine terminal would occupy 30 to 35 acres of leased subtidal land extending approximately 4,600 feet offshore to a depth of 52 to 56 feet mean lower low water (MLLW). The facility would consist of an unloading platform and the associated berthing and mooring dolphins.

1/ Other conversions are given in Appendices L and M.
2/ This cost estimate is one of several which can be derived from data on file before the FERC.

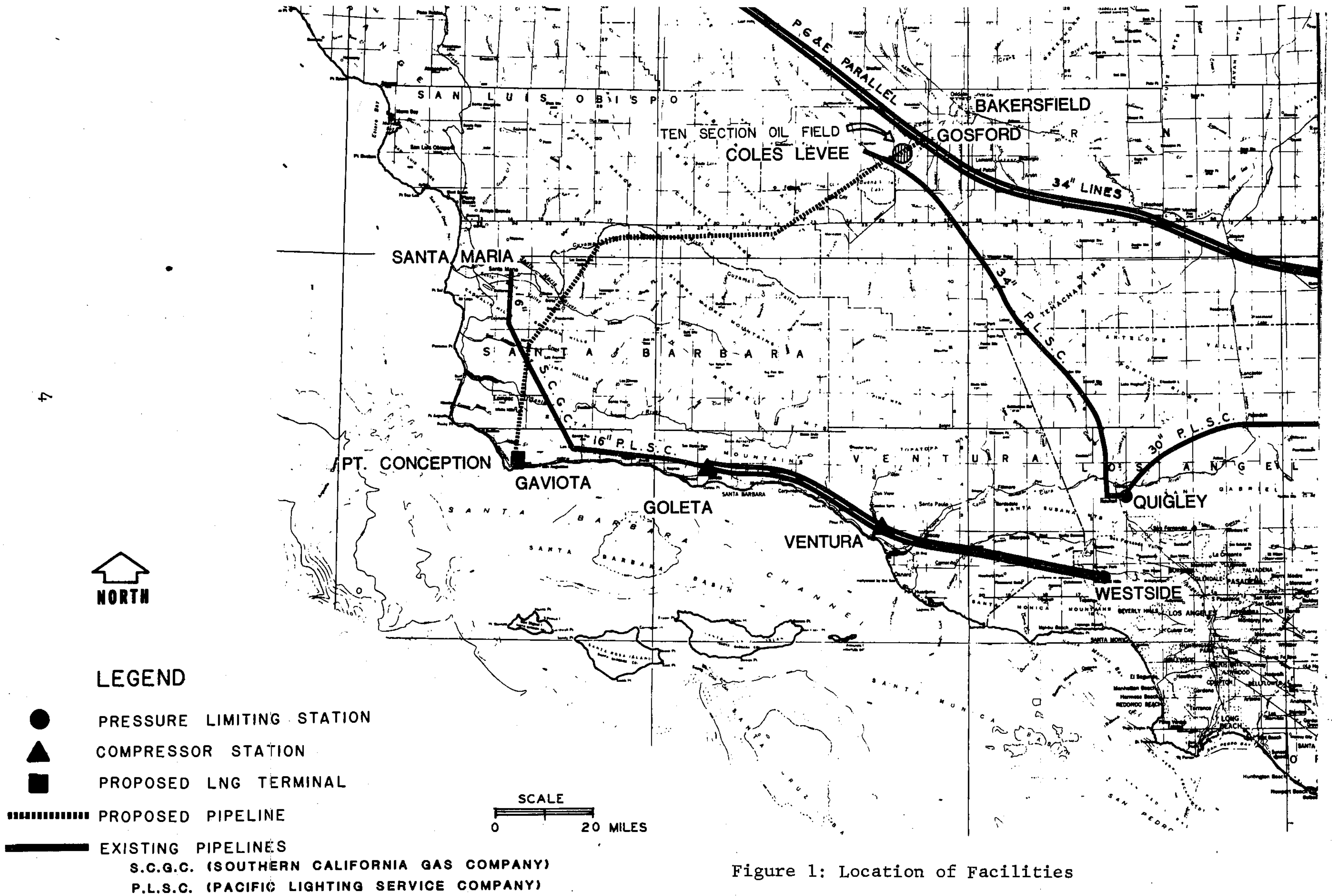


Figure 1: Location of Facilities

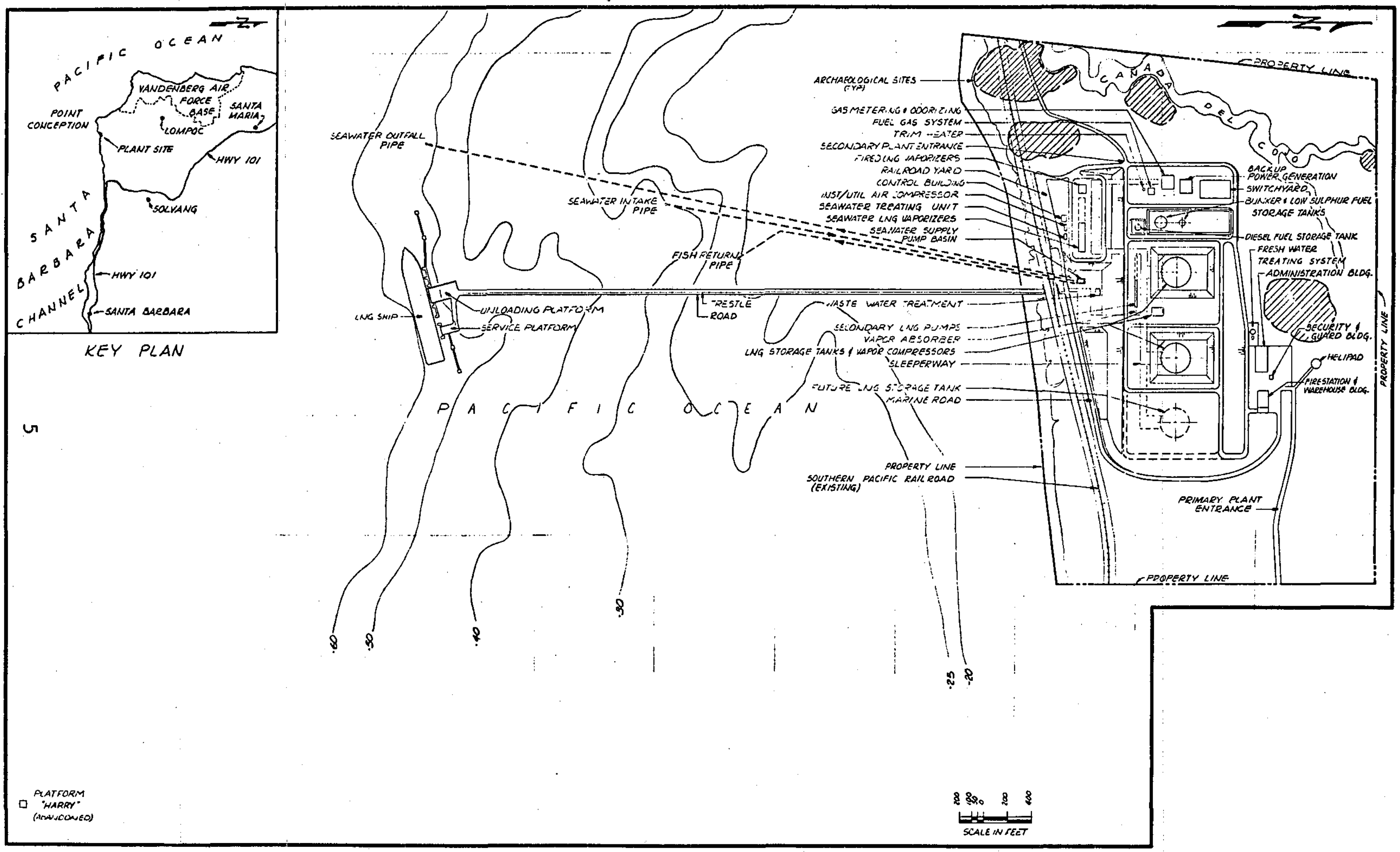


Figure 2: Plot Plan of the Proposed Point Conception Plant Site and Terminal

The unloading platform would contain four 16-inch diameter LNG unloading arms, one 16-inch diameter vapor return line, an LNG drain drum and pump, a nitrogen surge drum, one 12-inch diameter loading arm for Bunker-C fuel oil, and a control tower. All deck elevations would be 50 feet above MLLW. Figure 3 illustrates the location of facilities at the proposed marine berthing.

A service platform adjacent to the unloading platform would contain a fixed crane for loading ship's stores and a gangway for personnel access to the vessel. The four berthing dolphins at the unloading platform would be equipped with energy-absorbing fenders, a powered capstan, and quick-release hooks. Two mooring dolphins would have powered capstans and quick-release hooks similar to the berthing dolphins.

The unloading platform would contain the necessary equipment for pumping the LNG along the 4,600-foot trestle to shore and through the 1,400-foot land pipeline to the storage tanks. The trestle would be 43 feet wide and contain a 12-foot wide roadway, one 32-inch diameter insulated cryogenic pipeline for LNG, a 10-inch diameter vapor return pipeline, and a Bunker-C fuel-oil line. Trestle support would be provided by six pile jacketed structures at 160-foot intervals.

LNG transferred to the facility would be stored in two 550,000-barrel tanks. As shown in figure 4, the tanks would employ a double-wall, suspended deck design with the following approximate dimensions: outside diameter--240 feet, shell height--83 feet, overall height--145 feet. The storage tanks would be designed, constructed, and tested in accordance with Title 49 CFR, Part 192, Amendment 192-10; Minimum Federal Safety Standards, Liquefied Natural Gas Systems. The inner tank wall would be constructed of 9-percent nickel steel, an alloy that retains its strength and ductility at cryogenic temperatures. The outer tank wall and domed roof would be constructed of carbon steel. The annular space between the tank walls would contain expanded perlite, a noncombustible insulation. A fiberglass blanket separating the perlite insulation from the inner tank wall would absorb differential movements between the inner and outer tank walls which could cause compaction of the perlite. The tank floor would be insulated with foamglass blocks, a load-bearing insulation. An electrically heated sand bed would prevent soil freezing beneath the tank and consequent frost heaving. Mineral wool would insulate the suspended deck.

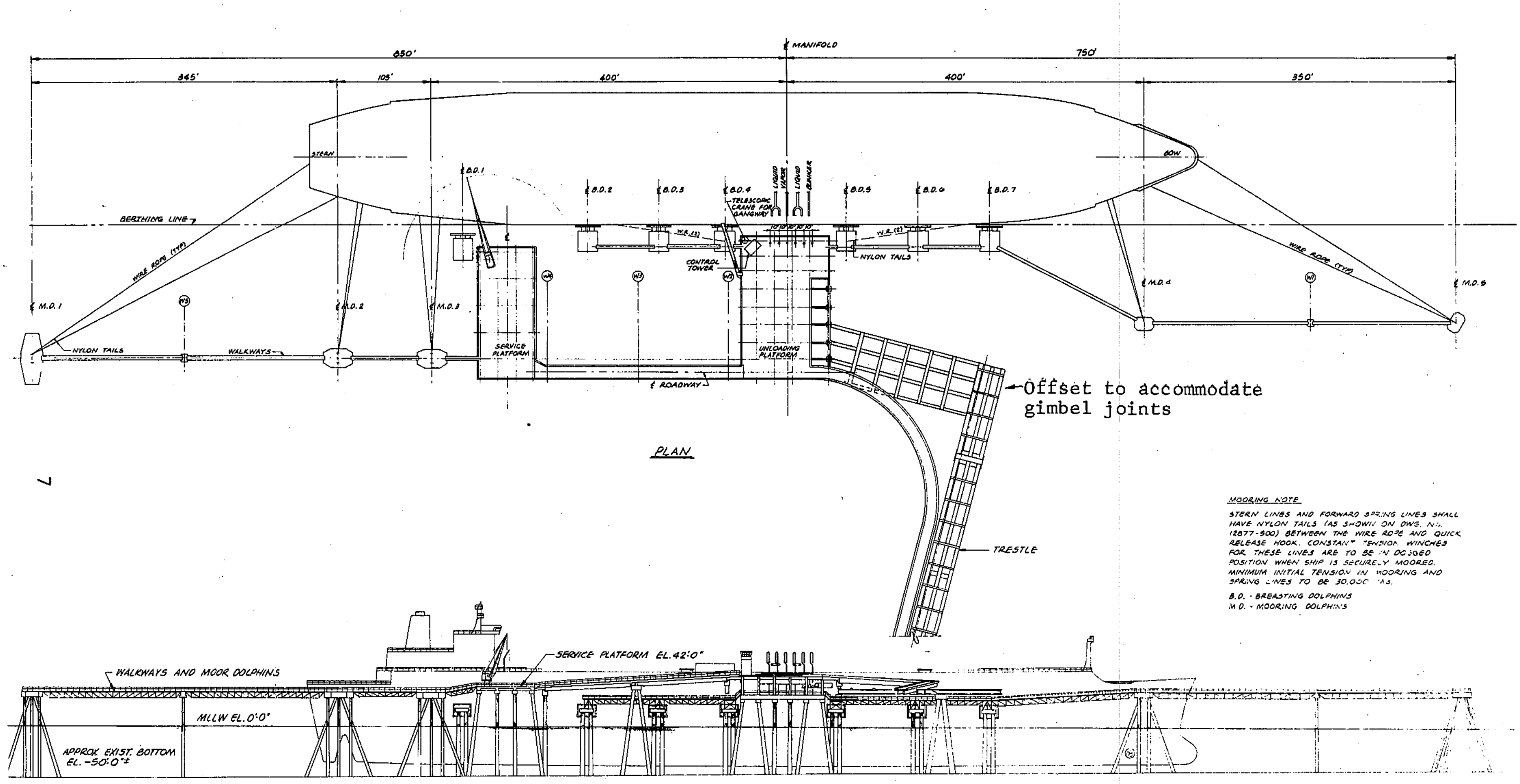


Figure 3: Marine Terminal-Single Berth

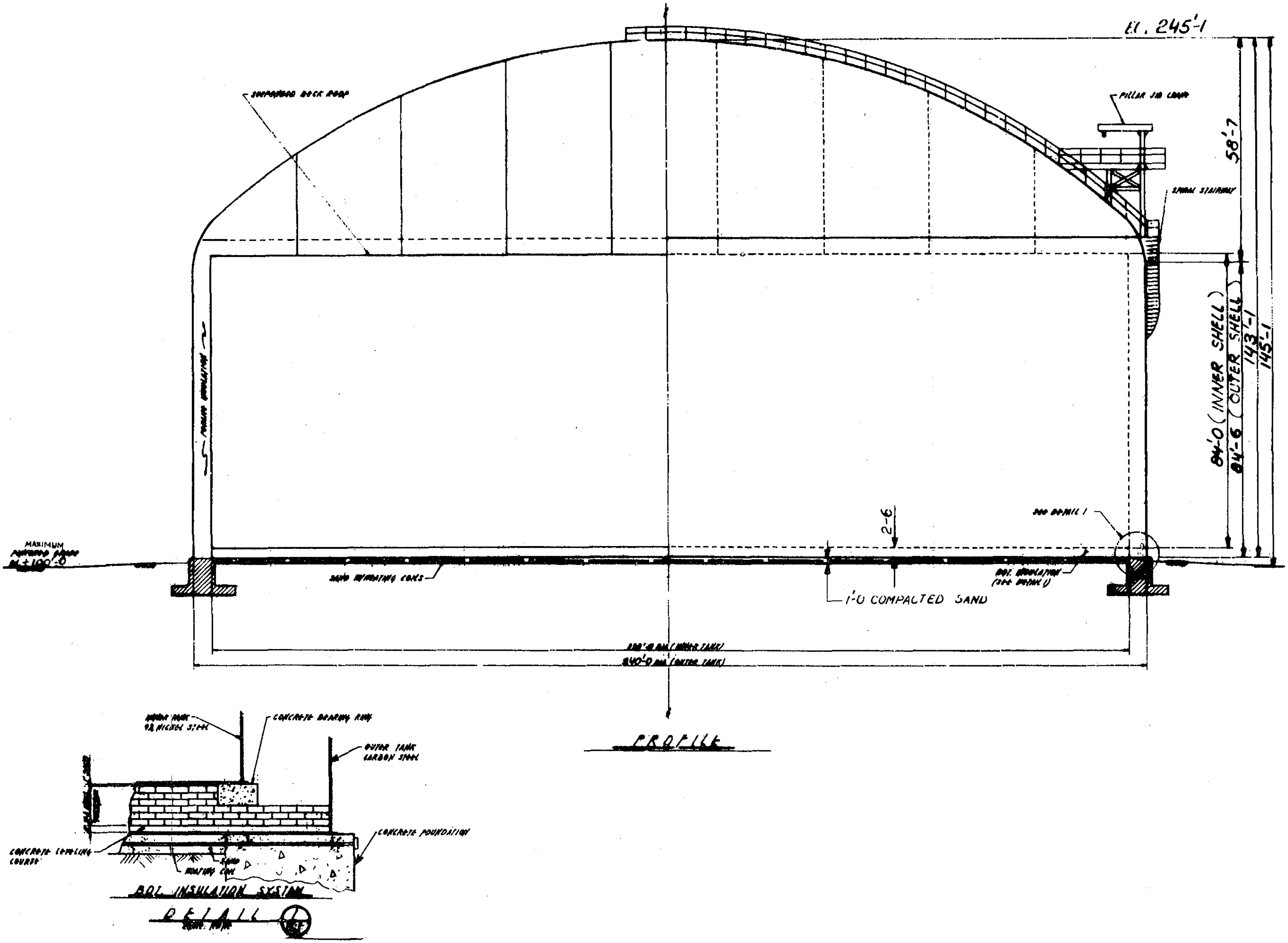


Figure 4: Typical Profile Of An LNG Storage Tank

All piping connections to the inner tank would enter through the roof of the storage tanks. Independent structures would support all external piping to the tank and prevent the transmission of static and dynamic pipe loads to the storage tank walls. Two separate fill nozzles would permit either top or bottom filling. Incoming LNG, heavier than the tank heel, would use the top fill nozzle, while lighter incoming LNG would enter through the bottom fill nozzle. This procedure would permit the tank contents to mix by natural convection and should eliminate the possibility of stratification. In addition, a pump circulation system would mix the tank contents while in storage. LNG would be withdrawn through the top of the tanks by two submerged cryogenic pumps located within each tank.

Normal boil-off gas from the storage tanks would be compressed and injected into the natural gas sendout system. Pressure and vacuum relief valves on each tank are designed to prevent tank damage caused by either high or low pressure within each tank.

The tanks would be designed to withstand instantaneous wind gusts up to 98 mph and an earthquake of magnitude 7.5 (Richter Scale) at the Santa Ynez River fault with a maximum horizontal acceleration of 0.4 gravity (g) at the plant site. A 440-foot wide by 440-foot long by 25-foot deep dike with earthen walls would surround each storage tank and be capable of holding the entire contents of the tank.

LNG pumped from storage would be raised to gas-line delivery pressure in the secondary vaporization pumps prior to gasification. For the 0.9-billion cfd project, nine direct seawater exchange vaporization units would provide baseload vaporization. The vaporization plant would require an average of 108,000 gallons per minute (gpm) of seawater which would be transported through one 9-foot diameter seawater pipeline extending 2,400 feet into the ocean at a depth of 30 feet MLLW and returned via a 7-foot diameter pipeline 4,300 feet into the ocean at a depth of 50 feet MLLW. In addition, 28,000 gpm of water would be transported through the 9-foot diameter intake pipe and returned via a 4-foot diameter fish return pipeline 2,200 feet into the ocean at a depth of 20 feet MLLW. Returned seawater would be 12°F. cooler than incoming water. Gas-fired trim heaters would raise the gas temperature to 50°F., as required for delivery. Three standby submerged-combustion gas-fired vaporizers would provide a peaking capacity of 300 million cfd of gas and would probably be used up to 480 hours per year. The vaporized natural gas would be odorized and metered prior to delivery into the proposed pipeline.

The terminal's daily electrical power requirements for the 0.9-billion cfd project would be 35,000 kilowatts (kw) peak and 25,000 kw average, which would be purchased from Southern California Edison Company and would require construction of a 66 kilovolt (kv) transmission line on a 50-foot wide right-of-way from its existing Goleta transmission substation approximately 35 miles from the site. Gas turbine generators would be provided to supply full plant power in the event of a power outage.

Raw water would be obtained from wells on the site and stored in a 5,000-barrel storage tank. Potable water would be obtained by processing a portion of the raw water and storing it in a 5,000-gallon surge drum. At full operation, the facility would produce 7,200 gallons per day of sewage which would be treated by a sewage treatment system located on the plant site. Wastewater from the gas-fired vaporizers, storm drain runoff, and treated sewage would be combined and retained in a holding pond prior to discharge into the ocean.

The applicant currently has three possible routes under study for access roads to the site. The first is called the Hollister Improved Route which closely follows the existing Hollister Ranch private road. In this case, the existing road would be improved to handle a design speed of 25 mph, with a 24-foot wide pavement and 8-foot wide shoulders. The second route would parallel the railroad right-of-way without actually entering the right-of-way. There are, however, two high trestles where the road would have to detour from the railroad to cross canyons. The third alternative, the Jalama Route, would necessitate the construction of 7 miles of new road from Jalama County Park to the proposed site with a design speed of 40 mph. About 9.7 miles of the existing Jalama County Road would also need improvement. This route approaches the site from the northwest, whereas the other two routes approach from the east. This road would essentially follow the railroad, as well as the existing Bixby Ranch Road, which is unsuitable for 40-mph traffic. Access roads are described more fully in section H.3 of this volume.

b) Pipeline

The pipeline route from Point Conception to Gosford, illustrated in figure 1, would require a new 100-foot wide right-of-way, an additional 100 acres for a metering station, and a temporary construction yard for a total of approximately 1,455 acres. A permanent 50-foot right-of-way and acreage for the metering station would be maintained for a total operational land requirement of about 685 acres.

The proposed pipeline would begin at the proposed Point Conception terminal and proceed north, crossing Jalama Creek at milepost (MP) 4.5, Los Amoles Creek at MP 7.5, and El Jaro Creek and California Route 1 at MP 8.5. At MP 15, the pipeline would cross the Santa Ynez River and proceed through Drum Canyon to a crossing of U.S. Highway 101 and the San Antonio Creek at MP 25. At MP 33, the pipeline would turn northeast and cross the Sisquoc River and continue through the San Rafael Mountains, the Los Padres National Forest, and the Sierra Madre Mountains. The pipeline would cross the Cuyama River and State Highway 166 at MP 56, turn easterly at MP 65, cross the Carrizo Plain, and proceed into the Panorama Hills at MP 75. At MP 86, the pipeline would turn northeast and proceed through Buena Vista Valley at MP 92. The pipeline would cross the Ten Section Oil Field at MP 108 and terminate at MP 112.4, the site of a proposed metering station adjacent to existing facilities near Gosford, California.

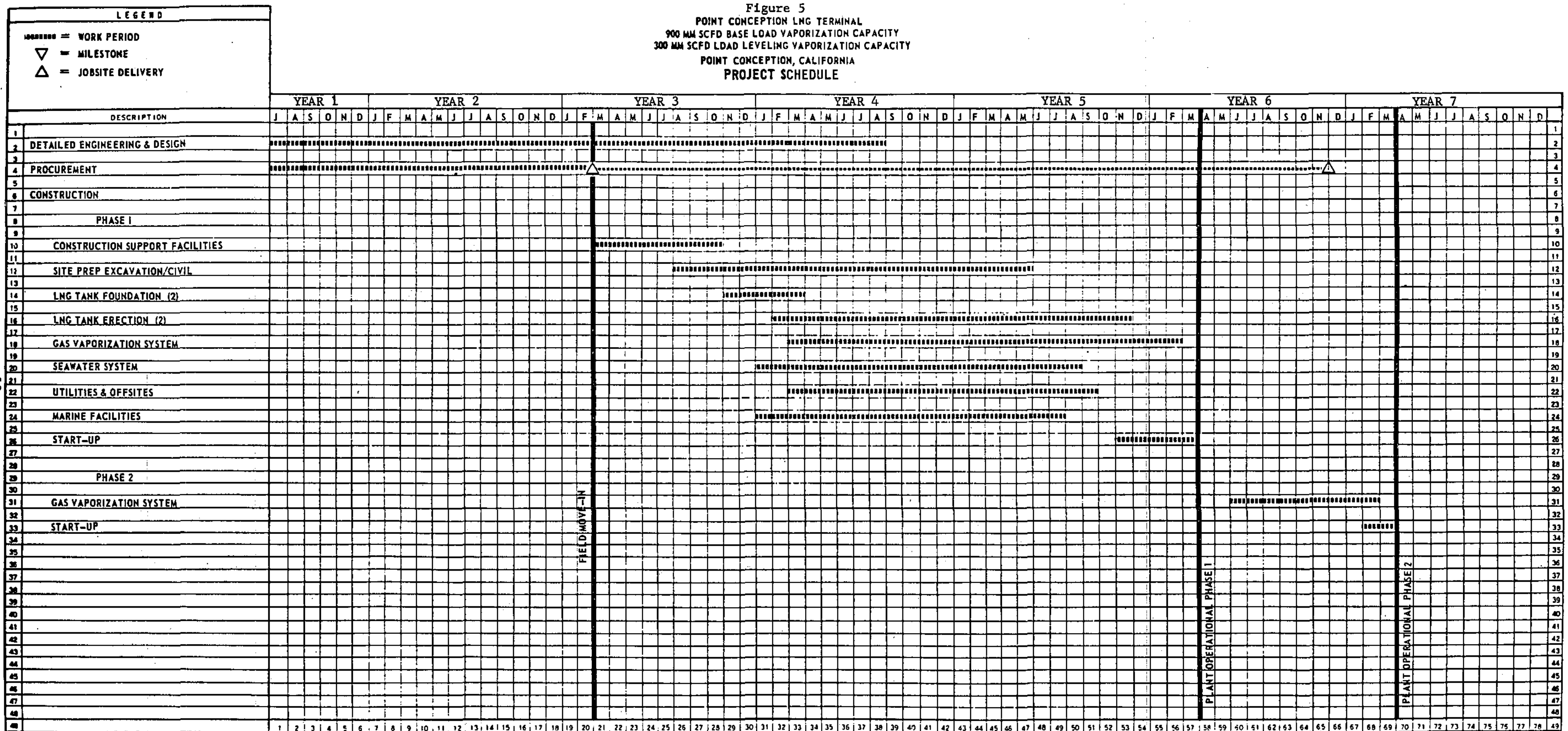
Metering and pressure limiting stations along the pipeline would be constructed at the Santa Barbara County crossover, the San Joaquin Valley crossover, and at Gosford, California. One orifice meter would be constructed at the Santa Barbara County crossover, at approximately MP 18, to measure the delivery of 50 million cfd of gas into Southern California Gas Company's (SoCal) existing 16-inch diameter pipeline. At the San Joaquin Valley crossover, at approximately MP 105, an orifice meter would be added to measure the delivery of 50 million cfd into an exisiting 34-inch diameter pipeline owned by Pacific Lighting Service Company (PLSC). A metering and pressure monitoring station would be constructed at MP 113.4 near Gosford. The station would contain orifice meters to measure the delivery of gas into two existing 34-inch diameter pipelines owned by PG&E.

3. Construction Procedures

Construction of the marine terminal and plant facilities would require 38 months. The size of the construction labor force would vary with the project schedule shown in figure 5, reaching a maximum of 1,500 during the eighth quarter of the project.

Construction of the seawater intake and return systems would require removal of approximately 146,000 cubic yards of

Figure 5
POINT CONCEPTION LNG TERMINAL
900 MM SCFD BASE LOAD VAPORIZATION CAPACITY
300 MM SCFD LOAD LEVELING VAPORIZATION CAPACITY
POINT CONCEPTION, CALIFORNIA
PROJECT SCHEDULE



dredge material. Some blasting would be required to fracture rock for removal by clamshell dredge. Removal of all other material would be accomplished by either clamshell or hydraulic dredge. A more complete discussion of the dredging operation can be found in section C.5.

The Point Conception-to-Gosford pipeline would have a maximum operating pressure of 1,440 psig and would not require compressor stations along the route. All underground pipe would be externally coated with a yard-applied pipe wrap to protect it against corrosion. The pipeline would be cleaned, primed, coated, and wrapped prior to lowering in the trench. A 12- to 15-inch layer of soft earth would cover the pipe to protect the outer coating from possible damage during subsequent fill operations.

Hydrostatic testing of the pipeline would require 9,360,000 gallons of water. Possible water sources include the California Aqueduct, deep-water irrigation wells, river, and the ocean. Testing would subject the pipeline to 1.25 times the maximum allowable working pressure. Test water would be disposed of by impounding to allow seepage and evaporation or by controlled flow back to the water source to minimize environmental damage.

There would be two cathodic protection stations along the route at approximately 40-mile intervals. The exact locations are unknown at this time. Cathodic protection test points would be located at regular intervals and at all buried insulators, pipe casing ends, and crossings with metallic cables, pipelines, roads, and railroads.

Mainline block valves would be located at 15- to 20-mile intervals and at the inlet and outlet piping to the pressure control and metering stations. Pneumatic actuators are designed to close the block valves when a pressure drop in the pipeline indicates a rupture.

Construction would begin with the clearing and grading of a temporary 100-foot wide right-of-way. Ditching operations would follow to prepare a trench 46 inches wide and sufficiently deep in Class I locations to allow a minimum cover of 30 inches in normal soil and 18 inches in consolidated rock. 1/ Class II locations and crossings of drainage ditches,

---

1/ Class locations are determined by the density of human occupancy within a corridor extending 220 yards on either side of the pipe centerline. Class I locations contain 10 or less buildings intended for human occupancy per mile of corridor. Class II locations may have more than 10 but less than 46 dwellings per mile of corridor. Source: U.S. Department of Transportation, Pipeline Safety Standards, Title 49 CFR, Part 192, Section 192.5: Definition of Class Locations.

public roads, and railroads would require sufficient trench depth to allow 36 inches of cover in normal soil and 24 inches in consolidated rock. The bore and casement method would be employed at all crossings of paved highways and railroads and aqueducts, while trenching would be used at minor highway crossings. Casings would be insulated from pipelines to reduce cathodic protection requirements. Blasting may be required in rocky areas and would be carried out by qualified contractors.

The pipeline would be strung along the right-of-way and bent as required to conform with the land contours. Pipe sections would be welded and radiographically inspected in compliance with the Department of Transportation Minimum Federal Safety Standards (Section 192.243). All piping welds at water crossings, in environmentally sensitive areas, and in encased sections would be 100-percent radiographically inspected.

The right-of-way would be regraded to its original contour, reseeded, and allowed to naturally revegetate. All debris would be removed from the temporary construction sites.

4. Operation, Maintenance, and Emergency Procedures

LNG vessels from Alaska would make the 2,037-nautical mile voyage through the Gulf of Alaska and the northeast Pacific Ocean to Point Conception in 4½ days. The ships would proceed through California coastal waters, keeping well offshore to avoid other traffic, enter the southbound traffic lane of the Santa Barbara Channel, and proceed to a point south of the proposed terminal. Once clear of traffic, the ships would turn toward the terminal. The voyage from Indonesia would be approximately 8,100 nautical miles and require about 19 days.

Approximately 129 deliveries of the 130,000-cubic meter type vessels would occur at the terminal each year; however, the exact number of arrivals would depend on the final selection of ship size. The marine facility could unload the ships at an average rate of 38,360 gpm and a maximum rate of 42,000 gpm. The unloading of a 130,000-cubic meter ship would require approximately 16 hours.

LNG from the ships would be transferred to the storage tanks through the 6,000-foot long LNG transfer line. Displaced storage tank vapor resulting from filling would be compressed and sent to the ship cargo tanks through the vapor return line in order to maintain positive pressure within the cargo tanks.

Submerged cryogenic pumps would transfer LNG from storage to booster pumps which would raise the pressure of the LNG to gas-line delivery pressure prior to regasification. Seawater vaporizers for baseload requirements and gas-fired vaporizers for peak load would gasify the LNG. Gas would be odorized, metered, and delivered through the proposed gas transmission pipelines. Figure 6 presents a schematic flow diagram for plant operations.

The facility would contain storage for Bunker-C fuel oil to enable the refueling of LNG vessels. Bunker-C fuel oil would be delivered to the site by oil tankers which would unload at the dock through the 12-inch unloading arm.

Most of the baseload equipment would consist of multiple units installed for parallel operation so that individual units may be shut down for inspection or maintenance while the other units remain in operation. The use of the gas-fired peaking vaporizers would permit routing inspection and maintenance of the seawater vaporizers while maintaining baseload capacity. Essential equipment not consisting of multiple units would have spare standby units. Intermittently operated equipment associated with LNG ship unloading and transfer could be maintained between scheduled periods of operation.

Fire detection and extinguishing equipment would be placed throughout the plant and marine facilities. Gas sensors, ultraviolet sensors, and high temperature or rate of rise sensors would indicate the presence of potentially combustible mixtures and fires. Low temperature sensors located in liquid containment areas and in the insulation of the storage tanks would detect LNG leaks. The fire protection system would include a high expansion foam system, manual and automatic dry chemical systems, and a fire water loop with nozzles, hydrants, and hose lines. An onsite freshwater storage tank and backup seawater pumps would provide water for fire-fighting.

LNG pipelines would be equipped with emergency shutoff valves which automatically activate in the case of abnormal operating conditions. The valves would also be designed for remote operation from the control room and local stations as well as being equipped for manual operation. Each of the 16-inch diameter marine unloading arms would contain a shutoff valve to reduce LNG spills in an emergency.

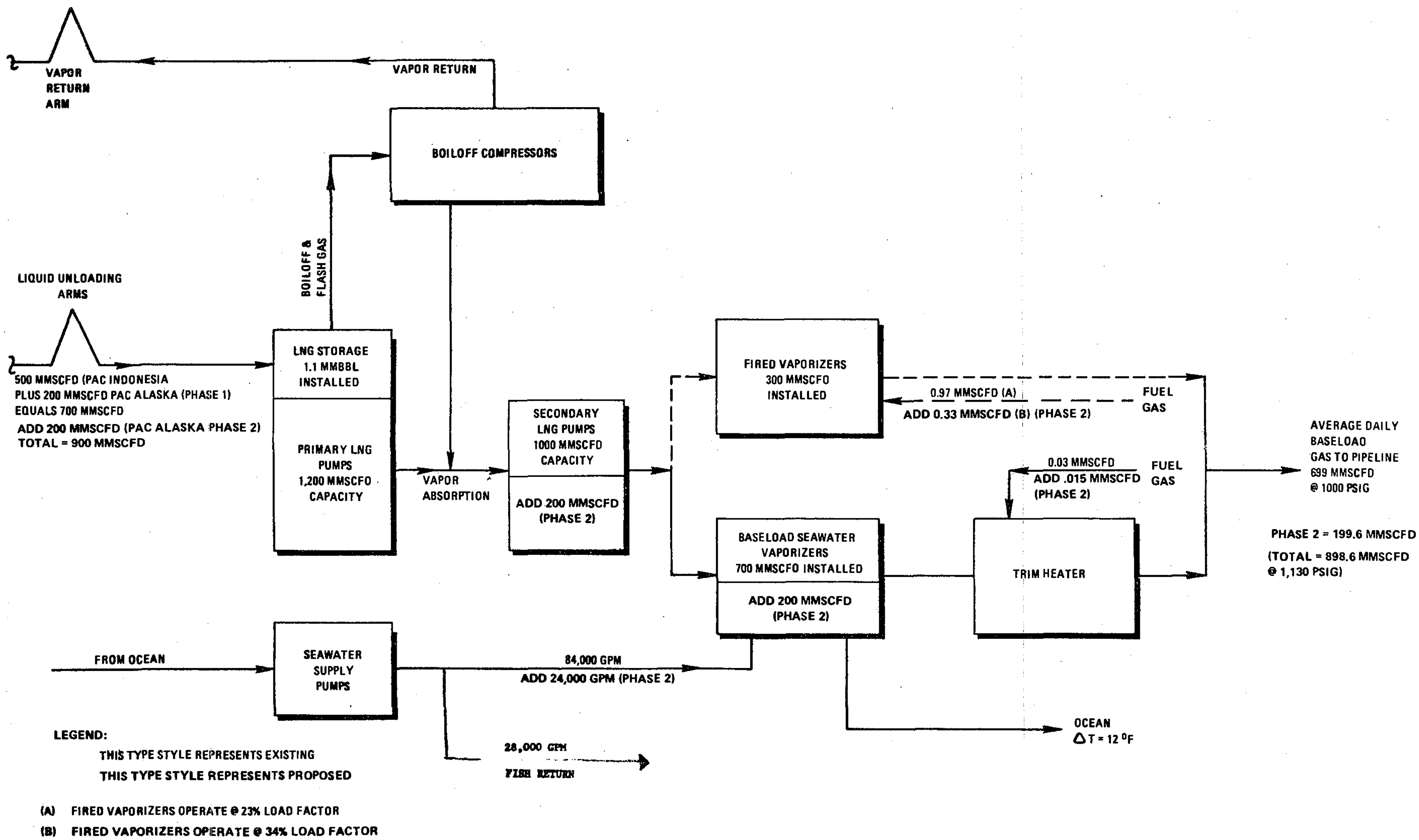


Figure 6: LNG Terminal Flow Diagram for the 0.9 Bcfd Project

Fifty full-time personnel would be required to operate the plant and terminal facilities. The operation and maintenance of both pipelines would require three or four additional people. The applicant would maintain a 50-foot wide right-of-way along the Point Conception-to-Gosford pipeline route and would permit natural revegetation except around aboveground installations which would be kept clear of large brush. The pipeline route would be inspected monthly for evidence of damage to the pipeline and the ground cover. A gas leak survey would be conducted within 1 year of pipeline startup, then once every 5 years in Class I locations and every 3 years in Class II locations. The pipeline would be equipped with pressure-activated block valves at 15- to 20-mile intervals. In the event of a pipeline failure, about 2 minutes would elapse before the block valves would close to insolate the pipeline rupture.

5. Future Plans and Abandonment

The supply of gas is the factor most affecting the operational life of the proposed facility. If additional gas becomes available, the use of the facility could extend beyond its projected 20-year life span. The proposed facility could expand to 1.3 billion cfd baseload and 300 million cfd peak by expanding the vaporization plant, constructing one additional 550,000-barrel storage tank, and increasing the number of LNG ship deliveries. The vaporization plant would require 160,000 gpm of seawater along with the 28,000 gpm of seawater for the fish return line. The site has adequate land available for expansion of plant facilities. Additionally, 45 miles of looping with 34-inch diameter pipeline would be required between MP 67.7 and MP 112.4

Ultimately, the project would be terminated and the facility could be dismantled and the site returned to its original use. The sewage treatment plant could be retained for community use and the storage tanks could be utilized for other industrial ventures. The gas pipeline would probably be abandoned in place and aboveground facilities dismantled, allowing the right-of-way to return to its prior use.

Western Terminal has not filed any application with FERC or ERA for expansion of the proposed facilities. As a result, with occasional exceptions, this EIS will not discuss environmental impacts that would result from construction and operation of possible future facilities which are not now the subject of a FERC application.

B. DESCRIPTION OF THE EXISTING ENVIRONMENT

1. Climate

The proposed project would be located in a climatic region known as the Pacific Coast Region. The area experiences a Mediterranean-type climate with dry summers and mild, wet winters. The local weather is directly influenced by the mountains to the north and east and the moderating influence of the Pacific Ocean, which combine to produce mild weather throughout the year.

A dominating factor in California weather is the semi-permanent high pressure area of the north Pacific Ocean. This pressure center moves northward in summer, holding storm tracks well to the north; as a result, California receives little or no precipitation from this source during that period. In winter, the Pacific high pressure retreats southward, permitting storm centers to swing into and across California. These storms bring widespread, moderate precipitation to the state. If the high pressure moves far enough south to permit storm centers to approach the coast from a southwesterly direction, copious amounts of moisture are carried by the northeastward-streaming air. This results in heavy rains and often produces widespread flooding during the winter.

These characteristics of the Pacific high pressure help to explain the unusual weather events of the winter of 1977-78. In November 1977, the Pacific high pressure was still in its summer position, although weakening. This produced precipitation about 50 percent below the 30-year normal for the area. By December, however, the Pacific airstream had penetrated to the California coast. A strong high pressure system developed off British Columbia, Canada, forcing the storm track south. A persistent low developed off the Pacific coast, driving Pacific storms into the western U.S. These pressure systems resulted in precipitation over 200 percent above normal for the month of December. This situation persisted through January to the middle of February. Precipitation totals 300 percent above normal were reported for both months. The weather station at Los Angeles International Airport reported a record 60-day total of 15.14 inches of rain. Data after mid-February indicate a return to the more normal pressure and precipitation patterns of earlier years.

The proposed terminal at Point Conception is located adjacent to the Santa Barbara Channel. The Santa Barbara Airport, the nearest U.S. Weather Station with a complete climatological record, reports an average January temperature of 51.6°F. and an average August temperature of 65.7°F. In general, precipitation in the area is light, occurring mainly between November and April. Average annual rainfall is 15.5 inches at the U.S. Weather Station at the Santa Barbara County Airport and 17.6 inches at the Santa Barbara City measuring station, which is closer to the coast.

Most coastal areas are subject to a marked diurnal wind reversal which features daytime onshore (sea breeze) and nighttime offshore (land breeze) winds. This sea-land regime is relatively shallow along the Santa Barbara Channel, so the mass of air affected is small and the phenomenon does not generally interfere with the prevailing site winds. Because of the relatively unprotected locations, the Point Conception and Point Arguello areas in particular commonly experience more wind than other coastal locations.

It would be highly desirable to have a detailed meteorological record of the LNG site itself. However, much of the data available for the site has been disputed by various parties in this proceeding. Therefore, the STAR program for Point Arguello, California, was used as a source for wind direction and stability class data (table 1). This information, compiled by the National Oceanic and Atmospheric Administration from hourly U.S. National Weather Service observations, was collected from the Point Arguello Light Station at a 90-foot elevation.

Several comments on the DEIS called attention to additional wind records from the Point Arguello area, including data collected by the U.S Coast Guard at several locations. Wind recording is heavily influenced by the type of equipment used, the exposure of the equipment, and the method of recording the data. After examining data from various sites collected from 1935 to 1964, the staff chose to use the STAR data, as well as additional data from the National Weather Service, in the FEIS. Several reasons support this choice: (1) they are the most recent data available (1959-1964); (2) they were collected at Weather Bureau Offices and are therefore assumed to be reliable; (3) the stations are situated at representative coastal locations and heights that provide meaningful wind information.

TABLE 1

PERCENT FREQUENCY OF WIND SPEED VS. DIRECTION
POINT ARGUELLO, JANUARY, 1960 - JUNE, 1964
(SOURCE: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION)

	Speed (kts)						
Direction	0-3	4-6	7-10	11-16	17-31	Greater Than 21	Total
N	1.82	1.28	.60	.24	.03	*	3.97
NNE	.67	.35	.25	.10	*	0	1.37
NE	.85	.23	.08	.03	0	0	1.19
ENE	.72	.24	.03	.01	0	0	.99
E	2.94	3.14	1.04	.04	.01	0	7.17
ESE	3.66	4.66	2.21	.21	.09	.02	10.85
SE	1.49	.87	.30	.31	.17	.06	3.20
SSE	.23	.08	.20	.29	.12	.03	.95
S	.21	.16	.23	.20	.05	.01	.86
SSW	.14	.15	.16	.13	.05	*	.63
SW	.37	.24	.26	.17	.03	0	1.07
WSW	.66	.46	.45	.20	.02	*	1.79
W	2.12	2.31	3.14	1.01	.05	*	8.63
WNW	2.83	4.21	6.26	2.91	.28	.03	16.52
NW	4.43	6.10	9.02	7.26	2.28	.35	29.44
NNW	2.78	2.99	2.93	2.03	.53	.02	11.28
TOTAL	25.92	27.47	27.16	15.13	3.71	.52	99.91**

* Less than .5%

** Error due to rounding

Although Point Arguello is located approximately 15 miles west of Point Conception, the wind data there may be considered representative for the region. As a headland, Point Arguello experiences winds two to three times as great as the wind flow at other locations. This creates a strong jet of air off of and to the south of Point Arguello. Both the southward flowing air and the air returning from from the east along the Santa Barbara Channel to complete the eddy also affect the site vicinity. In general, these effects are represented by the Point Arguello wind data.

Other data presented here for comparison include wind data provided by the applicant (table 2), hindcast for the period between July 1961 and June 1962. This hindcast was performed by Oceanographic Services, Inc. from synoptic weather charts. Wind roses prepared for the CPUC are shown in figure 7. These data were collected from a meteorological monitoring station located at the terminal site, as well as from weather bureau records. Table 3 presents Point Arguello weather bureau data collected at a 370-foot elevation. The staff also reviewed wind data prepared for the Hollister Ranch Owners Association by R. Rea Strange III; however, since only extreme wind values were tabulated, the data are not comparable to the others shown and are therefore not presented here.

On a yearly basis, the prevailing winds are from the northwest quadrant. Tables 1 and 3 show that winds occur from this direction about 60 percent of the time. The anti-clockwise eddy induced by these prevailing winds refracting around Point Arguello and the Channel Islands adds southerly and easterly winds to the site meteorology which would not be experienced farther out to sea. As shown in tables 1 and 3, these winds occur approximately 20 percent of the time annually. The applicant's data, presented in table 2, confirm strong southeasterly and northwesterly wind components. The site may also be affected by the so-called Santa Ana condition, characterized by strong easterly winds. Santa Ana conditions are most common during fall and winter.

Visibility in the site area is often restricted by haze and fog. The applicant reports that there are approximately 110 nonclear days annually in the area. Of these, approximately half are cloudy, and the remainder are foggy. Table 4 presents visibility data from the Naval Oceanographic Office collected approximately 8 miles south of Point Conception.

TABLE 2

PERCENT FREQUENCY OF WIND SPEED VS. WIND DIRECTION:
POINT CONCEPTION, JULY 1961 - JUNE 1962
(SOURCE: OCEANOGRAPHIC SERVICES, INC.)

	Speed (kts)						
Direction	0-5	6-10	11-15	16-20	21-25	Greater Than 25	Total
N	2.1	2.5	0.9	0.6	0.1	0.4	6.6
NNE	0.6	0.9	0	0	0	0	1.5
ENE	0.5	0.8	0	0	0	0.1	1.4
E	0.8	1.0	0.1	0.1	0	0.2	2.2
ESE	4.0	3.4	0.5	0.3	0.1	0.1	8.4
SSE	4.0	4.5	0.5	0.7	0.2	0.4	10.3
S	0.4	0.8	0	0.4	0	0.1	1.7
SSW	0.1	1.0	0.3	0	0	0	1.4
WSW	0.1	2.5	0.8	0.1	0	0	3.5
W	0.9	2.8	1.6	1.0	0.1	0.1	6.5
WNW	1.5	6.4	4.4	3.8	0.2	0.1	16.4
NNW	5.5	17.5	6.8	6.4	1.5	2.4	40.1
TOTAL	20.5	44.1	15.9	13.4	2.2	3.9	100

TABLE 3

PERCENT FREQUENCY OF WIND SPEED VS. DIRECTION
POINT ARGUELLO, JULY, 1959 - JUNE, 1964
(SOURCE: AIR WEATHER SERVICE)

Direction	Speed (kts) 1-3	4-10	11-21	22-27	28-40	Total
N	1.2	1.8	.3	*	0	3.3
NNE	.4	.6	.1	0	0	1.1
NE	.6	.3	*	0	0	.9
ENE	.5	.3	*	0	0	.8
E	1.7	4.6	.1	0	0	6.4
ESE	1.8	6.7	.3	*	*	8.8
SE	1.0	1.2	.4	.1	*	2.7
SSE	.2	.3	.4	*	*	.9
S	.1	.4	.2	*	*	.7
SSW	.1	.3	.2	*	0	.6
SW	.3	.5	.2	0	0	1.0
WSW	.4	1.0	.3	*	0	1.7
W	1.2	5.7	1.1	*	0	8.0
WNW	1.3	10.5	3.2	*	0	15.0
NW	2.2	14.9	9.2	.4	*	26.7
NNW	1.5	5.7	2.4	*	*	9.6
Calm	11.6					11.6
TOTAL	14.5	54.8	18.4	.5	*	99.8**

* Less than .5%

** Error due to rounding

TABLE 4

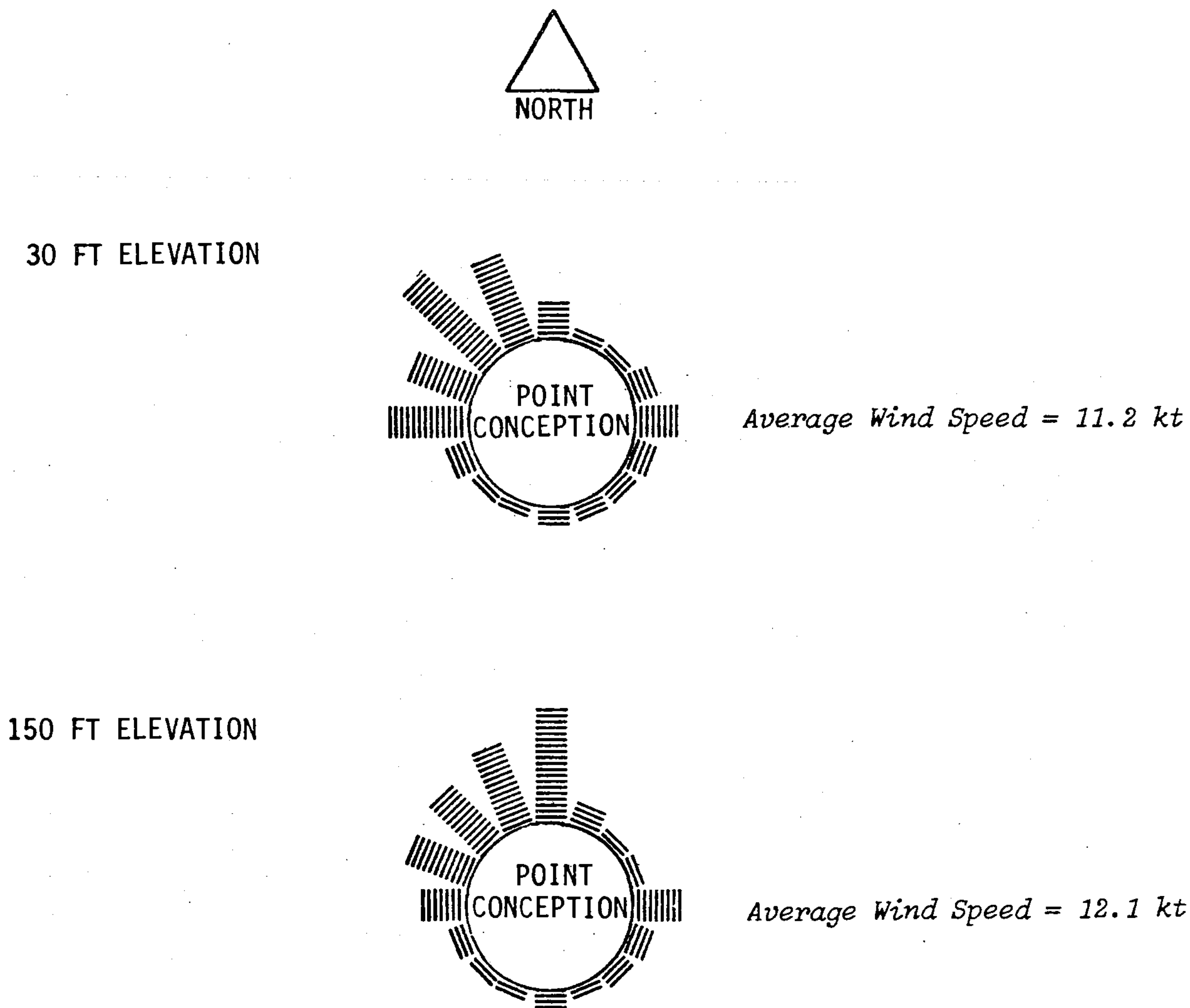
PERCENT FREQUENCY OF REDUCED VISIBILITY

(Ship observations taken in area immediately south at Point Conception site)

MONTH	LESS THAN		NUMBER OF OBSERVATIONS
	1/2 MILE	1 MILE	
JANUARY	0.0	3.7	54
FEBRUARY	1.4	1.4	72
MARCH	0.0	0.0	47
APRIL	0.0	0.0	63
MAY	2.0	2.0	50
JUNE	4.7	4.7	64
JULY	4.7	11.0	64
AUGUST	3.6	5.4	56
SEPTEMBER	4.3	6.5	46
OCTOBER	5.3	7.1	57
NOVEMBER	0.0	0.0	80
DECEMBER	5.0	5.3	38
AVERAGE (TOTAL)	2.9	3.9	(691)

Source: Naval Oceanographic Office, Fleet Weather Facility, Climatological Study, Southern California Operating Area, 1971. Data taken between 1949-1970 in area 25 x 30 miles centered approximately 8 miles south of Point Conception site.

Figure 7: Annual Average Frequency of Winds at 30-Foot Level And 150-Foot Level At Point Conception(All Stability Classes)



<u>KEY:</u> Each dash equals 1%.

Source: Southern California Edison, "Point Conception Meteorological Observations from 3/1/71 to 5/4/72," adapted by Thomas Reid Associates.

The stability of the atmosphere can also be obtained through the STAR program. Pasquill stability categories are assigned as a function of cloud cover, turbulence, and wind speed. Stability classes A, B, and C represent unstable conditions with good atmospheric diffusion; classes D and E are neutral; and classes F, G, and H represent surface temperature inversions with poor atmospheric diffusion. The staff again used Point Arguello data in this analysis. The annual stability distribution for the Point Arguello area is as follows:

Class A	Extremely Unstable	0.29 percent
Class B	Unstable	4.08 percent
Class C	Slightly Unstable	10.98 percent
Class D	Neutral/Day	27.37 percent
Class E	Neutral/Night	29.91 percent
Class F	Slightly Stable	8.64 percent
Class G	Stable	11.27 percent
Class H	Extremely Stable	7.45 percent

Severe weather conditions are relatively infrequent along the southern California coast, although tropical storms do occur occasionally. The closest recorded tropical storm was near Los Angeles in September 1939. Thunderstorms are also rare, averaging about two or three each year. The most severe weather hazard may be strong, sustained winds such as those experienced in December 1977 when newspaper reports indicate that gale force winds with gusts of up to 90 mph swept across southern California. Gale-force winds (up to 40 knots) were noted by Dames and Moore in February 1977 during a geophysical survey of the ocean floor off Point Conception. Table 5 presents the only extreme wind data currently available for the site area. This table has been developed from generalized wind data of the entire United States developed by H.C.S. Thom. While the figures are generally applicable, Thom indicates that suitable adjustments should be made "for special winds such as the Santa Ana and for exposures where unusual channeling or lifting occur, such as at ocean promontories, mountains, and gorges." 1/ These adjustments have not been made in this table, since local extreme wind data are unavailable. It should be noted that in the 5-year maximum wind record available for Point Arguello (1959-1964), the highest hourly wind speed recorded is 41 mph. Data from the Point Arguello Life Boat Station indicate a maximum wind speed of 64 mph from January 1949 to February 1958.

The climate along the proposed pipeline route is relatively similar to that at the proposed site. As the pipeline progresses from west to east, the major difference is that the climate generally becomes warmer and drier. At Bakersfield, near the terminus of the proposed route, the average January and July temperatures are 47.5°F. and 83.9°F., respectively, and the average annual rainfall measures only 5.72 inches.

1/ "New Distributions of Extreme Winds in the United States," Journal of the Structural Division, Proceedings of the American Society of Civil Engineers (July 1968), p. 1797.

TABLE 5

EXTREME WINDS:
POINT CONCEPTION AREA 1/

Recurring Interval (Years)	Maximum Instantaneous Gust 2/	Annual Extreme MPH 3/
2	47	36
10	68	52
25	78	60
50	91	70
100	104	80

1/ Wind speeds are given in miles per hour. They have not been adjusted for local conditions.
2/ Maximum instantaneous gust represents a solitary event that may occur at any time during the specified interval.
3/ "Annual extreme MPH" represents an unknown wind speed measurement.

Source: H.C.S. Thom, "New Distributions of Extreme Winds in the United States," Journal of the Structural Division, Proceedings of the American Society of Civil Engineers (July 1968), pp. 1,787-1,801. Adapted by the FERC staff.

2. Topography

The proposed LNG plant would be located 80 feet above sea level on a gently sloping coastal terrace which is generally less than a mile wide. East-west trending coastal cliffs truncate the terrace 80 feet above a narrow beach. Approximately 4 miles north of the site the crest of the Santa Ynez Mountains parallels the coastline at elevations of up to 1,800 feet. Figure 8 shows the contours of the land at and near the proposed site.

From the proposed LNG terminal site near Point Conception, the associated pipeline route would pass through three physiographic provinces, originating in the Transverse Ranges and crossing the southern Coast Ranges and the southern San Joaquin Valley. (See figure 9.)

To about MP 25, the proposed route would cross the trend of the Transverse Ranges. Mountains and major drainages trend east-west. With the exception of the segment along the floor of Drum Canyon, the proposed route would follow ridge crests within the Santa Ynez Mountains, Santa Rosa and Santa Rita Hills. The only major drainage to be crossed would be the Santa Ynez River.

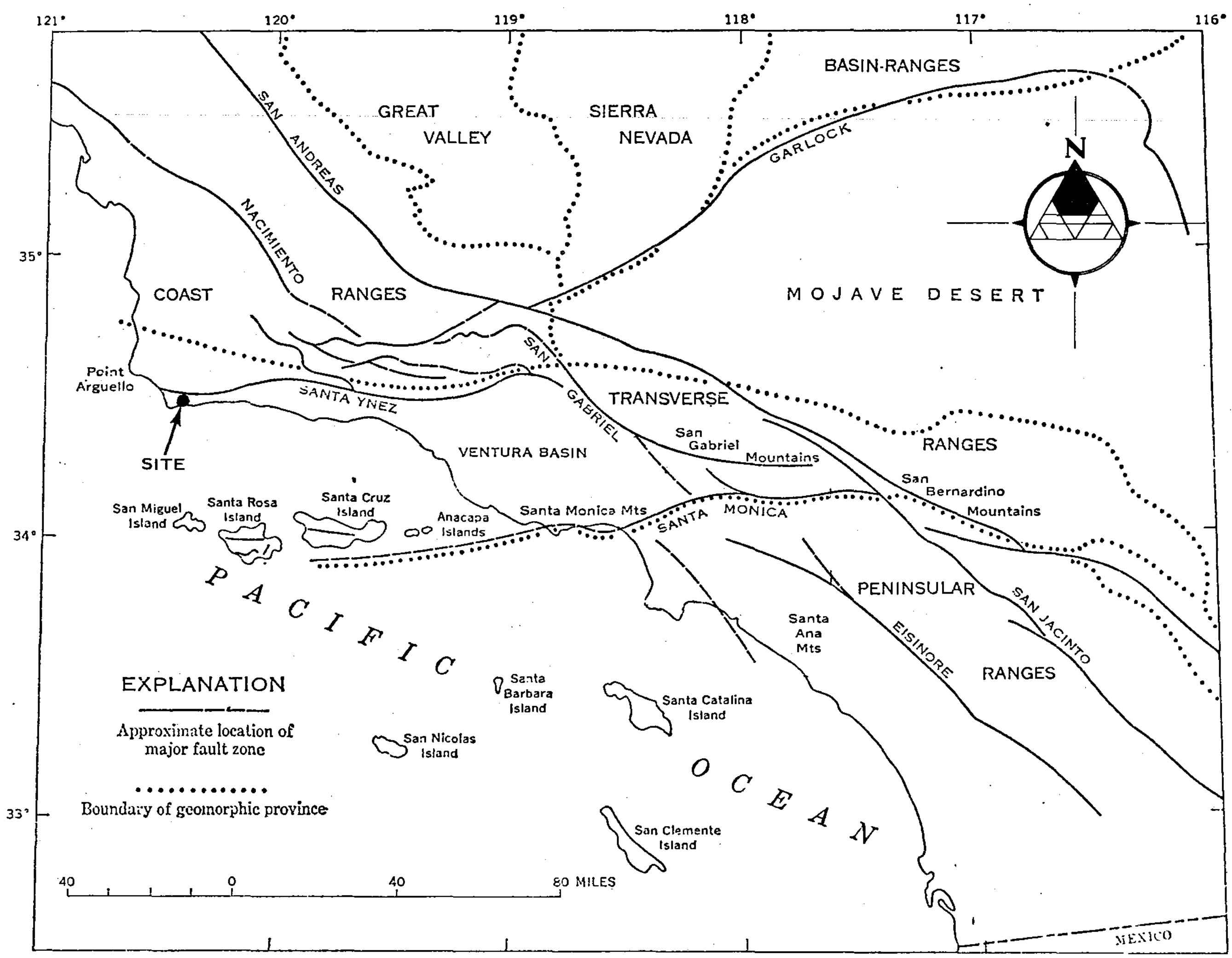
As the proposed route crossed the Los Alamos Valley at MP 25, it would enter the southern Coast Ranges. Here the structure trends northwest. The rolling gentle topography of the Los Alamos Valley, Solomon Hills, and Santa Maria Valley contrasts with the slopes just traversed and the rugged terrain beyond at the head of Tepusquet Canyon. Once again the route would follow ridge crests through the Sierra Madre Mountains and the Caliente Range until it entered the Carrizo Plain at about MP 67. The major drainages to be crossed are San Antonio Creek and the Sisquoc and Cuyama Rivers.

Within the shallow trough of the Carrizo Plain, the pipeline would lie at elevations of 1,900 to 2,200 feet. The route would head due east across the plain, passing about 1 mile south of Soda Lake, then cross the Elkhorn Scarp (MP 76.5), Panorama Hills, and the Elkhorn Plain prior to entering the Temblor Range.

The relatively moderate topography of the Temblor Range represents the last substantially hilly terrain to be crossed by the proposed pipeline as it heads toward Gosford. From a maximum elevation of 3,300 feet, the route would continue

Figure 8: Topography and Bathymetry Adjacent to the Proposed Point Conception Site.

Source: USGS, 1953
Dames and Moore, 1974



Reference: Yerkes, and Others, 1965

Figure 9: Natural Provinces and Major Faults Southwestern California

east, exiting the range through Crocker Canyon. The proposed route would cross Midway Valley, the northern tip of Buena Vista Hills, and Buena Vista Valley, steadily losing elevation except for minor reversals in the hills. After reaching an elevation of 400 feet near Dustin Acres, the route would head northeast across Elk Hills, where the maximum elevation along the route is 600 feet.

At MP 102 the route would exit the Coast Ranges and enter the San Joaquin Valley, crossing the California Aqueduct near Aqueduct MP 241. From here to the proposed terminus at Gosford, the route would traverse the virtually level valley floor, gaining only 50 feet of elevation in 10 miles. The elevation at MP 112.4 is 350 feet.

Table 6 summarizes the overall relief and the average and maximum slope along the proposed route. In addition, the maximum slope adjacent to the route is included. In mountainous regions, the average slope adjacent to the route is similar to the maximum slope along it.

TABLE 6

TOPOGRAPHY OF PROPOSED PIPELINE ROUTE

Region	Mileposts	Slope (feet per mile)			Relief (feet)
		Along Route			
		Maximum	Average	Adjacent Maximum	
Point Conception-Gosford					
Transverse Ranges					
Santa Ynez Mtns. and Santa Rosa Hills	0-16	5,000	1,000	5,500	1,600
Santa Rita Hills	16-18	1,800	1,000	3,300	600
Drum Canyon	18-22	270	130	3,300	600
Purisima Hills	22-25	2,000	600	3,300	950
Southern Coast Ranges					
Los Alamos and Santa Maria Valleys, Solomon Hills	25-35	1,600	600	4,400	870
Tepusquet Creek Valley	35-39	600	200	4,400	400
San Rafael Mtns., and Caliente Range	39-67	4,000	1,000	5,500	2,300
Carrizo Plain	67-77	80	40	*	330
Temblor Range	77-83	2,000	800	2,200	1,800
Midway and Buena Vista Valleys	83-98	1,500	100	*	1,100
Elk Hills	98-102	1,500	400	*	300
San Joaquin Valley	102-112.4	50	5	*	50

* Generally does not exceed maximum slope along alignment.

3. Geology

a) Structure

The proposed terminal site is located on the southern slope of the Santa Ynez Mountains, the westernmost of the Transverse Ranges. Structurally, this slope is a southward dipping homocline. Offshore from the site, the structure is modified by folding and faulting. The geologic faults of the project region are shown in figures 10 and 11. Figure 12 shows the detailed geologic structure onshore and offshore in the site area.

The site is located on the northern limb of the Government Point syncline whose axis comes ashore about 500 feet west of the site. Underneath the surficial terrace deposits, the shales of the Sisquoc Formation dip 35° to 45° to the south. The closest mapped major onshore fault is the northern branch of the Santa Ynez fault zone (including the Pacifico and Bulito faults), which is about 3.5 miles north of the site. A major fault, perhaps a splay of the Santa Ynez fault, may pass about 12 miles north of the site. Dames and Moore have called this the Santa Yniz River fault.

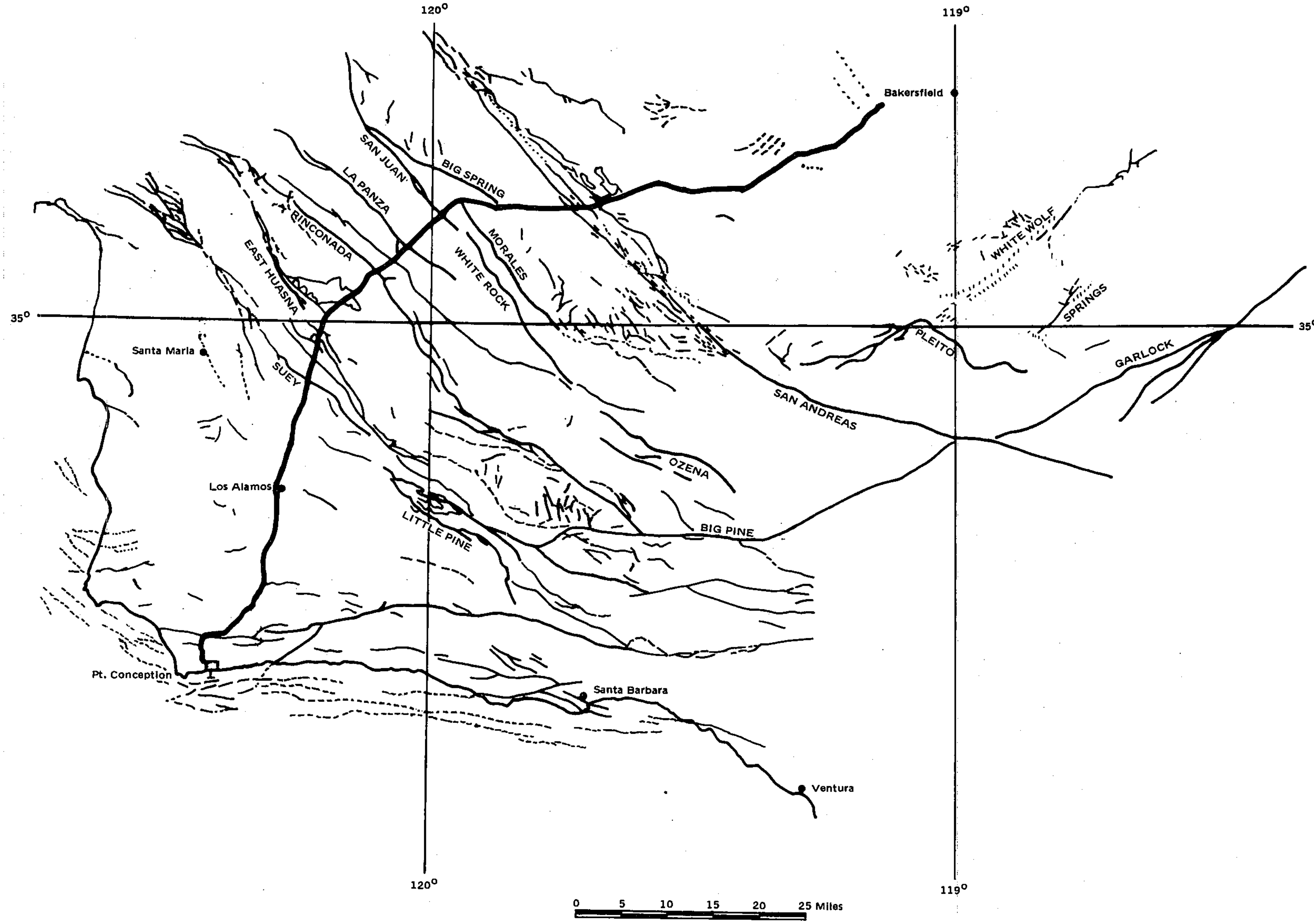
A recent study, conducted after the DEIS was issued, revealed a fault on the site. 1/ Subsequent studies revealed other faults on and near the site and provided a basis for estimating recency and magnitude of displacement. 2/

Figure 12 shows the approximate locations and orientations of the Arroyo and S-B faults, the Beach fault, and the AKS-9 fault. Each of these faults offset the bedrock-terrace deposit contact and consequently must have moved since the bedrock surface was formed at higher stands of sea level

---

1/ D.O. Asquith, Preliminary Evaluation of Active Fault at Proposed Cojo Bay LNG Site, Santa Barbara County, California (Sherman Oaks, California, April 26, 1978)

2/ Dames and Moore, Geological Investigations: Proposed LNG Terminal, Point Conception, California, for Western LNG Terminal Associates. (Los Angeles, June 9, 1978). Addendum. July 12, 1978.
MESA[2] Inc. and Marine Studies, Geosciences Department, California State University, Northridge, A Geophysical and Geologic Evaluation of the Offshore Extension of the Santa Ynez Fault, South Branch. (Northridge, California, May 19, 1978).



FROM: JENNINGS, 1973.

Figure 10: Major Faults Along The Proposed Point Conception Pipeline.

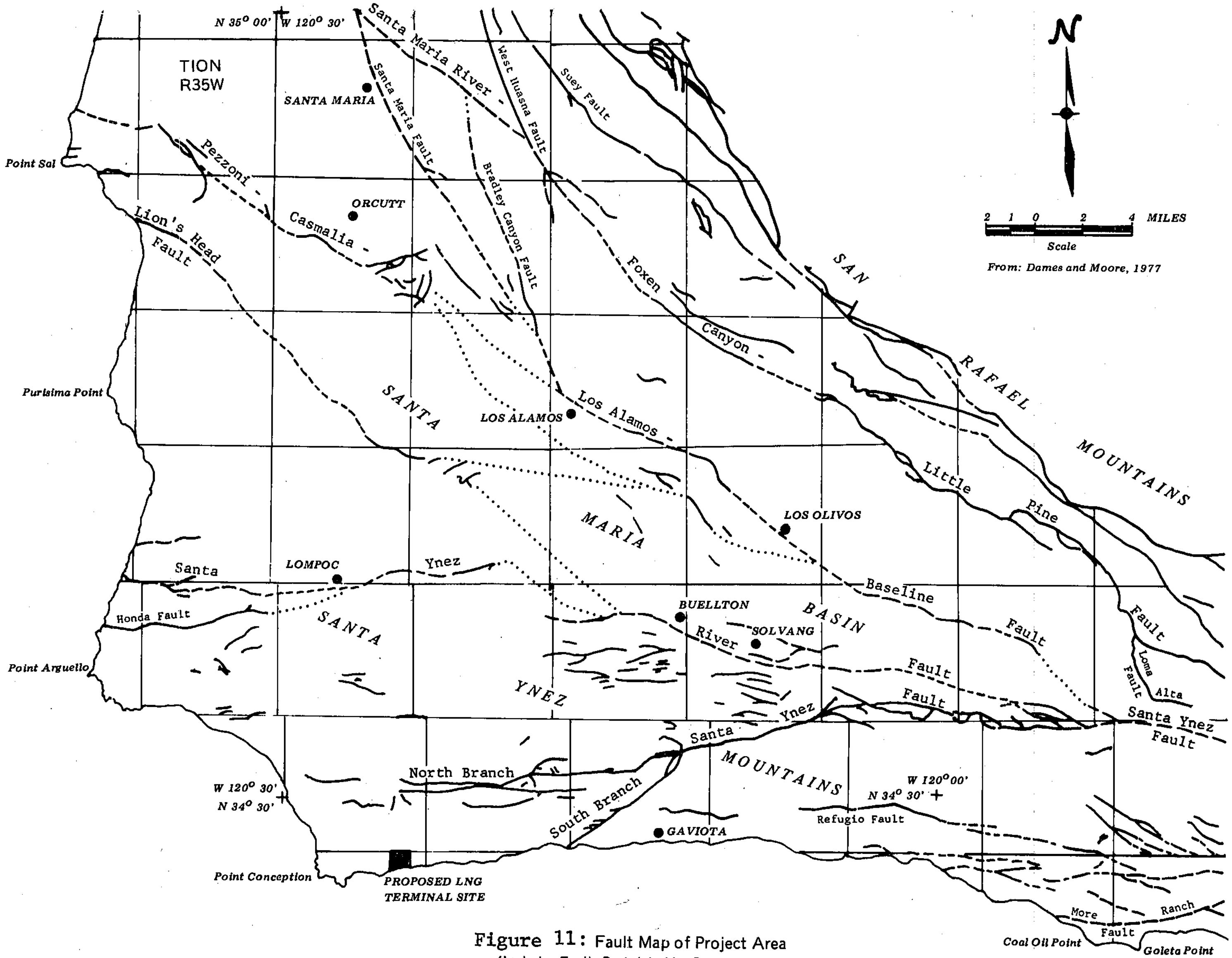


Figure 11: Fault Map of Project Area
(Includes Faults Postulated by Dames and Moore)

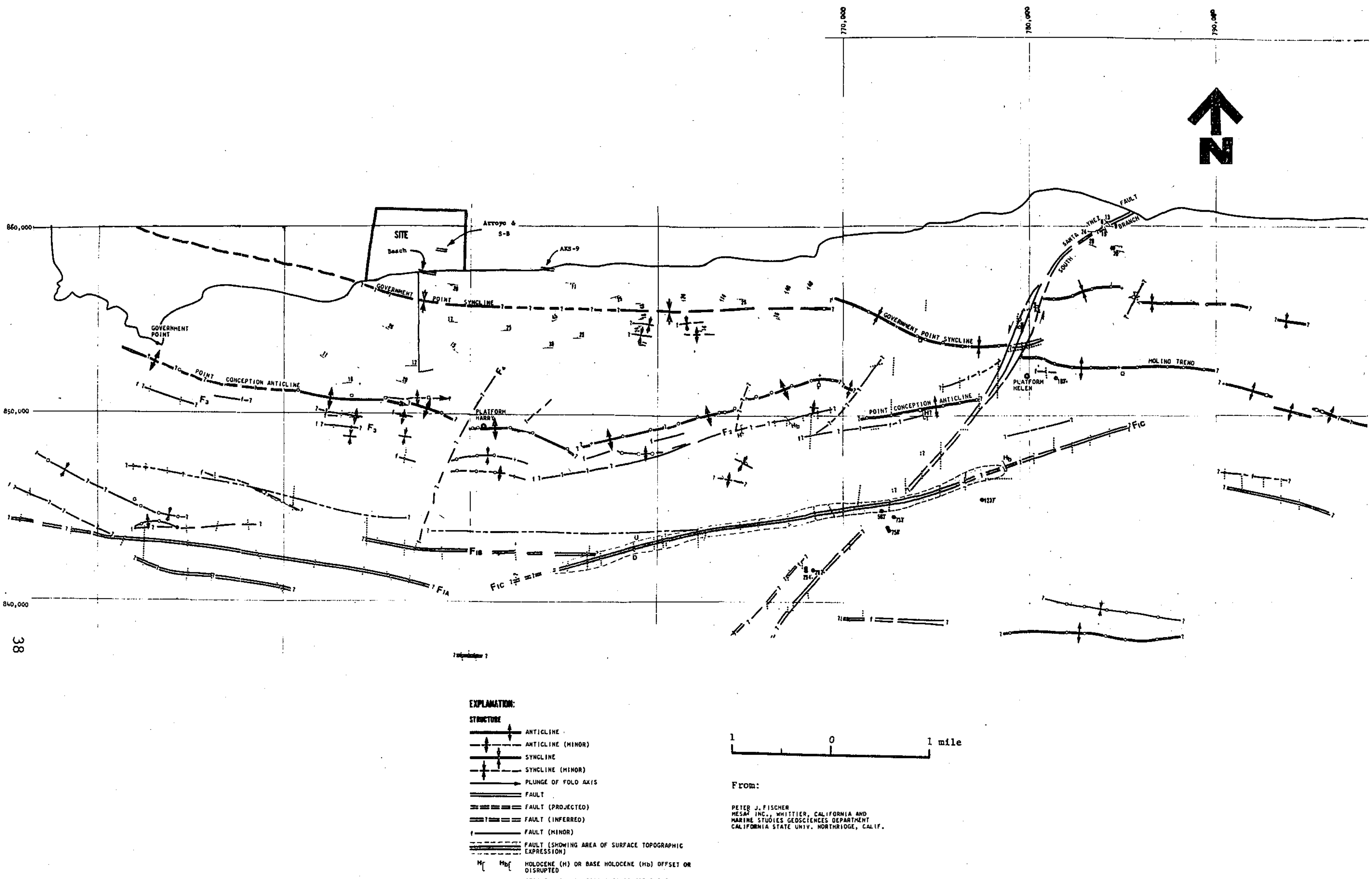


Figure 12. Geologic Structure: Northwestern Santa Barbara Shelf, and Onsite Faults

80,000 or 125,000 years ago. Shearing--i.e., displacement--of terrace deposits also occurred at each of these locations; however, the shears cannot be tranced the same distance into these deposits along each fault. Shears associated with the Arroyo fault extend to within 1.5 feet of the present ground surface, or about 20 feet above the bedrock surface. In comparison, shears associated with the Beach, S-B, and AKS-9 faults, have been shown to extend about 20, 2.3, and 2 feet, respectively, above the bedrock.

Radiocarbon age dates on samples from a trench excavated across the Arroyo fault indicate that movement probably occurred more recently than 13,000 or perhaps 21,000 years ago. Unfortunately, no datable samples were obtained from the near surface deposits sheared by the fault. It is likely that any samples from these deposits would be unusable because of contamination with recent carbon-14. Average sedimentation rates for the terrace deposits indicate that faulting has occurred within the last 4,000 to 8,000 years, a range also supported by the time required to produce the modern soil profile (5,000-6,000 years). 1/

Radiocarbon dating and correlation with depositional units suggest the S-B fault moved prior to about 20,000 years ago and more recently than either 80,000 or 125,000 years ago. Average sedimentation rates for the area reduce the upper age limits by 5,000 and 8,000 years, respectively. No available carbon-14 dates are applicable in dating movement of the Beach fault. Sedimentation rates imply that the latest displacement of terrace deposits occurred since 26,000 or 45,000 years ago. No lower limit can be assigned. An age of more than 37,000 years was determined for a sample from the vicinity of the AKS-9 fault. However, the relationship between the dated deposit and the fault is unknown. From sedimentation rates, it may be inferred that displacement occurred more recently than 75,000 or 117,000 years ago.

On the basis of this information, the staff concludes that the Arroyo fault is "active," since the most restrictive definition of that term requires evidence of displacement within the last 11,000 years. It would also appear to qualify as a capable fault, as that term is used by the

---

1/ Dames and Moore, Geological investigations. Appendix A (1979).

U.S. Nuclear Regulatory Commission. The other three faults cannot be termed active on the basis of the current data, nor can their possible activity be entirely ruled out.

Vertical offset of the bedrock surface at the Arroyo fault is about 32 to 34 inches, with apparent dip separation on the order of 44 inches. Each of the three bedrock exposures exhibit similar offsets. However, the amount of the offset resulting from shearing and the amount resulting from erosion prior to deposition of the terrace deposits is in dispute. Different investigators assign values ranging from 20 to 90 percent to the portion of the offset resulting from faulting. The data do not rule out the possibility that all of the bedrock offset resulted from faulting which occurred after planation of the bedrock surface during a higher stand of sea level some 80,000 or 125,000 years ago. On the other hand, the data may require the hypothesis that a scarp existed prior to the deposition of the lower 10 inches of sediment. This would mean that about 50 percent (24 inches) of apparent dip slip has occurred since deposition of those 10 inches of sediments.

Correlation of features within the terrace sediments implies that a range of 30 to 75 percent of the total bedrock offset also occurs within these sediments. Therefore, it would appear that 50 percent of the observed bedrock offset could have occurred since a significant portion of the terrace sediments were deposited. Although the amount of horizontal slippage, if any, cannot be determined, it would increase the total displacement on this fault.

Vertical bedrock offset at the Beach fault is about 8 to 12 inches, about 6 inches of cumulative vertical offset has been identified within the terrace sediments. Most of the faulted bedrock-terrace deposits contact has been removed by erosion, and the rest is obscured by the complex fault relationships at the cliff face.

Apparent dip offset of the bedrock at the S-B fault is about 14 inches. This represents the maximum dip slip which is likely to have occurred on this fault. However, less than 0.1 inch of displacement can be discerned in terrace deposits only 4 inches above the scarp.

Dip slip displacement of bedrock by the AKS-9 fault could be as much as about 30 inches. The terrace deposits are so homogeneous at this exposure that displacements, if they exist within the deposits, cannot be traced more than 10 inches above the scarp.

The lateral extent of each of these faults is not known with certainty. The Arroyo fault must be at least 400 feet long and the Beach fault at least 340 feet long. It has been suggested that the Arroyo fault and the AKS-9 fault to the east are one and the same. 1/ This is indeed possible and would mean that the Arroyo fault is at least 6,000 feet long. However, no data conclusively suggest that this is the case. No trace of the Arroyo fault could be found in an exploratory trench to the west of the arroyo in which it was first discovered.

No data are available on the easterly extent of the Beach fault. Evidence of this fault was not discovered in terrace deposits exposed in the railroad cut to the West. However, the orientation of this fault and the small magnitude of displacement expected within the terrace deposits would make discovery quite difficult without reference to a visible bedrock scarp.

Offshore, the subsurface is complicated by numerous folds and faults. It appears that the South Branch of the Santa Ynez fault passes approximately 5 miles south of the site. The F-1 fault, which had previously been identified as the South Branch, passes within 2 miles of the end of the proposed trestle--3 miles from the site. These faults, the Government Point syncline, and the Point Conception anticline are the dominant structural elements in the offshore area adjacent to the site.

The F-1 fault displays a prominent scarp on the ocean floor and is therefore of Holocene age and definitely active. The South Branch is apparently cut by this fault and is presumably older, although this does not preclude the possibility that the South Branch is active or has moved during the Holocene Epoch.

1/ D.O. Asquith, Summary of Seismic Hazards, Proposed LNG Terminal Site, Cojo Bay, Santa Barbara County, California, (Sherman Oaks, California, July 5, 1978).

The proposed pipeline route would be roughly perpendicular to the strike of the homoclinal structure as it proceeds north into the mountains. Three to 4 miles inland the structure is interrupted by an extensive zone of faulting including the Bulito, Pacifico and Santa Ynez faults at about MP 4 to MP 7 of the proposed route. From here to the Santa Ynex River (MP 15), the structure consists of numerous east-west trending folds. (See figures 10 and 11.) Near MP 17, the route would cross the presumed location of the Santa Ynez River Branch of the Santa Ynez fault.

After exiting the Transverse Ranges, the alignment would enter the southern portion of the Coast Ranges. This northwesterly trending region is some 400 miles long and 50 miles wide and is structurally comprised of northwest trending strike-slip faults and more westerly trending anticlines and synclines.

While no faults are observed at the surface in the Los Alamos Valley and the Solomon Hills (MP 24-33), wells have revealed several faults of mid-Pleistocene age. It is possible that the Los Alamos earthquakes of 1920 and 1915 were caused by activity on a fault near the southern border of the valley. Dames and Moore postulate the existence of two continuous fault zones comprised of several previously recognized faults. These faults, shown on figure 11 and crossed by the proposed pipeline between MP 23 and MP 25 and at MP 33, are the Pezzoni-Casmalia-Los Alamos-Baseline fault and the Santa Maria River-Foxen Canyon-Little Pine-Loma Alta fault, respectively.

In the Sierra Madre Mountains between MP 37 and MP 56, the proposed route would cross at least 10 known faults. Folds in this region are generally asymmetric, with the steeper limbs on the southwest and axes which plunge southeast.

The LaPanza and Caliente Ranges are formed on anticlinal structures related to westward thrusting on east-dipping thrust faults. These mountains form the southwestern border of the Carrizo Plain and host the proposed route from about MP 56 to MP 67. Three known faults would be crossed in this interval.

The structural depression of the Carrizo Plain is bordered on the northeast by the San Andreas fault zone. At about MP 76.5, the route would cross the Elkhorn Scarp of this zone and subsidiary faults within the Panorama Hills and Elkhorn Plain before entering the Temblor Range at MP 77.

At MP 83 the proposed route would exit the Temblor Range and then cross Midway Valley, skirt the north end of the Buena Vista Hills, and cross Buena Vista Valley. Between MP 98 and MP 102, the pipeline would cross the southern slopes of the Elk Hills. At MP 102 the proposed route would enter the San Joaquin Valley, where it would remain to its terminus at MP 112.4 near Bakersfield. This structural basin has received sediments continuously since the early Tertiary Period. Its southern margin contains a number of active faults including the White Wolf fault, the Pleito thrust fault, and the Kern Front fault. However, the proposed pipeline would not be near these faults.

b) Stratigraphy

Submarine surficial deposits are relatively thin and discontinuous in the vicinity of the proposed marine trestle. Except for a possible buried stream channel where thicknesses reach 20 feet, the fine, well-sorted quartz sand is seldom more than a few feet thick. The nature of this material, including its composition, sorting, and grain size, implies a northern upcoast source. Apparently very little of the surficial sediment is derived locally, and Bowen and Inman have estimated that approximately 100,000 cubic yards of sediment are transported south around Point Conception in a year.

The marine trestle would be underlain by upper Miocene silt-clay and mud-stones, probably of the Sisquoc Formation, which also forms the bedrock beneath the proposed LNG vaporization plant. The Sisquoc Formation which would be underneath the onland facilities consists of highly fractured diatomaceous marine mudstone which is often unstable on steep slopes. This problem could be compounded by the steep southerly (downslope) dip of the strata. The formation extends to depths in excess of 2,000 feet beneath the site. Above the bedrock are Pleistocene terrace deposits which consist of unconsolidated gravel, sand, silt, and clay. Their thickness ranges from 2 to 60 feet, and they are easily eroded.

Most of the proposed route is nearly perpendicular to the regional strike. Tertiary and Recent sediments dominate the indurated deposits, although sediments as old as the Jurassic Period occur along the route. About half of the proposed pipeline would pass through unconsolidated deposits composed mainly of fanglomerate and alluvium.

Holocene alluvium consists of generally fine-grained material with local lenses of gravel and occasional boulders. The deposits are irregular in thickness and in plan. These stream deposits and the coarser colluvium, which commonly covers adjacent slopes, are found in stream valleys and on terraces. Erosion of these unconsolidated materials is severe on steep slopes, although on gentler slopes the problem is not as great.

Between the following mileposts, the proposed route would lie on the unconsolidated deposits (areas less than 0.5-mile long are not included): Mileposts 0-0.7, 9.8-10.9, 15-15.5, 16.3-22, 24-39.5, 67-77.1, 82.3-112.4.

In the Transverse Ranges, the route would cross shales and claystones, sandstones, volcanics, and unconsolidated sediments. The rocks range in age from the Cretaceous to the Quaternary Periods. Shales to be crossed by the route belong to the Espada, Jalama, Anita, Cozy Dell, Rincon, Monterey, Sisquoc and Foxen Formations. These shales are generally not resistant to erosion, as evidenced by their occurrence in topographic lows. While steep slopes and even cliffs may be encountered in the Monterey and Sisquoc Formations, they are not stable.

Along the coastal terrace and the southern slope of the Santa Ynez Mountains, the proposed route would encounter Miocene and Pliocene shales and mudstones of the Sisquoc and Monterey Formations. The former is a highly fractured diatomaceous marine mudstone, while the latter also includes thin-bedded siliceous marine shale, minor quantities of limestone, and bentonite in the lower beds. The Monterey beds are also generally fractured and commonly contain tar. Both of these formations are reasonably resistant to erosion, but they present stability problems on slopes because they are so highly fractured.

The Rincon Formation presents special problems. It is comprised of highly fractured claystones which "tend to weather rapidly and deeply, and develop thick, unstable, expansive soils. The Rincon Formation erodes to low, rounded hills with hummocky, highly unstable, landslide-prone slopes. In addition, the upper part of this formation contains bentonite beds that are extremely unstable." 1/ This formation probably underlies the landslide deposits and most of the alignment from MP 14 to MP 15.

1/ Dames and Moore, Detailed Environmental Analysis Concerning a Proposed Gas Transmission Pipeline for Pacific Gas and Electric Company and Pacific Lighting Service Company Associated with Proposed Liquefied Natural Gas Facilities for Western LNG Terminal Associates Gas Transmission Pipeline from Point Conception to Gosford, California (October 1977), p. 2-17.

The sandstones beneath the proposed route belong to the Matilija, Sacate, Gaviota, Alegria, Sespe and Vaqueros Formations. In this region, sandstones are more resistant to weathering than shales, especially when the sands are as well-indurated as most of those to be crossed by this route.

The Tranquillon Formation, consisting of rhyolite, agglomerate, and ash, is the only volcanic unit exposed in this region. It lies unconformably above the Rincon Formation and has undoubtedly contributed to the instability of the terrain near MP 15, since it too contains bentonite.

In addition to being found in alluvium and terrace deposits, unconsolidated gravels, sands, silts, and clays are found within the following formations: Careaga, Paso Robles and Orcutt. These upper Pliocene and Pleistocene formations, as well as the Quaternary deposits, are easily eroded.

Within the Coast Ranges Province, the route would traverse the most varied stratigraphy along the proposed route. The age of the exposed units ranges from the Jurassic Period to the present, and the units display a complete modal range of clastic sediments, as well as metamorphic rocks.

Shales found along the proposed route within the Coast Ranges occur primarily between MP 35 and MP 43, where they are the predominant rock type. The route would apparently not cross the Rincon Formation. Shales belonging to the Monterey and Temblor Formations as well as unnamed shales of the upper Cretaceous and lower Tertiary (Paleocene and Eocene Epochs) Periods would be crossed in this physiographic province.

Sandstone exposures are quite extensive in this region and may be assigned to the Jurassic Knoxville Formation, the Jurassic to Cretaceous Franciscan Formation, undifferentiated upper Cretaceous deposits, and Tertiary formations including the Temblor, Simmler, Vaqueros, Branch Canyon, Santa Margarita, and Morales Formations.

The Franciscan Formation contains substantial amounts of volcanics and altered intrusives. These materials present slope and foundation stability problems caused by the presence of the mineral serpentine which has low shear strength. The formation is present from MP 47 to MP 49.

The proposed route would cross unconsolidated sediments of the Careaga, Paso Robles, Orcutt, and Tulare Formations, as well as unnamed unconsolidated deposits. These deposits are of Quaternary and upper Tertiary (Pliocene and Pleistocene) age, and primarily occupy valleys and streambeds except in the Buena Vista and Elk Hills. Here they cover the hills as well. Across the southern San Joaquin Valley, the proposed route would cross only Holocene alluvium.

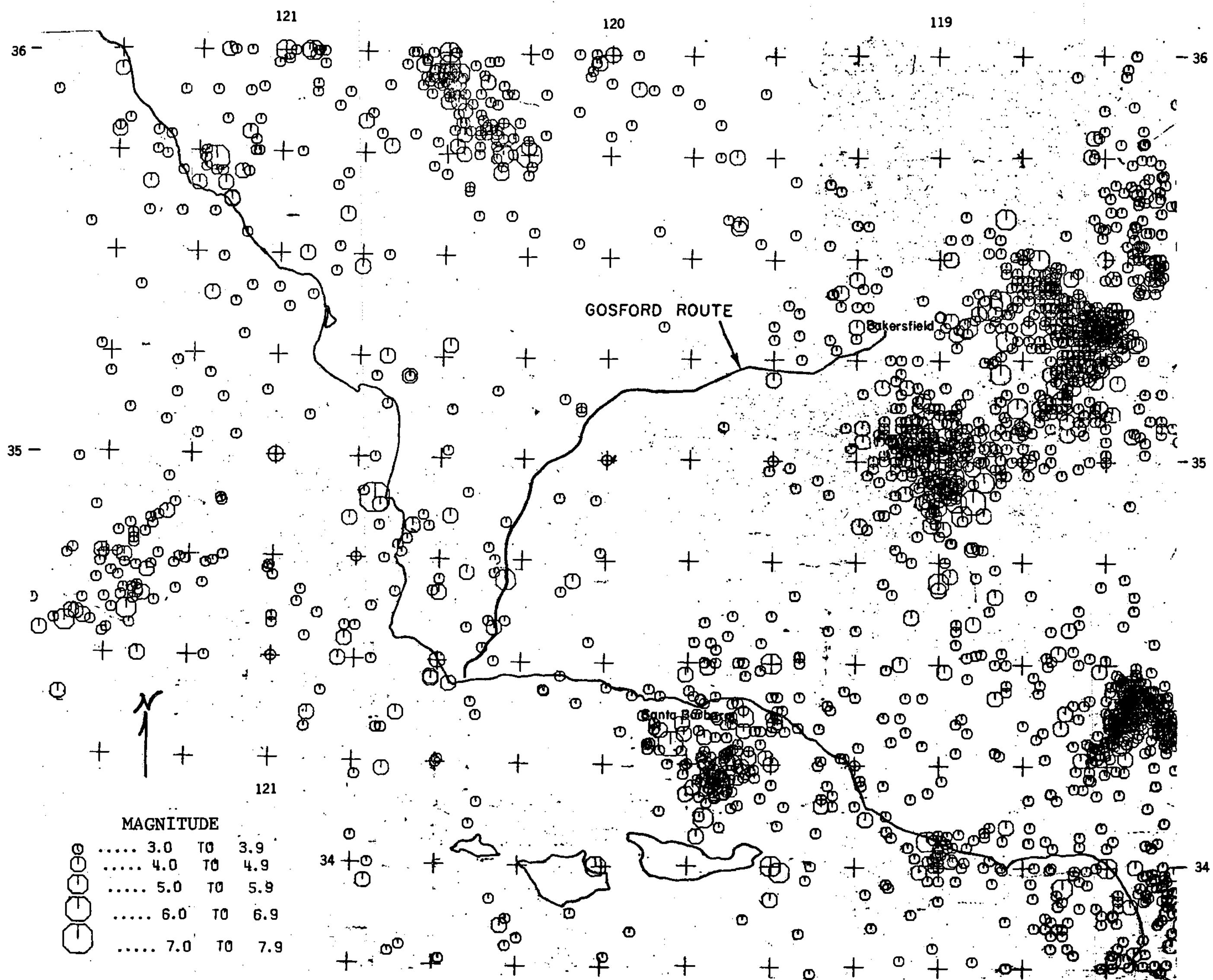
c) Seismicity

There are three major orientations and two major types of faults in southern California. An east-west orientation predominates on reverse faults, while strike-slip faults trend northeast-southwest or northwest-southeast. Right-lateral motion is predominant on faults with the latter orientation such as the San Andreas, whereas the other orientation is generally associated with left-lateral motion, such as along the Garlock fault.

To determine the hazards associated with faulting and earthquakes, it is necessary to have a reasonable record of previous activity in the area of interest. Unfortunately, the historical record for faults that are considered active is poor to nonexistent. The most extensive historical record of activity along a fault in North America is represented by the San Andreas fault, where records span a period of roughly 120 years. However, it can be shown that this fault has been active for at least 25 million years, so that the historical record covers less than one ten-thousandth of one percent of the lifetime of this feature. Knowledge of earthquake activity in southern California extends back no further than 1769, and C.F. Richter and Gutenberg note that "even a major earthquake could have escaped notice until about 1887" because of low population density and the lack of instrumentation. The same authors note that the record for earthquakes of magnitude 8 and over is not complete until after 1904, with 1932 marking the first date from which the record may be assumed complete to magnitude 3 in southern California. Figure 13 displays the locations of epicenters in the project region.

Table 7 lists all of the active or potentially active faults which have been mapped and which could significantly affect the proposed project. Any fault which has been determined to have moved during the Quaternary Period is considered potentially active. In some cases the extensions of these faults are also considered potentially active, even if they have no demonstrated Quaternary activity.

Using map distances and the attenuation curves given by Roger W. Greensfelder, the staff has estimated the maximum accelerations from the credible events for the proposed site and pipeline. It should be emphasized that the accelerations listed for facilities within the fault zones are in fact taken from an abscissa representing a distance of 2 miles



Modified from California Division of Mines and Geology, Computer Printout, 1977.

Figure 13: Earthquake Epicenter Map of Project Region, 1900-1975

TABLE 7

ACTIVE OR POTENTIALLY ACTIVE FAULTS

Fault	MCE 1/	Distance (miles) to: Site	Pipe	Acceleration (g) 2/ Site	Pipe	Pipeline 3/ D	MP	#
Arroyo	<5?	0	0	0.20-	0.20-	-	-	-
Beach	<5?	0	0	0.20-	0.20-	-	-	-
F-1	6.0	3	3	0.49	0.49	-	-	-
Santa Ynez (N)	7.5	3	0	0.67	0.73+	8	4-7	*
Santa Ynez (S)	7.5	5?	5?	0.57	0.57	-	-	-
Santa Ynez River	7.5	12	0	0.38	0.73+	8	16-19	3?
Baseline-Purisima Hills-Lompoc Oil Field-Lion's Head	7.5	16	0	0.32	0.73+	8	22	?
Santa Cruz Island-Dume	7.5	18	18	0.29	0.29	-	-	-
Baseline-Los Alamos-Casmalia-Pezzoni	7.5	20	0	0.27	0.73+	8	23-26	2?
Bradley Canyon	5.2	23	1.5	-	0.40-	-	-	-
Santa Maria	6.4	24	3	0.12	0.57	-	-	-
Santa Maria River-Foxen Canyon-Little Pine-Loma Alta	7.5	25	0	0.22	0.73+	8	33	?
More Ranch-Arroyo Parida	7.5	25	24	0.22	0.22	-	-	-
Little Pine	6.5	26	10	0.12	0.30	-	-	-
Hosgri	7.5	29	28	0.19	0.19	-	-	-
Nacimiento	7.5	31	0	0.18	0.73+	8	37.6	1
Unnamed (possibly associated with East Huasna)	-	37	0	-	-	3?	40-43.3	6
East Huasna	6.8	31	0	0.12	0.68+	3	47.2	1
Santa Rosa Island	7.0	33	35	0.12	0.11	-	-	-
Big Pine	7.5	38	28	0.14	0.19	-	-	-
Santa Lucia Bank	7.5	38	38	0.14	0.14	-	-	-
Rinconada	7.5	40	0	0.13	0.73+	8	52.8	1
South Cuyama-Ozena	7.0	46	0	0.07	0.70+	4	55	1
La Panza	6.5	50	0	-	0.66	2	56.5, 57.5	2
Graveyard-Turkey Trap	5.6	53	16	-	0.10	-	-	-
San Juan	6.5	54	0	-	0.66+	2	62.4	1
Morales	6.8	53	0?	0.05	0.68+	3	66?	?
Big Spring	6.5	60	0?	-	0.66+	2	69.5	1
San Andreas	8.5	64	0	0.10	0.75+	30	76.5-78	5
Recruit Pass	6?	66	0	-	0.58+	1	79.3, 79.5	2
Pleito Thrust	7.0	72	20	-	0.22	-	-	-
Buena Vista Thrust	5?	74	4	-	0.3-	-	-	-
Unnamed in Elk Hills	5?	82	2	-	0.4-	-	-	-
White Wolf	7.8	90	20	-	0.30	-	-	-
Garlock	7.8	90	36	-	0.17	-	-	-
Kern Front & Others	6?	100	10	-	0.24	-	-	-
Kern Canyon	7.5	130	36	-	0.15	-	-	-
Sierra Nevada	8.0	140	64	-	0.08	-	-	-
Owens Valley	8.5	190	91	-	0.05	-	-	-

* Fault is both crossed and paralleled.

1/ Maximum Credible Earthquake.

2/ Average peak acceleration in g's at the site and the nearest point on the proposed pipeline. + indicates value would be higher than the tabulated value, - indicates lower.

3/ For faults crossed by the proposed pipeline, D is expected fault displacement in feet if greater than 1 foot; MP is pipeline milepost at fault; # is number of mapped fault traces crossed.

from the site. These entries indicate a minimum value (+) and not a specific value, since no data exists to allow extrapolation to locations within a fault zone. M.G. Bonilla was the source for the ground displacements listed.

There is some confusion in the literature about the names of certain mapped faults. The staff has adopted the nomenclature used by C.W. Jennings. Dames and Moore treats the Rinconada and Nacimiento faults as being one and the same, while Jennings shows them as being quite distinct. The term Nacimiento will be used to refer to the continuous zone of faulting extending south from Jennings' Nacimiento fault and including the Edna, West Huasna, and Suey faults. La Panza will refer to the Huerhuero-Cuyama identified by Dames and Moore. The Santa Ynez (N) and San Juan faults of table 7 refer to the Santa Ynez, Pacifico, Bulito and the San Juan, Red Hills, Big Spring, Chimeneas faults of Dames and Moore, respectively.

The applicant's consultant, Dames and Moore, has postulated the existence of four other faults which are shown in figure 11. This may be compared to figure 10, which shows the location of all major faults previously identified in the project region. Of these newly postulated faults, only the Santa Ynez River branch of the Santa Ynez fault, referred to here as the River Branch fault, is of direct concern to the proposed LNG terminal site. The River Branch fault and the Pezzoni-Casmalia-Los Alamos-Baseline, Lion's Head-Lompoc Oil Field-Purisima Hills-Baseline, and Santa Maria River-Foxen Canyon-Little Pine faults proposed by the applicant are included in table 7 with the magnitudes ascribed to them by the applicant.

In previous studies for an LNG receiving terminal at this site, Dames and Moore concluded that the Santa Ynez fault was the most important fault to consider in the design of the terminal. Specifically, it stated that the South Branch of that fault was active and capable of a magnitude 7.0 earthquake. The location of the South Branch is well-known on shore: it enters the Santa Barbara Channel near Drake, 7.2 miles east of the proposed terminal site. Offshore it may pass within 5 miles of the proposed site. The new geoseismic investigations which Dames and Moore prepared for this site conclude that the "Santa Ynez fault" is still of major significance; however, the newly postulated River Branch fault is considered at least potentially active and capable of a magnitude 7.5 earthquake, while the South and North Branches are not. The River Branch is assumed to pass 12 miles north of the site. Apparently Dames and Moore has changed its opinion of what geologic structures constitute a hazard in this geographic area.

Page 1 of the Dames and Moore geoseismic investigation states its basis for determining potential significance: "For this study, faults were considered to be potentially significant only if they exhibited geologic or geomorphic evidence of Holocene activity, or if they were the probable source of historic seismicity." At several points it notes that there is no indication that the River Branch has exhibited geologic or geomorphic evidence of Holocene activity. The historic seismicity cited by Dames and Moore includes the 1812 Santa Barbara Channel earthquake and the 1927 Point Arguello earthquake of magnitude 7.3, as well as minor earthquakes in the vicinity of Lompoc. The location of the 1812 event is unknown, and the location of the 1927 event is the subject of considerable dispute. It is agreed that it occurred in the Pacific Ocean several miles west of Point Arguello. As for the Lompoc tremors, Dames and Moore indicates that "the tectonic significance of the local earthquakes may be questionable" (p. 25). Therefore, according to its own study, which included no ground inspection of this fault, the River Branch does not qualify as potentially significant.

Dames and Moore states that the South Branch does not meet the criteria. However, the South Branch comes closer to meeting them than the River Branch. In the description of the field investigations conducted by Dames and Moore, conclusive evidence is cited for late Pleistocene movement, and no evidence is presented that Holocene movement did not occur. Dames and Moore cites no evidence of late Pleistocene fault displacement on the River Branch. The 1812 and 1927 events are just as likely to have occurred on westward extensions of the South Branch as on the River Branch. It appears that there is only one reason that Dames and Moore no longer considers the South Branch significant: it has been replaced by the River Branch fault, which Dames and Moore now believes is the main western extension of the Santa Ynez fault. As summarized on pages 32 and 33:

> Fundamental differences in regional stratigraphy on either side of the Santa Ynez River fault suggest that it is probably the main extension of the Santa Ynez fault west of Lake Cachuma. . . .This fault forms the boundary between two structural blocks [the Coast Ranges and Transverse Ranges] with significantly different geologic histories. In contrast, the presently mapped western extensions of the Santa Ynez fault (South Branch and Pacifico/North Branch) are included within the same structural block [Transverse Ranges].

Other investigators express a different opinion:

> The tectonic history of the Transverse Ranges Province is not understood well enough to allow geologists or geophysicists to determine which branch or which portion of this fault will display the next seismic activity. If one segment is considered active, perhaps the entire fault system should be considered active. It is highly probable that major splay faults of the Santa Ynez system, such as the Santa Ynez River fault, will be active in the future, as Dames and Moore suggest. However, this does not rule out the possibility for activity on the Santa Ynez fault itself. The entire system is a major representative structure in a seismically active province.
>
> In conclusion, the South Branch of the Santa Ynez fault (both onshore and offshore segments) is considered, by this study, to be active (or at least potentially active) and worthy of consideration for design purposes. 1/

The four faults proposed by Dames and Moore, including the River Branch, may or may not exist as throughgoing structures. Each has been postulated by connecting previously

---

1/ Slosson and Associates, Environmental Geology and Seismic Analysis: Point Conception and Alternate Sites, pp. 60-61.

mapped faults with no known connection. The Dames and Moore study, a literature study, cannot supply conclusive evidence that they do connect nor can it prove that any of them connect with the previously mapped Santa Ynez fault. The structural argument in favor of a major fault dividing the Coast Ranges from the Transverse Ranges is intellectually satisfying and merits field investigation. Nevertheless, even if it is assumed that the River Branch is such a major fault and is the main western extension of the Santa Ynez fault, one cannot rule out the occurrence of major earthquakes on the South Branch.

The F-1 fault, which is certainly active and is closer to the site than the South Branch, has been assigned a "limiting earthquake magnitude" of 6.0 by Dames and Moore, and the staff has adopted this value as the maximum credible earthquake. 1/ It is a reasonable value based on the length of this fault determined by the MESA^2 study 2/. It is possible that the F-1 fault connects with other east-west trending offshore faults farther to the east, but the MESA^2 study does not support such a hypothesis.

The Arroyo and Beach faults appear to be quite small in horizontal extent and vertical displacement. The most generous estimate of minimum length for the Arroyo fault is about 1 mile with a maximum apparent vertical displacement of about 2.5 feet. Judging from the fault length, movement on the Arroyo fault could only result in a magnitude 5 earthquake if rupture occurred on 100 percent of the fault. It must be remembered that, even if the entire 2.5 feet of displacement is the result of faulting, no more than 50 percent could have occurred during a single event in the last 80,000 or 125,000 years. This places an upper bound of magnitude 6 on this fault, but since it is unlikely that only one event occurred during this period, such a magnitude is probably inappropriate. This conclusion is also supported by the length of the fault. Consequently, the Arroyo and Beach faults have been assigned a maximum credible magnitude of less than 5, with the peak acceleration for magnitude 5 listed in table 7 as a reference point.

1/ Dames and Moore, Technical Appendix A: Supplement (Los Angeles, 1978).
2/ MESA^2 and Marine Studies, 1978.

4. Soils

Climate, parent material, soil organisms, vegetation, topography, and time all influence the formation of soils. In southern California, climate and parent material have been especially influential. Almost all of the annual precipitation occurs during the winter, causing summers to be long and dry. Also important is the geographic distribution of rainfall, which is greatly influenced by the mountain ranges that parallel the coast. Rainfall along the coast in Santa Barbara County ranges from 13 to 17 inches. Some of the mountainous areas inland receive up to 30 inches of rain, while only 6 to 10 inches of precipitation fall on the more arid areas like the Carizzo Plain. Parent materials of the soils in the proposed project area have been derived primarily from sedimentary rock alluvium, consolidated sedimentary rock, and soft sedimentary rock.

The Soil Conservation Service has systematically classified the soils of the U.S. into 10 major soil orders. The proposed project area crosses soils belonging to four of these orders: Entisols, Mollisols, Alfisols, and Aridisols. Entisols have no natural genetic horizons and are therefore considered to be young soils. They have formed on recent alluvial deposits, floodplains and alluvial fans, and rapidly eroding areas where erosion has kept pace with soil formation. Soils of the coastal terrace area (MP 0.7 to MP 1.5) as well as those in and west of the Temblor Range (MP 77 to MP 112.4) are primarily Entisols.

Mollisols have dark-colored organic-rich surface horizons, are high in bases, and are usually formed under grass vegetation in subhumid to semi-arid climates. They are located on older alluvial deposits in the valleys and also on some upland areas. They are the major soils found in the low mountain areas of the Transverse Range Province (MP 1.5 to MP 25) and in the broad valley and rolling hills section of the Southern Coastal Range Province (MP 25 to MP 35).

The rugged mountain area of the Southern Coastal Range Province (MP 35 to MP 67) is comprised of a mixture of Mollisols and Alfisols. Alfisols are medium to high in bases, have gray to brown surface horizons, and a subsurface accumulation of clay that indicates a certain degree of maturity. Clay pans and hard pans are generally present in the terrace soils and older alluvial deposits. These restrictive subsurface layers affect drainage and permeability and limit soil use and the growth of certain plants.

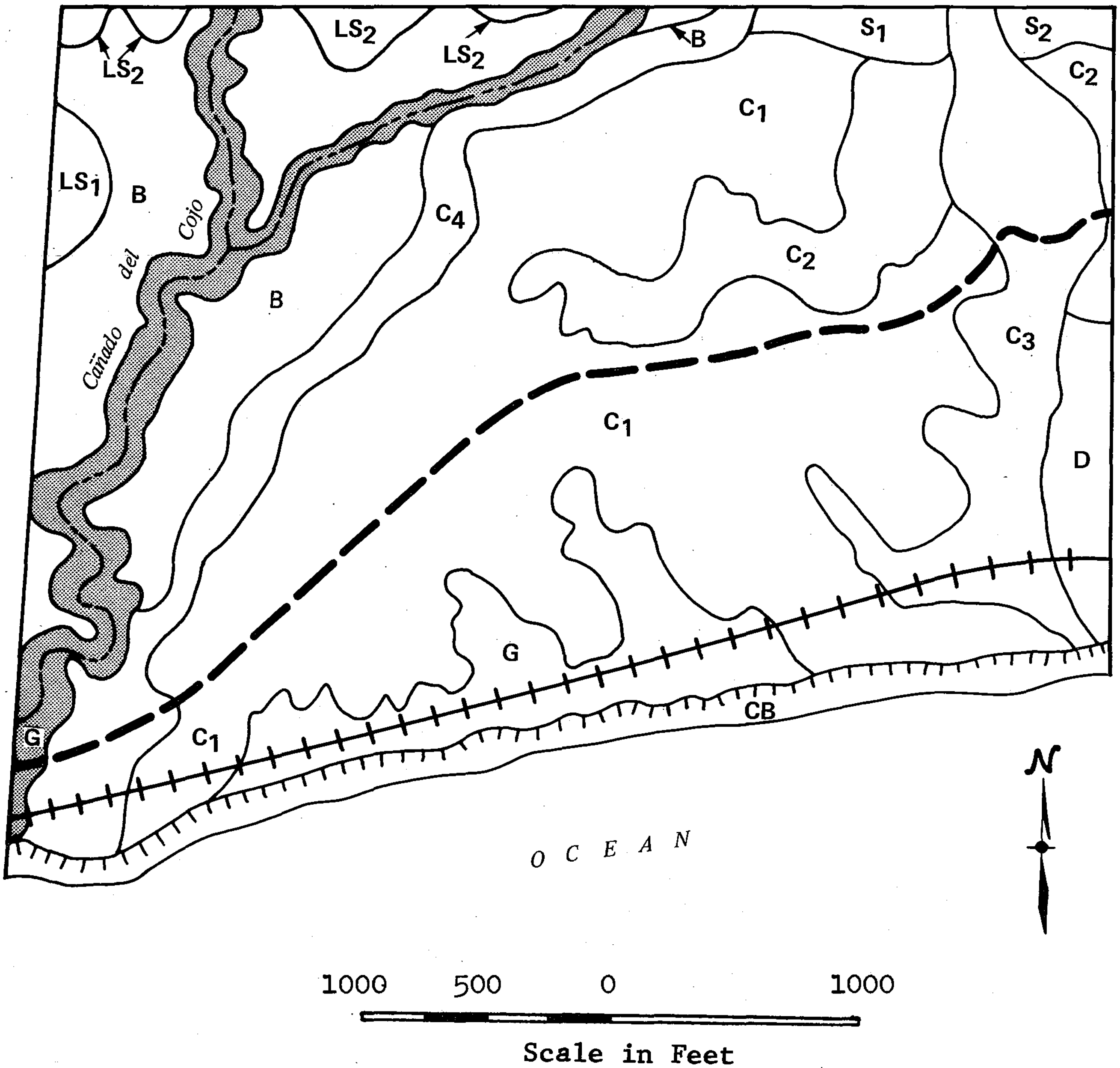


Figure 14: Soil Map of Proposed LNG Terminal Site

Source : USDA, Soil Conservation Service, 1977

Aridisols are soils that have some horison differentiation. They receive low amounts of rain and are moist for less than three consecutive months of the year; because of a sparse vegetative cover they have a low organic matter consent. The soils located in the Carizzo Plain (MP 67 to MP 77) are classified as Aridisols.

Agricultural production is confined mainly to the valley areas, with some dry land farming on the gently sloping hills and terraces. Table 8 presents the types of agricultural land to be crossed by the proposed project.

TABLE 8

TYPES OF AGRICULTURAL LANDS TO BE AFFECTED BY PIPELINE CONSTRUCTION

Agricultural Land Type	Approximate Location of Mileposts	Estimated Acreage To Be Disturbed
Wheat	66.5-70.	82.1
Fallow 1/	73.5-76 17.5-22 24.5-25.5 35-36 37-38 103-104 105-106.5	100.7
Vineyards	33-34.5	13.3
Cotton	109-112.4	50
Walnut	17.2-17.3	1.7
	TOTAL	247.8

1/ Cultivated land with no crops grown during December 29-30, 1977, survey.

On a local level, soils are classified as soil series--groups of soils with similar profile characteristics differing only in surface texture. Soil associations are groups of soil series that occur together geographically in a distinctive proportion and pattern. Figure 14 presents a soil map of the proposed LNG terminal site and table 9 presents selected soil characteristics of the soil series found on that map. Table 10 presents the selected soil characteristics of the soil associations to be crossed by the proposed pipeline.

TABLE 9

SOIL SERIES OF THE PROPOSED POINT CONCEPTION LNG TERMINAL SITE

Soil Name and Map Symbol	Selected Soil Characteristics: Texture: Surface	Texture: Subsurface	Range of Slopes (%)	Drainage	Permeability: Surface	Permeability: Subsurface	Erosion Hazard	Runoff	Suitability and Limitations of Soils for Selected Uses: Embankments and Dikes	Terraces and Diversions	Shallow Excavations	Roadfill	Sand	Gravel	Topsoil
B Botella	silty clay loam	silty clay loam	2-9	well (drained)	moderately slow	moderately slow	moderate	medium	low strength	slopes, slow perco-lation	moderate: low strength shrink-swell	poor: low strength	unsuited	unsuited	fair: too clayey
C_1 Concep-tion	fine sandy loam	clay, clay loam	2-9	moderately well	moderate	slow	moderate	medium	low strength, shrink-swell	slope, slow perco-lation	moderate: too clayey	poor: shrink-swell, low strength	unsuited	unsuited	good
C_2	fine sandy loam	clay, clay loam	9-15	moderately well	moderate	slow	severe	rapid	low strength, shrink-swell	slope, slow perco-lation	moderate: slope, too clayey	poor: shrink-swell, low strength	unsuited	unsuited	fair: slope
C_3	fine sandy loam	clay, clay loam	15-30	moderately well	moderate	slow	severe	rapid	low strength, shrink-swell	slope, slow perco-lation	severe: slope	poor: shrink-swell low strength	unsuited	unsuited	poor: slope
C_4	fine sandy loam	clay, clay loam	30-50	moderately well	moderate	slow	severe	rapid	low strength, shrink-swell	slope, slow perco-lation	severe: slope	poor: slope, shrink-swell, low strength	unsuited	unsuited	poor: slope
CB Coastal Beaches	sandy, stoney	sandy, stoney	nearly level	--------------variable and unstable-----------------------					-	-	-	-	-	-	-
D Diablo	clay	clay, mudstone	2-9	well	slow	slow	slight	medium	shrink-swell, low strength, compressible	complex slope, slow perco-lation	severe: too clayey	poor: shrink-swell, low strength	unsuited	unsuited	poor: too clayey
G Gullied Land	variable sand to clay		side slopes 50+	well	-----variable-----		severe	rapid	-	-	-	-	-	-	-
LS_1 Lopez-Santa Lucia Complex			9-30												
Lopez part	shaley clay loam	fractured shale		somewhat excessively	moderately slow	moderately slow	severe	rapid	thin soil	slope, depth to bedrock	severe: slope, depth to bedrock, small stones	poor: thin layer	unsuited	unsuited	poor: slope, small stones
Santa Lucia part	shaley clay loam	white shale		well	moderately slow	moderately slow	severe	medium	piping, thin soil	slope, depth to bedrock, piping	severe: slope, depth to bedrock, small stones	poor: thin layer	unsuited	unsuited	poor: slope, small stones
LS_2 Lopez-Santa Lucia Complex			30-50												
Lopez part	shaley clay loam	fractured shale		somewhat excessively	moderately slow	moderately slow	severe	rapid	thin soil	slope, depth to bedrock	severe: slope, depth to bedrock, small stones	poor: slope, thin layer	unsuited	unsuited	poor: slope, small stones
Santa Lucia part	shaley clay loam	white shale		well	moderately slow	moderately slow	severe	rapid	piping, thin soil	slope, depth to bedrock, piping	severe: slope, depth to bedrock, small stones	poor: slope, thin layer	unsuited	unsuited	poor: slope, small stones
S_1 Santa Lucia	shaley clay loam	white shale	9-15	well	moderate	moderate	moderate	medium	piping, thin layer	complex slope depth to bedrock,	severe: depth to bedrock, small stones	poor: thin layer	unsuited	unsuited	poor: small stones
S_2 Santa Lucia	shaley clay loam	white shale	15-30	well	moderate	moderate	severe	rapid	piping, thin layer	complex slope, depth to bedrock, piping	severe: slope, depth to bedrock, small stones	poor: thin layer	unsuited	unsuited	poor: slope, small stones

TABLE 10

SELECTED SOIL CHARACTERISTICS OF THE SOIL ASSOCIATIONS CROSSED BY THE PROPOSED PIPELINE

Soil Association	Approximate Mileposts	% of Association	Slope (%)	Topographic Position	Texture: Surface	Texture: Substratum or Parent Material[1/]	Soil Depth (inches)	Drainage	Soil Reaction (pH)	Available Water Capacity (inches water per inch soil)	Hydrologic Group[2/]	Present Land Use[3/]
Santa Barbara County												
Marina-	0-1	50	2-9	undulating terraces	sand	sand	60+	somewhat excessively	5.1-7.3	.06-.08	B	range
Oceano		45		gently sloping old sand dunes	sand	sand	60+	excessively	5.1-6.5	.05-.08	A	
Shedd-	1-2	60	15-50	moderately steep to steep hills	silty clay loam	shale or mudstone R	24-40	somewhat excessively	7.8-8.4	.16-.21	C	range
Linne		35			silty clay loam	shale or mudstone R	20-40	well	7.9-8.4	.10-.19	C	
Los Osos-	2-3	60	15-50	moderately steep to steep hills and mountains	clay loam	sandstones and shales R	20-40	well	5.6-7.3	.12-.19	C	range
San Benito	4-11	30			clay loam	shale R	40-60	well	6.6-8.4	.17-.21	B	
Rockland-	3-4	75	-	steep to extremely steep mountains	mostly rock outcrops	shale or sandstone R	0-6	excessively	-	0-.10	D	watershed
Rough Broken Land	39-40	15	-		mostly bedrock some thin soil	soft sandstone R	0-20	excessively	-	0-.15	D	
Santa Lucia-	11-16	65	15-50	steep hills and mountains	shaley clay loam	hard shale H	20-40	well	5.1-6.5	.08-.14	C	range
Crow Hill		30			silty clay loam	shale R	20-40	well	4.5-6.5	.17-.20	C	
Santa Lucia-	21-24	65	50-75	very steep hills and mountains	shaley clay loam	hard shale H	20-40	well	5.1-6.5	.08-.14	C	range
Crow Hill	38-39 40-43	30			silty clay loam	shale R	20-40	well	4.5-6.5	.17-.20	C	
Sorrento-	15	60	0-2	alluvial fans	loam	loam	60+	well	6.1-8.4	.10-.19	B	cropland
Salinas		25			loam	clay loam	60+	well	6.6-8.4	.12-.19	C	
Arnold-	16-17	60	15-50	moderately steep and steep hills	sand	soft sandstone R	40-60	somewhat excessively	5.1-7.3	.05-.09	B	range
Marina	26-27	30		rolling dissected terraces	sand	sand	60+	somewhat excessively	5.1-7.3	.06-.08	B	
Sorrento-	17-21, 30	50	2-9	alluvial fans	sandy loam	sandy loam	60+	well	6.1-8.4	.10-.19	B	cropland, pasture
Mocho	33-34 35-38	30			sandy loam	sandy loam	60+	well	7.4-8.4	.10-.21	B	
Chamise-	24-25	60	15-50	moderately steep to steep, dissected high terraces	shaley loam	shaley deposits	60+	well	4.5-6.5	.06-.14	C	range
San Andreas	27-33	30		moderately steep to steep rolling hills	sandy loam	soft sandstone R	20-40	well	5.6-7.3	.11-.17	B	
Mocho-	25-26	50	2-9	alluvial fans	silty clay loam	loam or clay loam	60+	well	7.4-8.4	.10-.21	B	cropland, pasture
Salinas	27	40			silty clay loam	clay loam	60+	well	6.6-8.4	.12-.19	C	
River wash	34, 55-56	95	nearly level	active stream channels	stratified sand, gravel and stones		60+	excessively	-	.01-.03	B	recreation or waste
Pleasanton-	34-35	50	2-9	gently to moderately sloping terraces	sandy loam	gravelly sandy loam	60+	well	5.6-7.8	.10-.18	B	pasture, cropland
Ballard		40			fine sandy loam	gravelly sandy loam	60+	well	6.0-6.5	.05-.10	B	
Contra Costa-	43-44	65	30-75	steep to very steep hills and mountains	loam	hard sandstone R	20-40	well	5.6-7.3	.13-.19	C	range
Gaviota	45-49	25			sandy loam	hard sandstone H	10-20	somewhat excessively	6.1-6.5	.10-.20	C	range, watershed

TABLE 10 (cont.)

Soil Association	Approximate Mileposts	% of Association	Slope (%)	Topographic Position	Texture: Surface	Texture: Substratum or Parent Material[1]	Soil Depth (inches)	Drainage	Soil Reaction (pH)	Available Water Capacity (inches water per inch soil)	Hydrologic Group[2]	Present Land Use[3]
Santa Barbara County (cont.)												
Mollic Haploxeralles-	44-45	40	40-70	steep uplands	silty loam	mudstone R	20-40	well	6.7-7.0	-	C	Los Padres National Forest
Lodo-	49	25			loam	shale or sandstone R	4-20	excessively	6.1-7.3	.12-.18	D	
Milsholm		25			loam	shale R	13-20	well	5.6-7.3	.14-.19	D	
Modesto-	49-52	40	10-50	hilly to steep uplands or alluvial fans	loam	clay stone H	25-55	well	5.8-6.9	-	C	national forest
Positas		35			clay loam	clay stone R	35-70	well	5.1-8.4	.03-.13	D	
Exchequer-	52	25	30-80	steep uplands	loam	sandstone H	10-20	excessively	5.6-6.5	.11-.14	D	national forest
Millerton-	54-55	25			sandy loam	sandstone H	10-20	well	6.7-7.0	-	D	
Aqua Dulce		25			sandy loam	conglomerate rock R	35-75	well	6.5	-	C	
Aqua Dulce-	52-54	40	20-80	hilly to steep uplands	sandy loam	conglomerate rock R	35-75	well	6.5	-	C	national forest
Modesto	55	30			loam	clay stone H	25-55	well	5.8-6.9	-	C	
San Luis Obispo County												
Contra Costra-	55-56	65	30-75	steep and very steep hills and mountains	loam	shattered sandstone and shale R	20-40	well	5.6-7.3	.13-.19	C	range
Lodo		25		steep and very steep hills and mountains	loam	fractured sandstone R	4-20	somewhat excessively	6.1-7.3	.12-.18	C	
Exchequer-	56-59	25	30-80	steep uplands	loam	sandstone H	10-20	excessively	5.6-6.5	.11-.14	D	national forest
Millerton-	60	25			sandy loam	sandstone H	10-20	well	6.7-7.0	-	D	
Aqua Dulce		25			sandy loam	conglomerate rock R	35-75	well	6.5	-	C	
Aqua Dulce-	57, 58, 59-60	40	20-80	hilly to steep uplands	sandy loam	conglomerate rock R	35-75	well	6.5	-	C	national forest
Modesto		30			loam	clay stone H	25-55	well	5.8-6.9	-	C	
Balcom-	57	65	20-50	hilly to steep uplands	silt loam	shale R	35-40	well	7.9-8.4	.13-.19	B	national forest
Nacimiento		20			clay loam	sandstone R	20-40	well	7.9-8.4	.17-.19	C	
Modesto-	60-61	40	10-50	hilly to steep uplands or alluvial fans	loam	clay stone H	25-55	well	5.8-6.9	-	C	national forest
Positas		35			clay loam	clay stone R	35-70	well	5.1-8.4	.03-.13	D	
Los Osos-	61-62	50	9-30	strongly sloping to moderately steep hills and mountains	clay loam	fractured shale R	20-40	well	5.6-7.3	.12-.19	C	grain, range
Millsholm		30		moderately steep hills and mountains	loam	shattered sandstone and shale R	10-20	well	5.6-7.3	.14-.19	D	
Vista-	62	60	30-50	steep hills and mountains	sandy loam	fractured granite R	20-40	somewhat excessively	5.6-7.3	.07-.12	C	range
Pinnacles		30		moderately steep to steep dissected terraces	gravelly sandy loam	granitic alluvium	25-40	well	4.5-6.0	.04-.18	C	
Nacimiento-	62-65	70	9-30	smooth moderately steep hills	silty clay loam	soft sediments or shale R	30-50	well	7.9-8.4	.17-.19		grain, pasture
Linne		25			silty clay loam	soft shale R	24-50	well	7.9-8.4	.10-.19	C	
Nacimiento-	65-67	60	30-50	smooth steep hills	silty clay loam	soft sediments or shale R	24-40	well	7.9-8.4	.17-.19	C	range
Linne		30			silty clay loam	soft shale R	20-36	well	7.9-8.4	.10-.19	C	

TABLE 10 (cont.)

Soil Association	Approximate Mileposts	% of Association	Slope (%)	Topographic Position	Texture: Surface	Texture: Substratum or Parent Material[1]	Soil Depth (inches)	Drainage	Soil Reaction (pH)	Available Water Capacity (inches water per inch soil)	Hydrologic Group[2]	Present Land Use[3]
San Luis Obispo County (cont.)												
Panoche-	67-69	50	0-5	alluvial fans and valleys	loam	alluvial sediments	60+	well	7.4-8.4	.10-.18	B	grain, pasture
Panhill	74-75, 77	40			silty clay loam	stratified sediments	60+	well	7.4-8.4	.16-.18	C	
Simmler-	69-74	55	-	nearly level basin areas	sandy loam	silty clay sediments	60+	somewhat poorly	6.5-7.9	.16		range
Chicote		25	-		sandy loam	silty clay sediments	60+	somewhat poorly	7.4-8.4	.10-.15	B	
Kettleman	75, 76-78 79-80	80	15-50	moderately steep to steep hills	loam	sandstone or shale R	20-40	well	6.6-8.4	.14-.18	B	range
Tierra-	76	55	2-9	gently to moderately sloping terraces	sandy loam	old alluvium	60+	moderately well	5.1-8.4	.02-.19	D	cropland, pasture
Atascadero		30		gently sloping to rolling low hills	sandy loam	soft sandstone R	12-37	well	5.6-6.0	-	B	grain, pasture
Rockland-		60	-	steep to extremely steep mountains	mostly rock outcrops	shale and sandstone	0-6	excessive	-	0-.10	D	watershed
Rough Broken Land	78-79	30	-		mostly bedrock	soft sandstone or terrace material R	0-20	excessive	-	0-.15	D	
Kern County												
Kettleman	80-85 89-92 97-102	85	15-50	mountainous upland	loam	sandstone R	20-40	well	6.6-8.4	.14-.18	B	range, oil fields
Hilmar-	85-86	50	nearly level	alluvial fan or basin rim	loamy sand	silt loam to loamy sand	60+	somewhat poorly	7.8-8.5	.08-.10	A	pasture, row crops, field crops
Mocho		30			loam	sandy loam	60+	well	7.4-8.4	.10-.21	B	
Panoche	86-89 105, 106-107	90	2-5	alluvial fan	loam	loam	60+	well	7.4-8.4	.10-.18	B	pasture, cropland
San Emigdio-	92-97	45	2-5	alluvial fan	sandy loam	sandy loam	60+	well	7.9-8.4	.10-.16	B	cropland, orchard
Hesperia	102-103	45			sandy loam	sandy loam	60+	well	6.1-8.4	.08-.16	B	pasture
Cajon-	103-105	75	nearly level	alluvial fans and plains	sand	sand	60+	somewhat excessively	7.4-8.4	.04-.10	A	cropland, pasture
Tujunda	111-112	20			loamy sand	granitic alluvium	60+	somewhat excessively	6.1-7.8	.04-.10	A	
Hesperia-	105-106 109-111	70	nearly level	alluvial plains	sandy loam	sandy loam	60+	well	6.1-8.4	.08-.16	B	range, urban
Hanford	112-124	20			sandy loam	sandy loam	60+	well	5.6-7.8	.08-.15	B	
Traver-	107-109	40	nearly level	alluvial fan	loam	loam	60+	moderately well	8.3-9.0	.12-.14	A	pasture,
Pond		45			clay loam	sandy loam	60+	moderately well	8.0-8.5	.10-.12	A	cropland

1/ Bedrock hardness - Where bedrock is fractured or soft enough to allow ripping by conventional excavation equipment, it is denoted with an R; where bedrock is too hard to be ripped, it is denoted with an H.

2/ Hydrologic Soil Groups - Hydrologic soil groups are used for estimating the runoff potential of soils on watersheds. The soils are classified on the basis of intake of water at the end of long duration storms occurring after prior wetting and opportunity for swelling and without protective effect of vegetation. The Soil Conservation Service has defined four groups based on soil properties that influence runoff:

Group A - Soils having high infiltration rates even when thoroughly wetted, consisting chiefly of deep, well to excessively drained sands and/or gravel. These soils have a high rate of water transmission and would result in a low runoff potential.
Group B - Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately coarse to medium textures. These soils have a moderate rate of water transmission.
Group C - Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soils with a layer that impedes the downward movement of water or (2) soils with moderately fine to fine textures and a slow infiltration rate. These soils have a slow rate of water transmission.
Group D - Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with a high swelling potential; (2) soils with a high permanent water table; (3) soils with a claypan or clay layer at or near the surface; and (4) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

3/ Present Land Use - This column represents the primary land use of the particular soil association at the time the county soil report was completed; 1967 for Kern County and 1968 for Santa Barbara and San Luis Obispo Counties.

5. Water Resources

a) Hydrology

i. LNG Site

The proposed site is in a coastal drainage region which lies between the east-west oriented Santa Ynez Mountains and the Santa Barbara Channel coastline. The coastline parallels the mountains at the proposed site location, as shown in figure 15. The crests of the mountains near the proposed project site are inland approximately 3 miles and range in elevation from 1,000 to 1,600 feet. Drainage areas are typically perpendicular to the coastline and range from 0.5 to 3 square miles. As a result of the steep slope and the unfavorable water retention characteristics within the watershed, stream channels are deeply incised and runoff is rapid.

The two largest streams in the site area are Canada del Cojo and Barranca Honda. Several springs exist in the drainages of these streams and contribute to streamflow.

Surface Water Hydrology

The Canada del Cojo is associated with a drainage basin of approximately 3.2 square miles. The main stem of the stream has a length of 4 miles and an average gradient of 300 feet per mile. Within the site property, the stream has steep banks up to 40 feet high. Approximately 0.5 mile upstream from the coast, the Canada del Cojo is joined by a major tributary, the Canada del Cementerio.

The Barranca Honda drains an area of approximately 2 square miles. The stream is joined by a parallel flowing tributary (Canada del Gato) approximately 0.1 mile upstream from the coast. The main stem is 2.3 miles long and has an average gradient of 325 feet per mile. The area between the Canada del Cojo and Barranca Honda drains through several gullies. No perennial flow is found in the gullies.

Runoff from the drainages occurring on the site goes directly into the Santa Barbara Channel. Because of their lack of importance to the water resources of California, these streams are not gauged, and the runoff is not known. However,

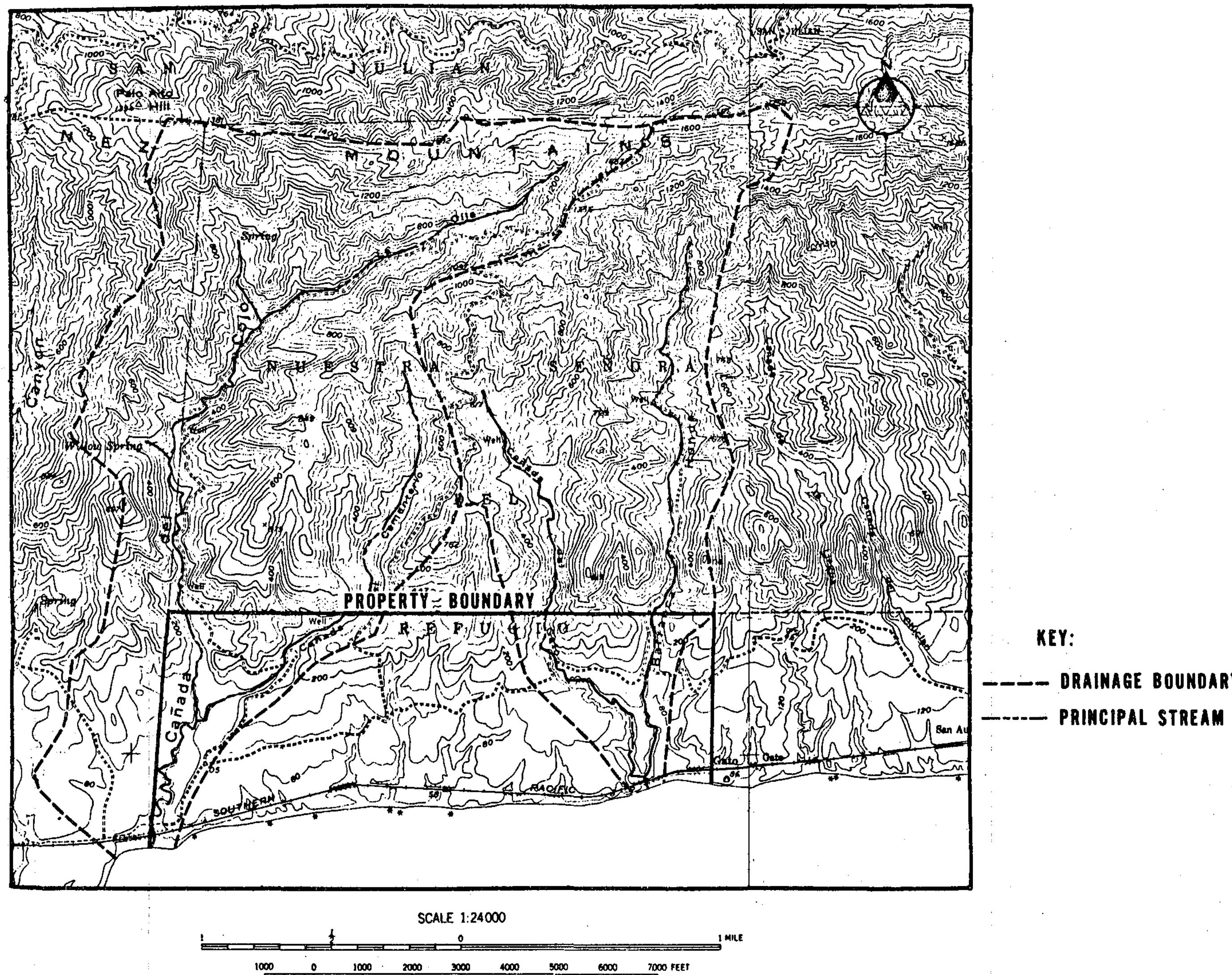


Figure 15: Drainage Map

table 11 (USGS, 1974) indicates the relationship between mean annual rainfall and runoff for Santa Barbara County. Equations derived from local area coastal drainages (USGS, 1974) for calculating peak streamflows were applied by the applicant to the Canada del Cojo and Barranca Honda. The results of these calculations are shown in table 12.

During periods of high flows, streams may be expected to scour several feet into their beds because the steep slopes of the stream channels produces high water velocities. A depth of scour in the stream bottom equal to the difference in depth between the flood flow and the normal flow is not uncommon.

Groundwater

Earth materials within the proposed LNG facilities site and the immediate vicinity consist of limited quantities of alluvium confined in the adjacent canyon with Quaternary Terrace deposits, Sisquoc Formation, and Monterey Formation rock units underlying the site and the surrounding area.

Groundwater was encountered in the alluvium in one instance at a depth of 23 feet. The transmissivity ("aquifer permeability") of the alluvium is assumed to be small. Recharge to the alluvium is probably from surface water in the Canada del Cojo, and possible seasonal variation in the groundwater level occurs.

The fracture transmissivity of the Sisquoc shale and the transmissivity of the fine-grained terrace deposits are also expected to be low. Recharge to the shale is probably from the highly fractured shales and sandstones to the north. Discharge from the fractures in the shale probably provides the recharge to the terrace deposits.

The Monterey shale is considered to be a poor aquifer. When limited quantities of groundwater are encountered within fractures or fracture zones within the Monterey Formation, the water is of such quality that it is not suitable for prevailing beneficial uses. It is thought that recharge to the formation is probably limited.

ii. Pipeline Routes

The water resources associated with the proposed pipeline route are divided into eight drainage regions (figure 16).

TABLE 11

MEAN ANNUAL RAINFALL-RUNOFF RELATION FOR SANTA BARBARA COUNTY

Precipitation (inches)	Runoff (inches)	Precipitation (inches)	Runoff (inches)
14	0.20	26	2.95
15	.30	27	3.30
16	.45	28	3.70
17	.60	29	4.10
18	.75	30	4.60
19	.95	31	5.15
20	1.15	32	5.75
21	1.40	33	6.35
22	1.65	34	7.05
23	1.95	35	7.75
24	2.25	36	8.50
25	2.60		

TABLE 12

CALCULATED PEAK STREAMFLOW

Drainage Basin Name	Area In Square Miles	Recurrence Interval Years	Calculated Peak Flow cfs
Canada del Cojo	3.16	2	111
	3.16	5	378
	3.16	10	670
	3.16	25	1,183
	3.16	50	1,672
	3.16	100	2,247
Barranca Honda	1.99	2	81
	1.99	5	276
	1.99	10	494
	1.99	25	879
	1.99	50	1,248
	1.99	100	1,686

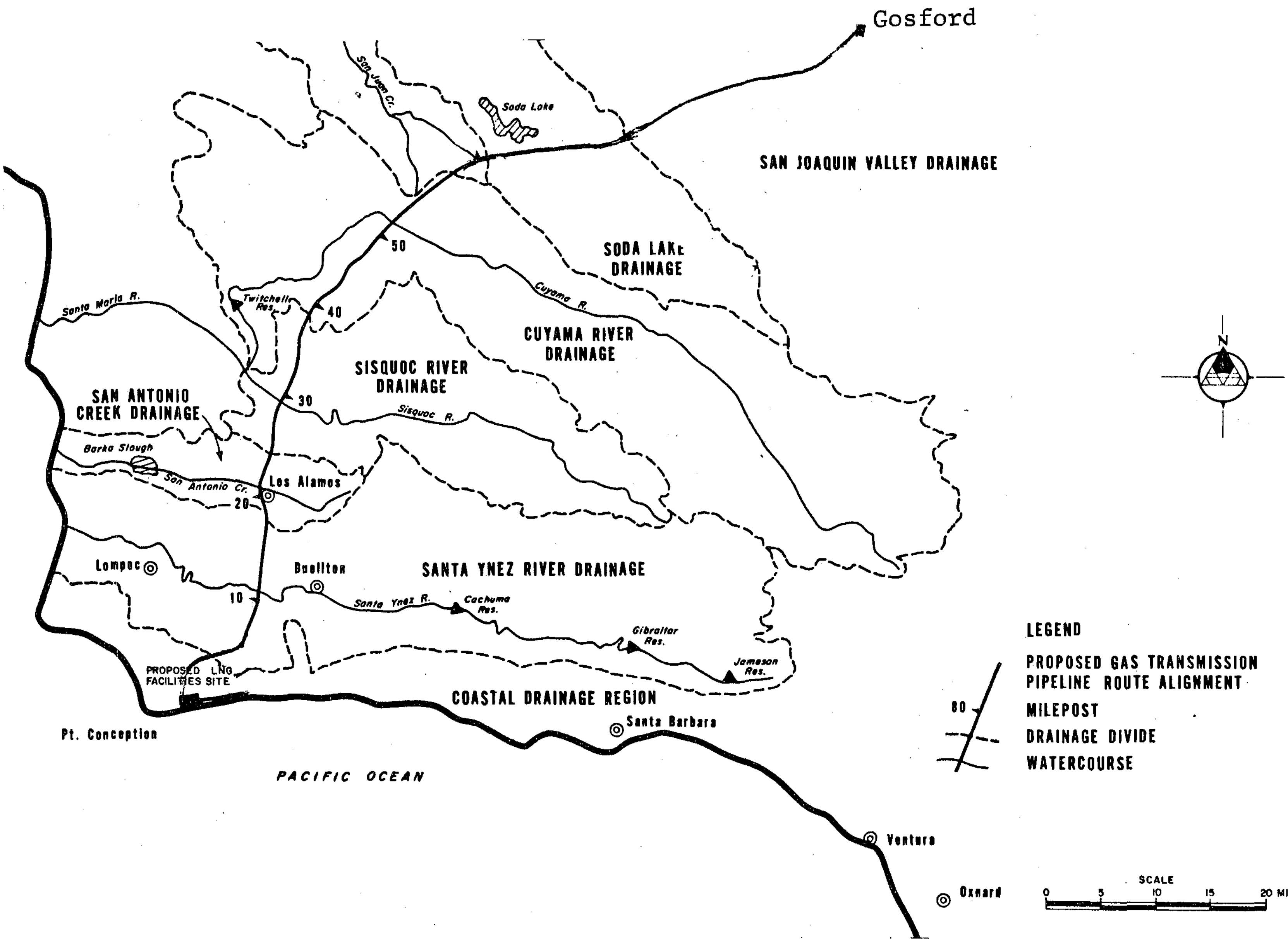


Figure 16: Drainage Regions-Point Conception Pipeline Route

From Point Conception to Gosford there are:

1) Coastal Drainage Region
2) Santa Ynez River Drainage
3) San Antonio Creek Drainage
4) Sisquoc River Drainage
5) Cuyama River Drainage
6) San Juan Creek Drainage
7) Soda Lake Drainage
8) San Joaquin Valley Drainage

Table 13 lists drainage basin information for streams which the applicant proposes to cross for the Point Conception-to-Gosford route.

Surface Water Hydrology

Coastal Drainage Region

Significant aspects of this drainage have been discussed in connection with the proposed LNG terminal.

The pipeline extends through this region for 2.7 miles. Approximately 19 miles of the proposed pipeline would cross Jalama Creek, Los Amoles Creek, El Jaro Creek and parallels Ytias Creek. The largest of the streams to be crossed in this drainage, the Santa Ynez River, has an average flow of 40 cubic feet per second (cfs) and a flow range of from 0 to 81,000 cfs. Three U.S. Bureau of Reclamation storage projects, upstream of the proposed Santa Ynez River crossing, store water for irrigation and municipal use for the Santa Barbara area.

Santa Ynez Drainage Region

The principal source of groundwater in this drainage region is the alluvium associated with the Santa Ynez River. Water withdrawn from this alluvium is used for irrigation and municipal purposes.

San Antonio Creek Drainage Region

Approximately 6 miles of the proposed pipeline would cross three tributaries of San Antonio Creek in this drainage. The most important of these tributaries flows in Howard Canyon and drains 2 square miles. The average flow rate at the proposed pipeline crossing is 1.1 cfs. During periods of high runoff (flows of 2,300 cfs have been recorded), large silt loads are possible.

TABLE 13

DRAINAGE BASIN INFORMATION

Drainage Basin Name	Approx. Total Area (square miles)	Approx. Area Above Alignment (square miles)	Milepost at Crossing	Design Storm: 6-Hour 50-Year (inches)	Approx. Maximum Elev. (feet)	Elev. at Crossing	Historical Flood on Mainstream: Date	Historical Flood on Mainstream: Discharge (cfs)
COASTAL DRAINAGE								
Jalama Creek	20.5	4	4.8	3.5	1,750	500	1/24/67	1,710
SANTA YNEZ DRAINAGE								
Los Amoles Creek	5.5	1.5	7.4	3.5	1,720	720		
El Jaro Creek	29	18	8.8	3.5	1,773	510		
Ytias Creek	5	0.50	11.3	3.5	1,760	Does Not Cross		
Canada de la Vina	2	0.20	Does Not Cross	3.5	1,680	Does Not Cross		
Santa Ynez River	950	650	15.4	3.5	6,800	240	1/25/69	81,000
Santa Rosa Creek	10	9	18.4	3.5	1,600	520		
SAN ANTONIO CREEK DRAINAGE								
Unnamed Stream	1	0.70	24.2	3.3	1,672	700		
Canada de las Calaveras	1	1	Does Not Cross	3.3	1,600	Does Not Cross		
San Antonio Creek	150	60	25.4	3.3	2,000	520	2/25/69	2,300
Howard Canyon	3	2	26.6	3.3	1,600	720		
SISQUOC RIVER DRAINAGE								
Unnamed Tributary to Cat Canyon	0.5	0.25	29.6	3.5	1,450	800		
Cat Canyon	18	7.20	30.1	3.5	2,000	710		
Long Canyon	1	0.30	31.3	3.5	1,120	780		
Olivera Canyon	1	0.80	33.0	3.5	1,050	550		
Sisquoc River	475	430	33.7	3.5	6,800	450	12/6/66	23,200
Tepusquet Creek	30	27	35.4	3.5	2,500	640		
Colson Canyon	10	10	38.6	3.5	3,100	894		
CUYAMA RIVER DRAINAGE								
Buckhorn Canyon	8	8	43.9	4.0	2,700	980		
Miranda Pine Canyon	20	19	45.5	4.0	4,100	940		
Aliso Creek	10	5	47.7	4.0	3,400	1,140		
Clear Creek	5	2	54.1	4.0	3,300	1,580		
Cuyama River	1,200	800	55.3	4.0	7,500	1,310	2/25/69	17,800
Gypsum Canyon	2	1.50	56.6	4.0	3,500	1,580		
Sycamore Creek	3	0.10	Does Not Cross	4.0	3,050	Does Not Cross		
SAN JUAN DRAINAGE								
Barrett Creek	13	5.5	61.6	4.0	3,183	2,430		
SAN JOAQUIN DRAINAGE								
Crocker Canyon	13.5	8.5	82.0		3,957	1,875		
Buena Vista Creek	80	18	93.3			575		

Groundwater occurs in the fractures of consolidated rocks, in the Paso Robles Formation, and in river alluvium. The alluvium provides water for livestock watering, irrigation in Los Alamos Valley, and the municipal water supply of the town of Los Alamos.

Sisquoc Drainage Region

This region would be crossed by approximately 14 miles of the proposed pipeline. The major stream to be crossed in this drainage, the Sisquoc River, has an average discharge of 43.2 cfs and flow occurs year-round.

Groundwater is available from the fractures of consolidated rocks and from valley floor alluvium. Water from these groundwater sources is used for irrigation and domestic purposes. Downstream of the proposed crossing, surface water is also used for irrigation.

Cuyama Drainage Region

Much of this drainage region lies in the Los Padres National Forest. The Cuyama River and six of its tributaries having drainages ranging from 2 to 20 square miles would be crossed by a 15-mile segment of the proposed pipeline.

The Cuyama River, which flows intermittently, has an average discharge of 23.7 cfs near the proposed crossing and a peak recorded flow of 17,800 cfs. Fifteen miles downstream of the Cuyama River crossing, the river flows into the Twitchell Reservoir. The Cuyama River carries considerable silt even during periods of low flow.

Groundwater is available from the fractures of consolidated rocks and from thick alluvium deposits along the Cuyama River. Alluvium groundwater is used for irrigation, and springs and wells in the higher areas underlain by consolidated rock provide all the water needed by isolated ranches.

San Juan Creek Drainage Region

Four miles of the proposed pipeline would cross this drainage. The only stream of significance, San Juan Creek, flows only after there has been substantial rainfall.

Groundwater which supplies some small-capacity wells at the higher elevations occurs in the fractures of consolidated rocks. Downstream, particularly in the Salinas Valley, both groundwater and surface water are used for irrigation, municipal, and industrial purposes.

Soda Lake Drainage Region

This region would be crossed by approximately 17.5 miles of the proposed pipeline. There are no perennial streams in the region; however, intermittent drainages would be crossed.

Groundwater in the Carrizo Plain generally occurs in the younger alluvium and in the Paso Robles Formation. At present, the only use of water in this region is groundwater for livestock and domestic purposes.

San Joaquin Drainage Region

The proposed pipeline would cross 33 miles of this drainage region. Intermittent drainages would be crossed in the Temblor Range foothills. The California Aqueduct would also be crossed.

The following is a list of the four surface water-carrying facilities crossed by the proposed pipeline route:

Facility Name	MP at Crossing	Design Flow* cfs
California Aqueduct	102.2	5,950
Outlet Canal	102.3	250
Inlet Canal	102.4	4,000
James Canal	110.7 110.8 111.3 111.7	Intermittent, unmeasured flow for agricultural purposes. No flow data available.

* Since flows vary greatly, average flow data were not available.

All facilities are concrete-lined. The California Aqueduct is the only facility used as a permanent water carrying facility. All others have intermittent flow. The Inlet Canal is used for flood control. The James Canal, which is crossed at four separate locations, is used for agricultural purposes only.

It is anticipated that the California Aqueduct and the Outlet Canal would be crossed by use of an aboveground span. The crossing would probably be made at right angles to the channels and be supported by appropriate foundation structures on each end of the span. A detailed design and construction procedures have not yet been developed.

Crossing of the Inlet Canal and the James Canal (all four locations) would most likely be made by boring under the channel and installing an appropriate casing pipe. The 34-inch diameter gas pipeline would be installed inside this casing. No detailed design or construction details have been developed to date.

Groundwater use in the San Joaquin Valley drainage basin is substantial and is used for agriculture. Well yields generally range from 500 to 1,500 gpm.

b) Physical Oceanography

The site of the proposed marine terminal and vaporization plant lies on the northern end of the Southern California Bight, approximately 3.5 miles east of Point Conception in the area of the National Ocean Survey wave measurement stations 5 and 6. (See figure 17.) The Southern California Bight is an open embayment of the Pacific Ocean extending from Point Conception to Baja, California. The coastline in this area turns abruptly at Point Conception to an east-west orientation, forming the northern end of the Santa Barbara Channel. The Santa Barbara Channel is bounded on the south by a chain of islands approximately 30 miles from the mainland.

i. Tides

On the west coast, the astronomical tide is characterized as mixed semidiurnal. For a period of approximately 10 days, one tidal cycle (duration: 25 hrs.) has two high waters and two low waters. This is followed by a 3- to 4-day period

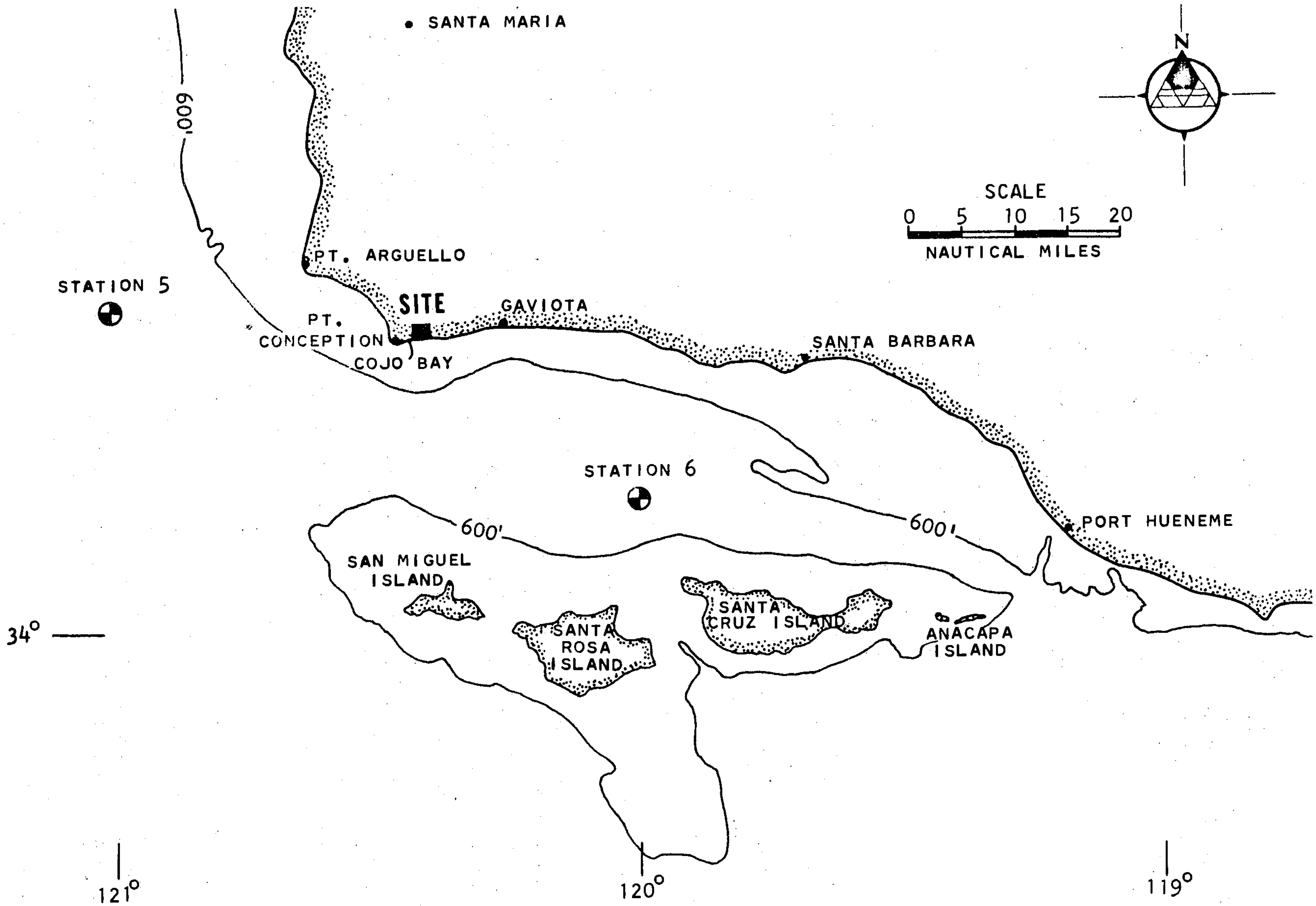


Figure 17: Wave Hindcast Stations Near Point Conception

during which the 25-hour cycle is composed of only one high and one low water.

Tide statistics for National Ocean Survey Stations 5 and 6 at Point Arguello and Gaviota, respectively, are presented in table 14.

Higher water levels than those produced by the astronomical tides acting alone can generally be expected as the result of onshore winds and/or low barometric pressure. However, sea level changes caused by seasonal weather patterns in this region are probably less than one-half foot.

ii. Waves

Comparisons of sea and swell roses for wave Station 5 (figure 18) and Station 6 (figure 19) reflect the effects of the protection from heavy northwest swells and rough sea conditions afforded the Santa Barbara Channel by the configuration of the mainland. The dominant direction of swell and sea approach at Station 5 is from the northwest, whereas the dominant direction of swell at Station 6 is from the west. In response to prevailing winds, the dominant direction of sea approach at Station 6 is from the northwest.

R. Rea Strange, using data personally compiled, data obtained from the North American Weather Consultants, and meteorological soundings from Vandenberg Air Force Base, hindcast from the year 1973 the wave regime at Point Conception. The year 1973 was selected because "complete weather records and observational data were available" and "the storm frequency was somewhat above normal, but not so far above as to rank the year as an extreme case."

In summary, Strange hindcast a "relatively high frequency of significant wave heights above 6 feet during January and February (figure 20). Waves of 4 feet and above were very common, occurring 30.8 percent of the time from November to March, and 22.1 percent of the time on an annual basis. Waves above 6 feet, however, were far less frequent during the other seasons, with no occurrences hindcast between May and September. Maximum waves were hindcast from the storm of January 18 with 14-foot, 8-second southeast seas occurring during the same 6-hour period as 15-foot, 10-second

TABLE 14

ASTRONOMICAL TIDE DATA

	Avila	Gaviota
Extreme High Water	8.0	-
Mean Higher High Water	5.2	5.3
Mean High Water	-	4.6
Mean Tide Level	2.7	2.8
Mean Sea Level	-	2.49
Mean Low Water	-	1.0
Mean Lower Low Water	0.0	0.0
Extreme Low Water	-2.5	-
Mean Range (Mean High Water - Mean Low Water)	3.5	3.6
Diurnal Range (Mean Higher High Water - Mean Lower Low Water)	5.2	5.3
Extreme Range	10.5	-

Reference: National Ocean Survey, 1974

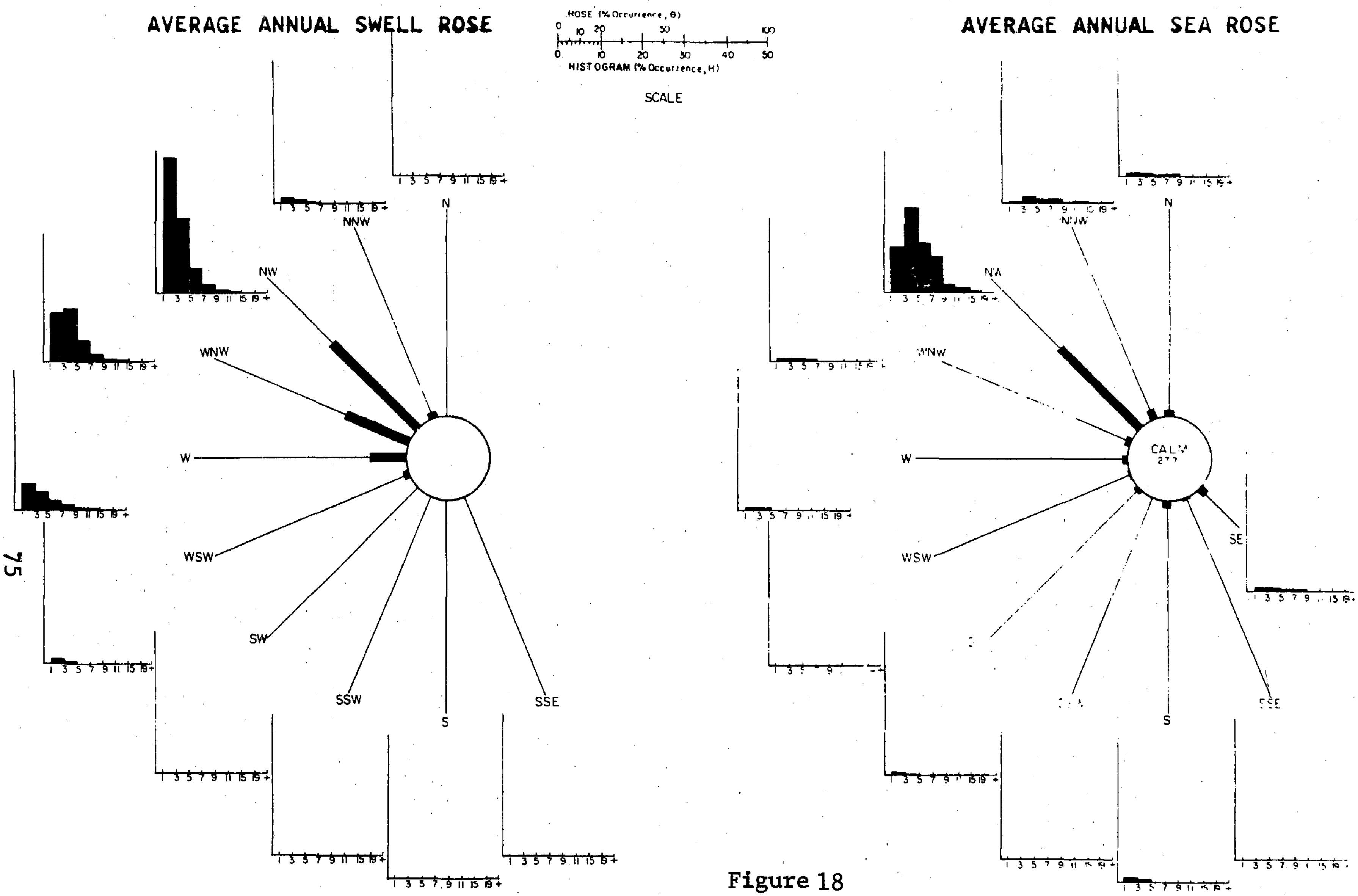
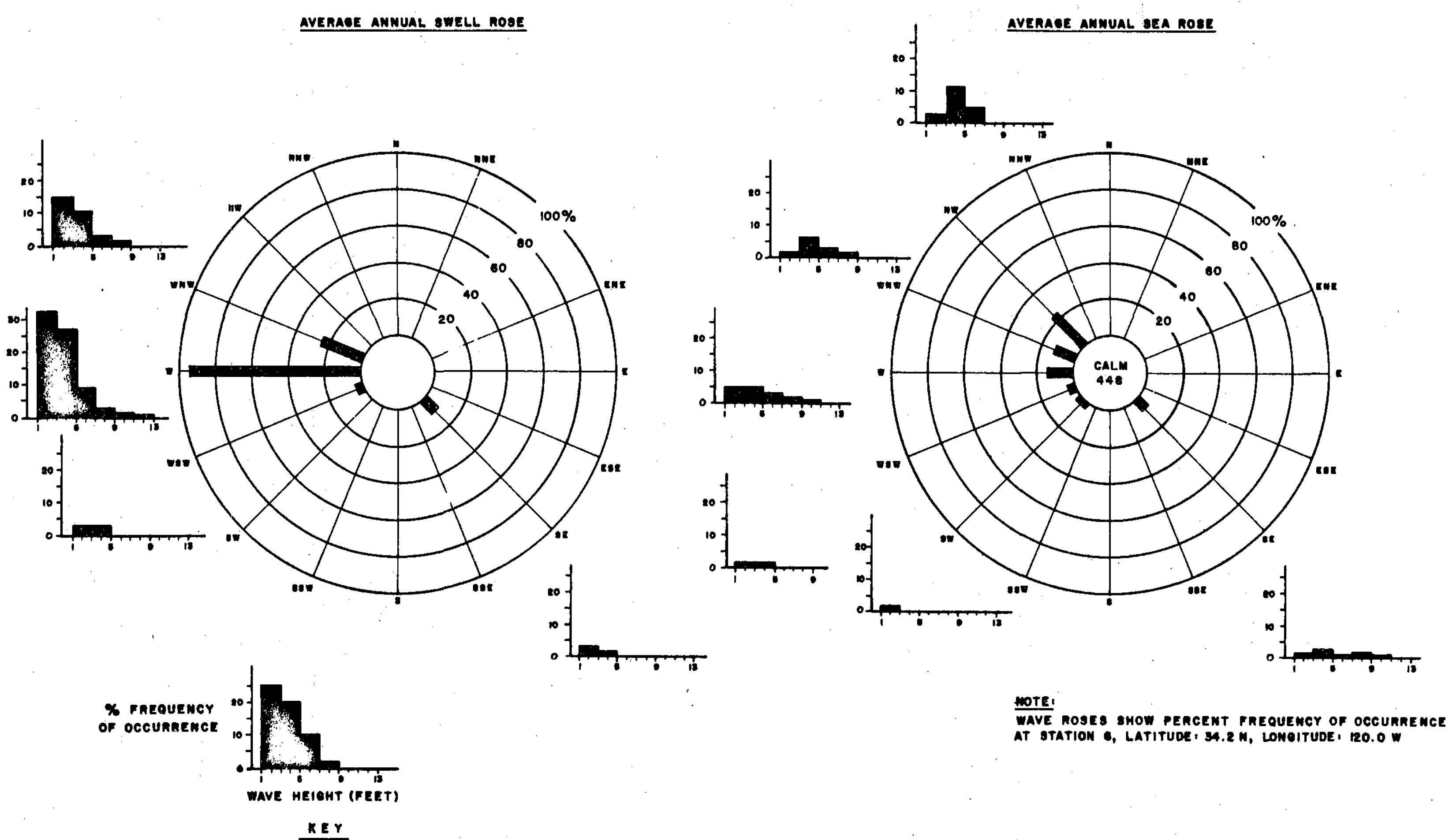


Figure 18

WAVE ROSES OFFSHORE POINT CONCEPTION STATION 5

(LAT 34.5N, LONG 121.0 W)

REFERENCE: NATIONAL MARINE CONSULTANTS, 1960



REFERENCE:
NATIONAL MARINE CONSULTANTS, 1960

Figure 19: Wave Roses-Santa Barbara Channel Station 6

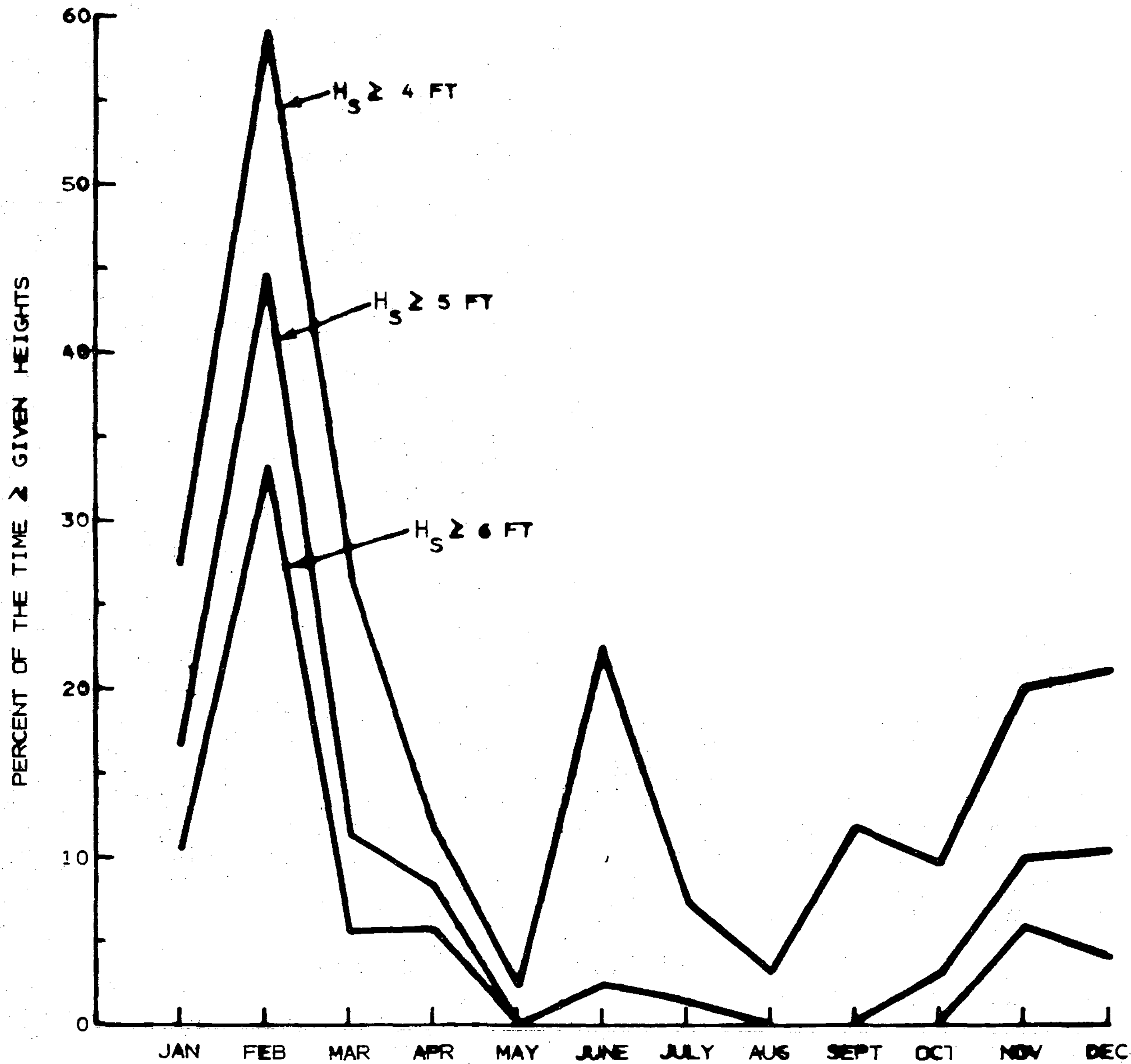


Figure 20: **Monthly frequency of selected significant wave heights Pt. Conception LNG site, 1973**

southwest swell. The highest west-southwest swell occurred during a February storm and had a significant height of 11 feet with a period of 15 seconds.

The most common significant wave periods were 6 to 8 seconds in the case of southeast seas, 13 to 15 seconds for westerly swell, and 15 to 17 seconds for southerly swell. The latter occurred frequently during late spring and early summer, when wave heights as a rule were 3 feet or less but on occasion reached 4 to 5 feet. The maximum period reported for southerly swell was 19 to 20 seconds.

Although the site receives protection from prevailing northwest seas outside Point Conception, some portion of this wave energy does reach the site through angular dispersion. This portion is computed to be about 30 percent in most cases, with the wave approach direction at the site being west-southwest. Long-period wave energy approaching from the west-northwest is also not completely blocked by the headlands. Wave refraction accounts for up to 40 percent of the deep water height at the LNG terminal depth of 50 feet for deep water approach directions as great as 290°.

A wave hindcast report was also prepared by Oceanographic Services, Inc. (OSI), which included extreme wave conditions. According to this study, two types of severe conditions affect the site of the proposed facility. Northwesters with winds of up to 50 knots have produced deep water swell heights of 25 feet with a period of 14 seconds. Wind directions are between 270° and 290°. Sea waves due to a limited fetch of 1 to 2 miles are limited to 5 feet with a period of 4 seconds. Southeasters can generate winds in the site vicinity of 70 to 80 knots with gusts over 100 knots. Sea heights during a severe storm have been in the 20- to 25-foot range with periods of 10 to 11 seconds. Deep water swell from the southwest to west directions has had wave values between 20 and 25 feet with periods from 10 to 13 seconds.

OSI estimates for 100-year waves indicate that for northwesters, sea wave heights would not exceed 6 feet and swells would be in the 27-foot range. For southeasters, the 100-year sea wave height is 25 feet, while the swell is approximately the same as the northwester.

Southern Hemisphere swell, which accoridng to OSI continues to plague those contemplating offshore operations in the North Pacific area, has not been studied at the proposed site *per se*. However, the Port Hueneme site, which has an exposure nearly identical to the proposed site, has been studied (OSI, 1975). The average frequency of occurrence of swell waves with a significant height of 2.2 feet or greater and periods from 14 to 25 seconds are 3 percent for both July and August.

Because of the potential effects of the wave regime on the safe and reliable operation of LNG tankers in the site vicinity, considerable attention has been given the subject. However, due to the lack of historically acquired data at the site, it has been necessary for the most part to extrapolate or hindcast site wave conditions. Consequently, some controversy has existed regarding how accurately the results of these studies have reflected actual site wave conditions.

In an effort to obtain a workable range of conditions, Arthur D. Little compared several significant wave studies, including those prepared by OSI and R.R. Strange. This comparison relative to the percent frequency of waves off the California coast is presented in table 15. From the comparison, it was concluded that "OSI's hindcast data for the site falls slightly outside of and lower than this distribution of estimates, while the estimate by Strange represents an upper bound." Little went on to say that "In any event on an annual basis, nobody estimated that significant wave height greater than 6 feet would occur as much as 5.5 percent of the time."

As part of an ongoing survey which began in December 1977, Tetra Tech, Inc. prepared a report summarizing the result of field measurements of wind and wave conditions in the vicinity of Point Conception for the period of time between December 1977 and April 1978. The measurement locations are shown in figure 21. The spar buoy is at the location of the proposed berth.

TABLE 15

PERCENT FREQUENCY OF WAVES OFF CALIFORNIA COAST

	Deep Water Station #5[1] Sea/Swell > 2 Meters		Pt. Conception Vicinity[2] Sea/Swell > 6 Feet 0-290°		OSI[3] Wave Height > 6 ft.	Strange[4] Wave Height ≥ 6 ft.
	All Directions	0-290°	West (Sq. #7)	South (Sq. #8)		
January	11.3	5.8	10.8	7.5	1.6	10.5
February	12.0	4.8	13.1	8.6	2.2	33.0
March	24.3	4.8	6.0	4.0	1.6	5.5
April	26.9	1.9	3.1	1.3	2.5	5.5
May	43.0	1.0	0.9	0.5	0.8	0.0
June	42.0	1.0	0.7	0.3	0.0	0.0
July	24.6	0.1	0.1	0.0	0.0	0.0
August	20.0	1.1	1.1	0.2	0.0	0.0
September	10.0	0.0	0.0	0.0	0.0	0.0
October	7.0	0.1	0.5	0.1	0.0	< 0.5
November	10.3	3.9	9.1	2.2	0.4	5.5
December	9.7	4.7	12.2	9.4	1.2	4.0
Annual Average	20.1	2.4	4.8	2.8	0.9	5.4

Sources:

1. California DNOD, Deepwater Wave Statistics for the California Coast, unpublished, 1977.
2. Naval Weather Service, Climatological Study of the Southern California Operating Area, March 1971, as modified by DNOD directional information (see text).
3. OSI, Point Conception Hindcast, February 1977, Table 3
4. R.R. Strange, Hindcast of Wind and Wave Conditions at the Proposed LNG Site, Near Point Conception, California, October 1977, Figure 9.

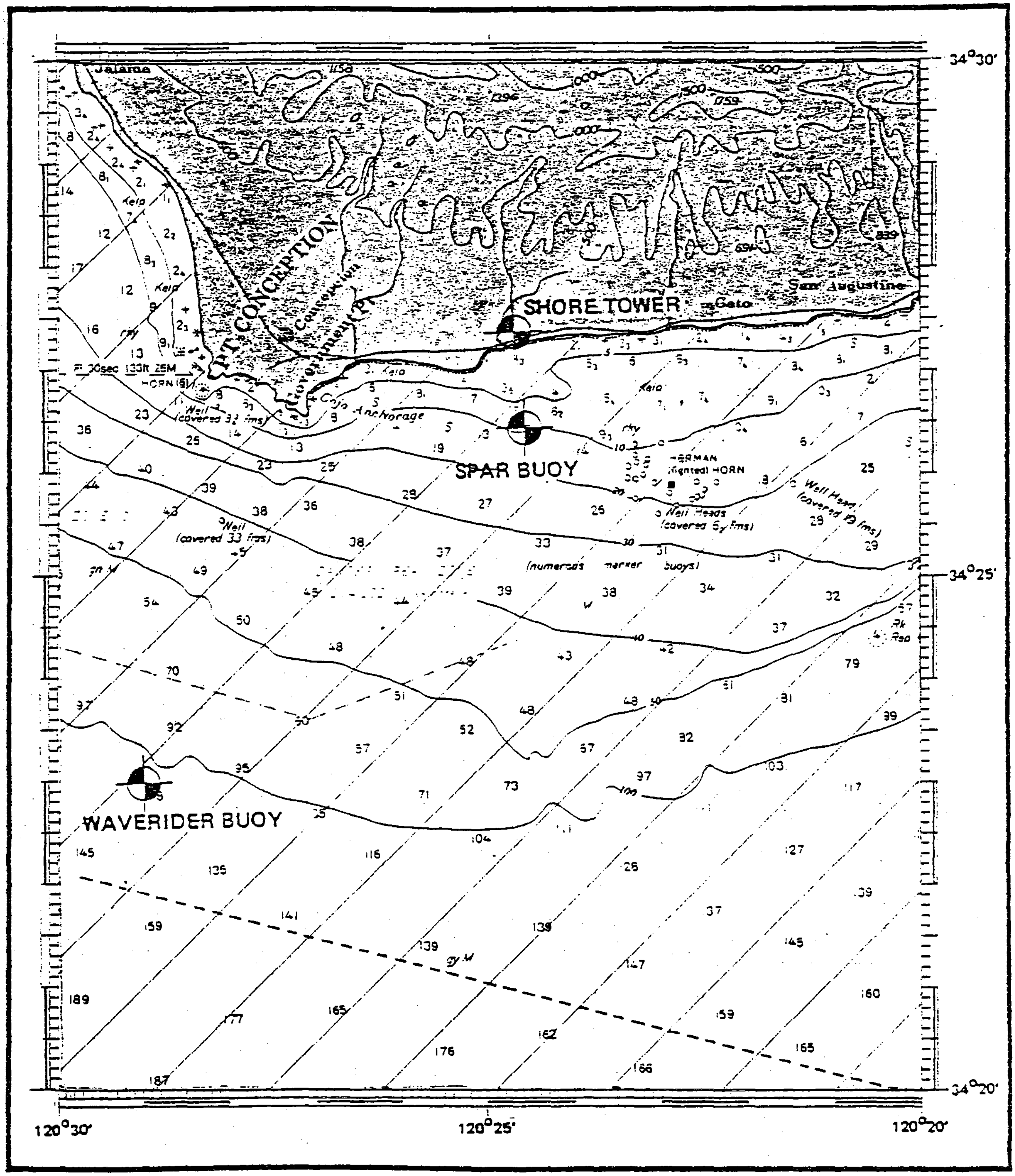


Figure 21: Measurement Locations

Table 16 provides a comparison of Strange's hindcast figures and Tetra Tech's spar buoy data relative to the percent frequency of wave heights equal to or greater than 6 feet.

TABLE 16

PERCENT FREQUENCY OF WAVES AT PROPOSED POINT CONCEPTION BERTH

	Strange Wave Height ≥ 6 feet	Tetra Tech Wave Height ≥ 6 feet	
December	4.0	2.8	(Data Recovery Rate = 60%)
January	10.5	32.0	(Data Recovery Rate = 20%)
February	33.0	47.1	(Data Recovery Rate = 78%)
March	5.5	35.5	(Data Recovery Rate = 70%)
April	5.5	5.2	(Data Recovery Rate = 64%)

It should be noted that the Tetra Tech measurements were made when weather conditions were considered to be unusually severe.

iii. Currents

A prime influence of the water movement offshore of the west coast is the California Current. This current transports approximately 42 million cubic feet per second of relatively cool, low-salinity water southward.

South of Point Conception, a large, counterclockwise grye (circular motion) forms between the mainland and the California Current. The inshore side of this grye, the Southern California Countercurrent (figure 22), transports relatively warm saline water northward through the Channel Islands. This northwesterly countercurrent off Point Conception is best developed in the period from November through January.

In the spring and early summer, strong northerly and northwesterly winds push the California Current offshore. This permits upwelling which supplies nutrient-rich water to the coastal waters.

Speed calculations of currents past Point Conception yield an average 0.3 knots northerly flow from October through January.

The flow of water in the nearshore region is nearly parallel to the coastline. The predominant directions observed varied between 240° and 330° (to the west-northwest) and between 60° and 150° (to the east-southeast). The maximum current speed recorded was less than 1.1 knots, and a large percentage of the speeds less than 0.2 knot. The annual net longshore component of wave power in this area is to the east. The littoral transport of sediment in the nearshore zone is predominantly to the east throughout the year.

iv. Tsunamis

Since 1946, tsunamis generated at distant locations have been recorded at several stations along the west coast. Major tsunami heights for several stations near the Santa Barbara Channel and Point Conception are presented in table 17.

Flood elevations with a frequency of once every 100 years and once every 500 years caused by tsunamis have been calculated for the Santa Barbara area to be 6.2 feet and 12.6 feet,

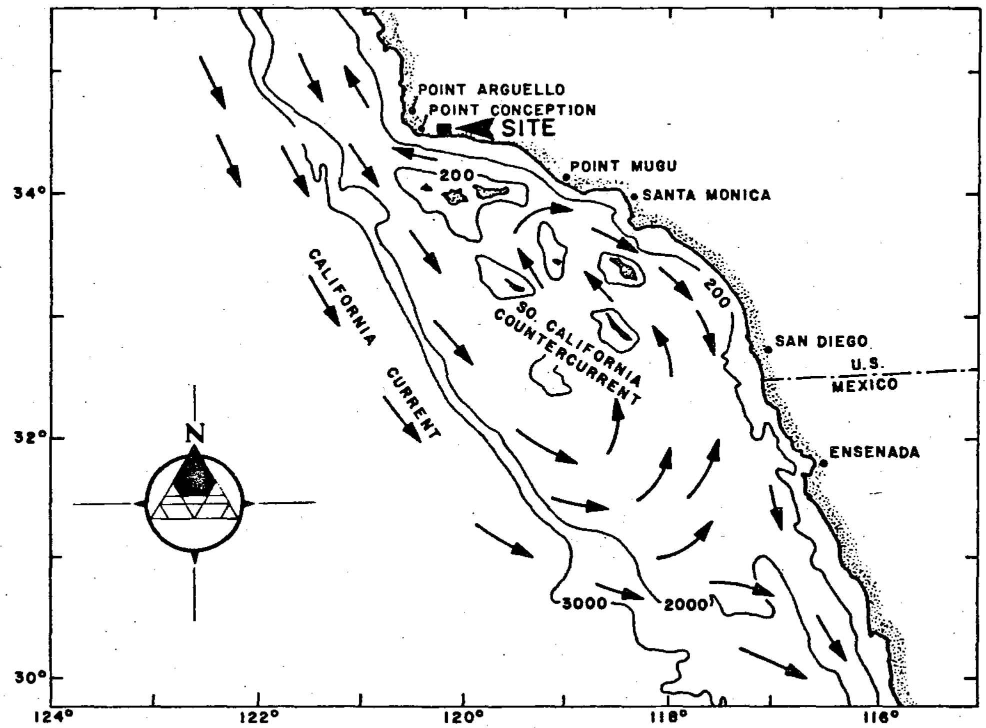
TABLE 17

MAJOR TSUNAMI HEIGHTS AT SELECTED STATIONS

Date of Earthquake	4-1-46	11-4-52	3-9-57	5-23-60	3-28-64
Location	Aleutians	Kamchatka	Aleutians	Chile	Alaska
Magnitude	7.4	8.3	8.0	8.5	8.4
Recording Station					
Avila Beach	8.5	9.5*	3.5	-0-	10.4*
Rincon Island					5.9*
Port Hueneme	5.5	4.7	3.5	8.8	-0-
Santa Monica	-0-	3.6	3.0	9.1	6.5

* Gauge limit exceeded

References: Berkman and Symons, 1964; Spaeth and Berkman, 1967.



ARROWS INDICATE APPROXIMATE DIRECTION OF FLOW

DEPTH SHOWN IN METERS

SCALE

0 100 200

KILOMETERS

REFERENCE: JONES, 1971

Figure 22: Surface Circulation(0-100m)
Southern California Bight

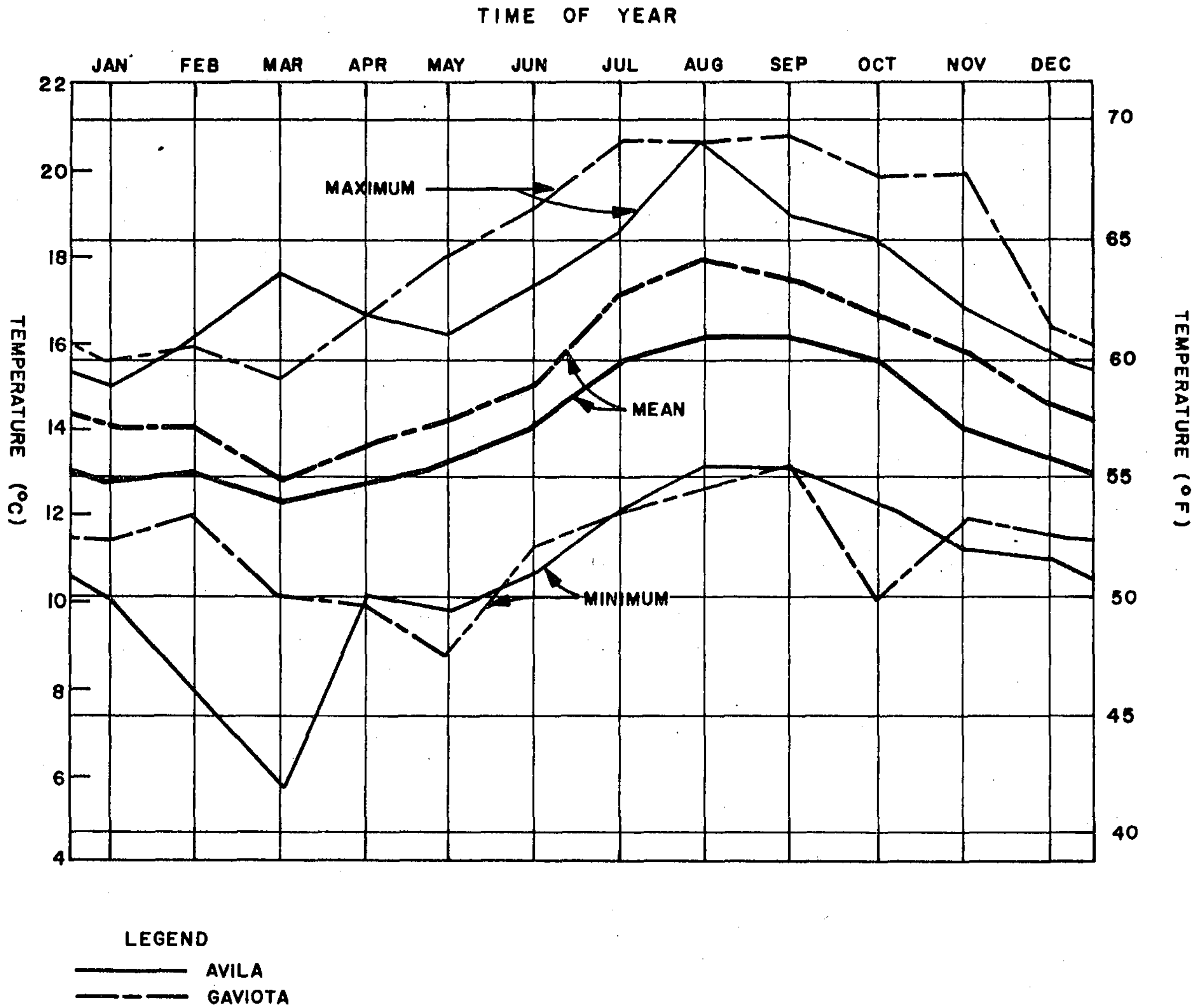
respectively, above mean sea level. The foregoing data apply to the proposed marine terminal in that they provide an order of magnitude of possible tsunami occurrence and inundation in the region.

v. Temperature

Temperatures of the coastal waters in the northern part of the Santa Barbara Channel are influenced by the general circulation patterns of the different water masses in the region as well as by seasonal climatic changes, fluctuations in solar heating and nocturnal radiation, and the mixing effect of wind and waves.

The lowest annual surface water temperatures are the result of the offshore upwelling of deep, cold water. These temperatures occur during the months of February through May. Warmer climatic conditions and the strengthening Southern California Countercurrent produce the highest surface water temperatures from July through October.

Surface water temperatures measured in the surf zone between 1956 and 1968 at both Avila and Gaviota are given in figure 23. Seasonal variations in temperatures of the coastal water adjacent to the site, which are similar in magnitude to those recorded at Avila and Gaviota, can be expected. The coldest water temperatures are expected to occur during the months of January to May, with small vertical and horizontal temperature gradients. A thermocline structure can be expected during the warm months of July through October. Consequently, summer difference between surface and bottom vary significantly. On occasion, this difference may reach as much as 6°F. and frequently attains 4°F. The vertical distribution of median seasonal temperatures in the vicinity of the proposed seawater vaporizer return outfall is provided in table 18.



REFERENCE: MARINE ADVISERS, 1971

Figure 23: Surf Temperature at Gaviota and Avila,1956-1968

TABLE 18

MEDIAN SEASONAL TEMPERATURES AT STATION 3 1/

Depth from MLLW	Winter	Summer
"Surface" (-19 ft.)	54.6°F.	64°F.
"Mid-depth" (-37 ft.)	54.4°F.	63.5°F.
Bottom (-55 ft.)	54.3°F.	62.5°F.
T (Surface Bottom)	0.3°F.	1.5°F.

vi. Transparency 2/

The transparency of the nearshore waters in the vicinity is affected by wave action, runoff, currents, upwelling, and biological activity.

Mean transparencies of the coastal waters in the Southern California Bight ranged from less than 20 feet to greater than 60 feet during the late 1950's. Observed transparency values indicated a decreased clarity in more shallow waters. Increased stream discharges tend to decrease the transparency of the nearshore waters during periods of heavy rainfall.

c) Chemical Oceanography

i. Salinity

Fluctuations in salinity along the inshore regions can result from regional circulation and mixing processes, upwelling of deep ocean waters, runoff from adjacent land, and precipitation and evaporation.

1/ R.C.Y. Koh, "Analysis of In-Situ Ocean Temperature and Current Data." October 26, 1977.

2/ The "clearness" of the water and, thus, an indication of the ability of sunlight (required for photosynthesis) to penetrate the upper portion of the water column.

Salinity in the general vicinity of Point Conception decreases with increasing distance offshore and increases with depth. Surface salinities measured at Avila (figure 24) indicate the seasonal variation of salt concentration in nearshore waters. Salinity minima are typically recorded in winter when precipitation and runoff are high and evaporation is low.

ii. Dissolved Oxygen

Dissolved oxygen (DO) levels in the water column are influenced by 1) the oxygen mixing with open ocean water, 2) rates of diffusion across the air-water interface, 3) rates of oxygen consumption and production by living organisms, and 4) absorption and generation rates associated with other chemical reactions.

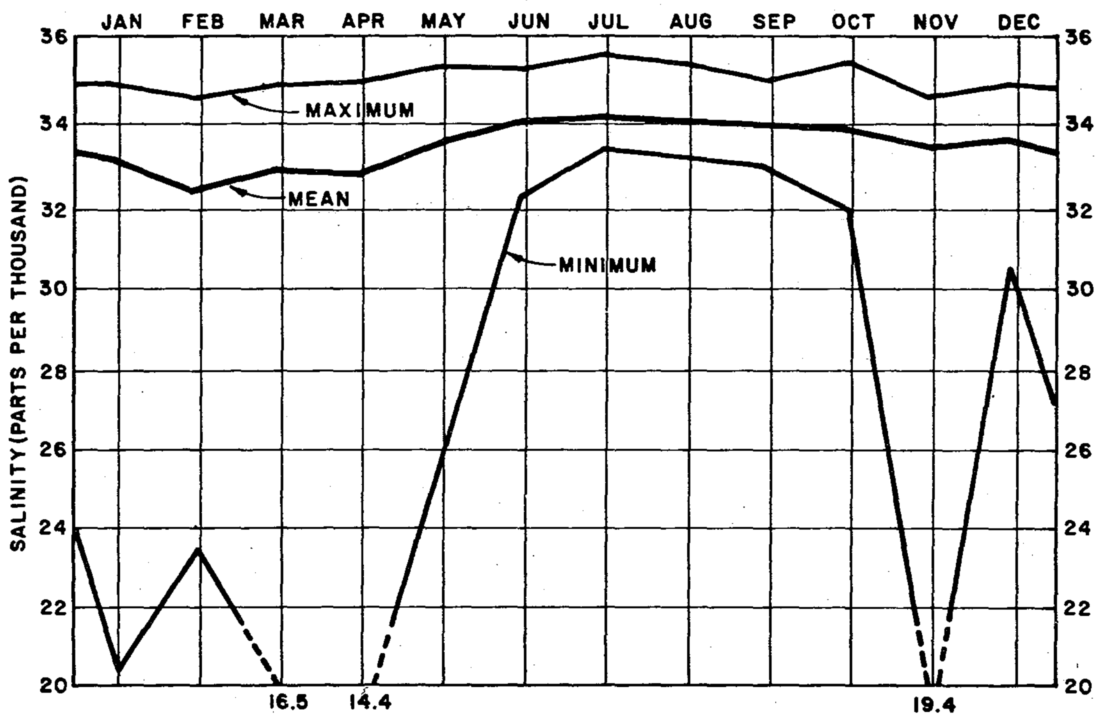
Surface DO concentrations between Point Conception and Santa Barbara (measured between 1957 and 1959) ranged from 3.8 to 15.2 milligrams per liter. The DO was found to be lowest in winter and highest in late spring and summer.

iii. pH and Nutrients

An average pH of 8.2 was measured in coastal waters adjacent to the proposed plant site from 1957 to 1959.

Concentrations of the nutrient elements nitrogen, phosphorus, and silicon are closely linked to biological productivity in the marine environment. In the upper layers of the water column, where the penetration of light is good and biological activity is high, nutrient concentrations are almost continually being diminished.

Nitrogen, phosphorus, and silicon were all observed to be in greatest abundance in the surface coastal water in the Point Conception region between April and June. This is attributed to upwelling.



REFERENCE: MARINE ADVISERS, 1971

Figure 24: Surface Salinity at Avila, 1956-1968

6. Vegetation

a) Terrestrial Vegetation

The distribution of vegetation in south-central California is governed by a complexity of historical and environmental conditions. Maritime influences moderate temperatures and produce frequent summer fogs along the coast, while the Transverse and Coast Ranges serve as a barrier between the moist coast and semi-arid interior. Superimposed on these regional factors are more local conditions affecting vegetation, such as soil variety, fire incidence, grazing history, topographic gradients, and various disturbances. All of these factors have interacted to produce an intricate mosaic of plant communities characteristic of the region.

i. LNG Site

Five different vegetational communities--coastal strand, coastal bluff, coastal sage, riparian woodland, and valley grassland--occur on the proposed LNG plant site and associated beach area, as shown in figure 25. A sixth community, oak woodland, occurs nearby off the site. Valley grassland, or grassland mixed with components from other communities, dominates the site. The remaining vegetation is mostly coastal sage scrub and riparian woodland.

The coastal strand community is restricted at the site because the beach is narrow and waveswept at high tide. The wider portions of the beach support colonies of sand verbena, silver beachweed, saltbush, and sea rocket. Strand species must adapt to salt spray, burial by wind-blown sand, low soil fertility, increased transpiration, a quickly receeding water table, and the exposure of roots to the atmosphere, so these communities are generally sparsely vegetated.

The coastal bluff community is found on steep, eroding cliffs and in ravines and canyon mouths adjacent to the coast. The plants found here are opportunistic species which can colonize unstable, eroding substrate and tolerate salt spray and wind. This vegetation is a soil-related variation of coastal sage. Bush sunflower, a minor species in coastal sage, is a dominant of the bluff community, along with sage, coyotebrush, and wild rye. Seablite is the most common cliff species.

KEY

SYMBOL	VEGETATION
X_s	COASTAL STRAND
S_b	COASTAL BLUFF
S_bH	COASTAL BLUFF AND HERBS
SH	COASTAL SAGE SCRUB AND HERBS, ALSO grassland SIGNIFICANTLY INVADED (MORE THAN 20% COVER) BY COASTAL SAGE SCRUB
H	valley grassland
W	OAK WOODLAND

SYMBOL	VEGETATION
WB	OAK WOODLAND WITH COASTAL SAGE SCRUB UNDERSTORY
WH	OAK WOODLAND WITH GRASSLAND UNDERSTORY
W_r	RIPARIAN WOODLAND
X	BARREN. FOLLOWS VEGETATION SYMBOL WHERE VEGETATION PREDOMINATES, PRECEDES SYMBOL WHERE THE BARREN CONDITION PREDOMINATES. AREA TYPE INCLUDES BULLDOZED, ERODED, AND OVERGRAZED LAND.
S	COASTAL SAGE SCRUB

Figure 25: Vegetation Map - Point Conception LNG Plant Site

Coastal sage vegetation occurs all along the central and southern California coast, dominating large areas below 1,000 feet, particularly in the south. In San Luis Obispo and Santa Barbara Counties, this community often forms complex mixtures with valley grassland and chaparral. Coastal sage is a semi-woody, deciduous vegetation dominated by California sage, goldenbush, coyotebrush, purple sage, and wild buckwheats. An understory of herbaceous plants is usually prominent, and on the terrace at Point Conception, open mixtures of coastal sage-grassland are second in dominance only to valley grassland communities.

Riparian woodland occurs along Canada del Cojo and associated drainages. It is dominated by plants requiring abundant moisture throughout the growing season, many of which have taproots extending into the water table and enjoying a constant water supply. Arroyo willow, a tall shrub in thick stands, dominates Canada del Cojo. Elderberry is common on the upper banks and sycamore, black cottonwood, white alder, and coast live oak are scattered along the stream bottom. California box elder, a central California species seldom found in coastal Santa Barbara County, has been reported in Canada del Cojo.

Valley grassland is an important California vegetation type, contributing 80 percent of the native range forage for domestic livestock. It is distributed around the central valley, growing on rolling plains and foothills adjoining the cultivated bottomlands. In a few areas, including western Santa Barbara County, this grassland occurs along the coast. Although this vegetation is very diverse, containing hundreds of species, several species of annual grasses and forbs are by far the most dominant and widespread. Chief among these are ripgut brome, wild oat, soft chess, red brome, filaree, foxtail, and bur clover. Other clovers, perennial grasses, and shrubs are generally present in varying amounts. Most of these plants are introduced species that have achieved dominance during the past 200 years of California's settled history. The original vegetation in these areas was evidently perennial bunchgrass, which is still locally abundant along the coast. Native bunchgrasses such as California oatgrass, melic grass, purple needlegrass, and bluegrass also remain as minor components of valley grassland and open shrub communities.

In areas of intense grazing, less desirable nonforage species, such as shrubs, vinegar weed, and dove weed, develop extensive stands. Mixtures of shrubland and woodland plants often occur in various densities with grassland.

The annual grasses sprout quickly with the rains of late fall and winter, briefly turning the hills bright green. They mature and dry by late spring, giving the southern California landscape its characteristic golden brown color.

ii. Pipeline Route

The first 35 miles of the pipeline route, between Point Conception and Tepusquet Canyon, would traverse the Transverse Ranges and valleys where coastal sage, grassland, and oak woodland communities predominate. The first two communities have already been described.

Oak woodland tends to occur on the cooler, moister north slopes, although it can be found on nearly all exposures and substrates. It occasionally forms a closed-canopy forest. The most widespread formation occurs in the Santa Ynez Mountains and the Purisima Hills and is composed of open stands of coast live oak and toyon, with a well-developed undergrowth of coastal sage scrub and/or herbland. Valley oak occurs in open stands along river terraces and in the contiguous small valleys and hills of the Santa Ynez, Los Alamos, and Santa Maria Valleys. In canyons and on the lower north-facing slopes of the San Rafael Mountains are found dense formations of coast live oak, toyon, and California bay with scattered chaparral species. In the dry, south slope saddles below the ridges of these mountains, a few pure stands of blue oak may be found. Big-leaf maple, white alder, sycamore, box elder, cottonwood, and willow are the most common trees found in the riparian (streambank) areas. Willow thickets are common along lowland creeks and river channel borders. River channelization and agricultural development of floodplains have substantially reduced the extent of riparian woodlands. This route segment would cross approximately 16 miles of coastal sage communities (actually a mix of sage and grassland species), 7 miles of agricultural land, 7 miles of valley grassland, and 5 miles of oak woodland.

The next 26 miles of proposed pipeline would cross the Coast Ranges, where chaparral and coastal sage communities dominate the landscape. Over 10 miles of this section would cross chaparral, while 6 miles of coastal sage mixed with chaparral shrubs, 8 miles of valley grassland, and about a mile each of oak savanna and cultivated land would be crossed. Chaparral grows on higher elevations of the area to be traversed by the proposed pipeline. It is composed of evergreen, hard-leaved (sclerophyllous) shrubs growing in dense thickets. Chamise, ceanothus, manzanita, and scrub oaks are the principal species. Chaparral is best developed along the portion of route crossing the Sierra Madre Mountains. In the La Panza-Caliente range area, chaparral is thinner and heavily mixed with valley grassland.

The remaining 50 miles of pipeline would traverse the more arid plains and valleys of central California where valley grassland and San Joaquin saltbush communities dominate the natural vegetation and large areas are cultivated.

Valley grassland in this region varies from that found along the coast. Redstem filaree, Arabian grass, red brome, and foxtail grasses are the common annuals. Saltbush is an abundant co-dominant with these species on the plains and low hills. Other common small shrubs found include ephedra, bladderpod, and cheeseweed. These grasslands are more sparsely vegetated than the coastal form of the community.

San Joaquin saltbush vegetation covers arid hills and plains with alkaline soils, especially poorly drained sinks. Salt tolerant shrubs and annual grass growing in open associations characterize this community.

Approximately 18 miles of this latter route segment would cross saltbush vegetation. Twelve miles of cultivated land and 20 miles of variable open disturbed land, consisting of thin grassland and scrub or denuded areas in oilfields, would be crossed.

Table 19 summarizes the amount of each vegetation community type which would be crossed by the proposed pipeline.

TABLE 19

APPROXIMATE DISTANCE IN EACH VEGETATIONAL COMMUNITY THAT WOULD BE TRAVERSED BY THE PROPOSED ROUTE
(Distance in Miles)

Plant Community	Existing ROW	New ROW	Total
Oak woodland 1/	0	6	6
Chaparral	0	5	5
Coastal sage	1	26	27
San Joaquin saltbush	0	18	18
Valley grassland	.5	14.5	15
Agricultural	7	15	22
Disturbed/open	1	19	20
TOTAL	9.5	103.5	113

1/ Includes short distances of riparian woodland and north coast hardwoods.

iii) Threatened or Endangered Species

The U.S. Fish and Wildlife Service has published lists of native plants proposed for threatened or endangered status, including some from California. The California Native Plant Society has devised a more extensive and locally researched list of the state's rare and endangered plants warranting special protection. Plants from these two lists which might occur near the proposed pipeline route and LNG site are shown in appendix N.

The California list contains many species which are rare but widespread enough so that potential for extirpation is low (status R_1). The staff interprets this as meaning that these plants are not currently threatened or endangered, so they were not included in appendix N unless they also appeared on one of the Federal lists. Rare plants of more limited distribution (status R_2) were included in the appendix because destruction of local groups of these plants could pose a threat to the species population vigor. Plants given an E status by either authority are thought to be in danger of extinction over all or a significant part of their range.

b) Aquatic Vegetation

i. Marine

Phytoplankton, an important component of marine vegetation inhabiting surface waters of the sea, are discussed together with zooplankton in section 7(b)i.

Plants of the intertidal zone along the coast require solid substrate to maintain their hold against wave action and are essentially confined to rock outcrops. Rocky substrates are limited in the site area, and intertidal plant communities are not well-developed there. Two rock reefs, located several hundred feet east of the proposed pier location, support limited intertidal communities. Small green algae and various brown rockweeds inhabit the upper zones, while mid and lower intertidal areas are dominated by several species of green and red algae, such as sea lettuce, Enteromorpha, Porphyra, Gigartina, and coralline algae.

Subtidal vegetation is rarely or never exposed to the atmosphere, but is still subject to wave and swell action, temperature changes, and is particularly sensitive to light-reducing increases in turbidity. Transects of subtidal communities are schematically illustrated in figures 26, 27, and 28.

The upper subtidal region, down to about 10 feet below sea level, is dominated by eelgrass, a flowering plant. Various species of brown and red algae dominate lower zones to the lower limit of light penetration at about 100 feet. The most productive benthic vegetation are the kelp beds, best developed on rocky substrate between 30- and 50-foot depths. Kelp beds are forests of large brown algae (Macrocystis sp.) anchored to the rock by large "holdfasts" and growing to the surface, where the beds are seen from shore as a wide brown stripe paralleling the coast. These plants provide food and habitat for a wide variety of invertebrate and vertebrate animals. They probably inhibit the growth of associated algae by shading and reproduce best when storms or commercial harvesting eliminate the upper canopy, allowing light to reach the bottom. Kelp bed densities in the vicinity of Point Conception are illustrated in figure 29.

Kelp has been harvested commercially for years for the extraction of algin, used as a food stabilizer and in preparation of laboratory media. Kelp bed 32 is partially within the marine terminal area of the site. It is one of the most productive beds in California, accounting for 10 percent of the state's harvest in some years. According to Kelco Company, the kelp offshore Point Conception is among the most vigorous in southern California, growing to larger size and living longer than elsewhere in the region. Kelp has usually been harvested three times per year in this area.

ii. Freshwater

Only small amounts of freshwater aquatic vegetation are found in the proposed project area. Freshwater aquatic plants such as filamentous algae, cattail, horsetail, sedge, and bulrush may be found along some of the moister watercourses along the pipeline route in the Transverse and Coastal Ranges.

In the San Joaquin Valley canals, drains, sloughs, and irrigation systems support fresh- to brackish-water wetland communities that often serve as valuable wildlife habitat. Tamarisk, cyperus, rush, spike-rush, cattail, and various weedy herbs characterize these areas. Willow and cottonwood may grow along the more stable watercourses.

Salty alkaline flats which are wet in winter also occur in this region. The largest area of flats is Soda Lake Basin, about 2 miles north of the proposed route which contains species

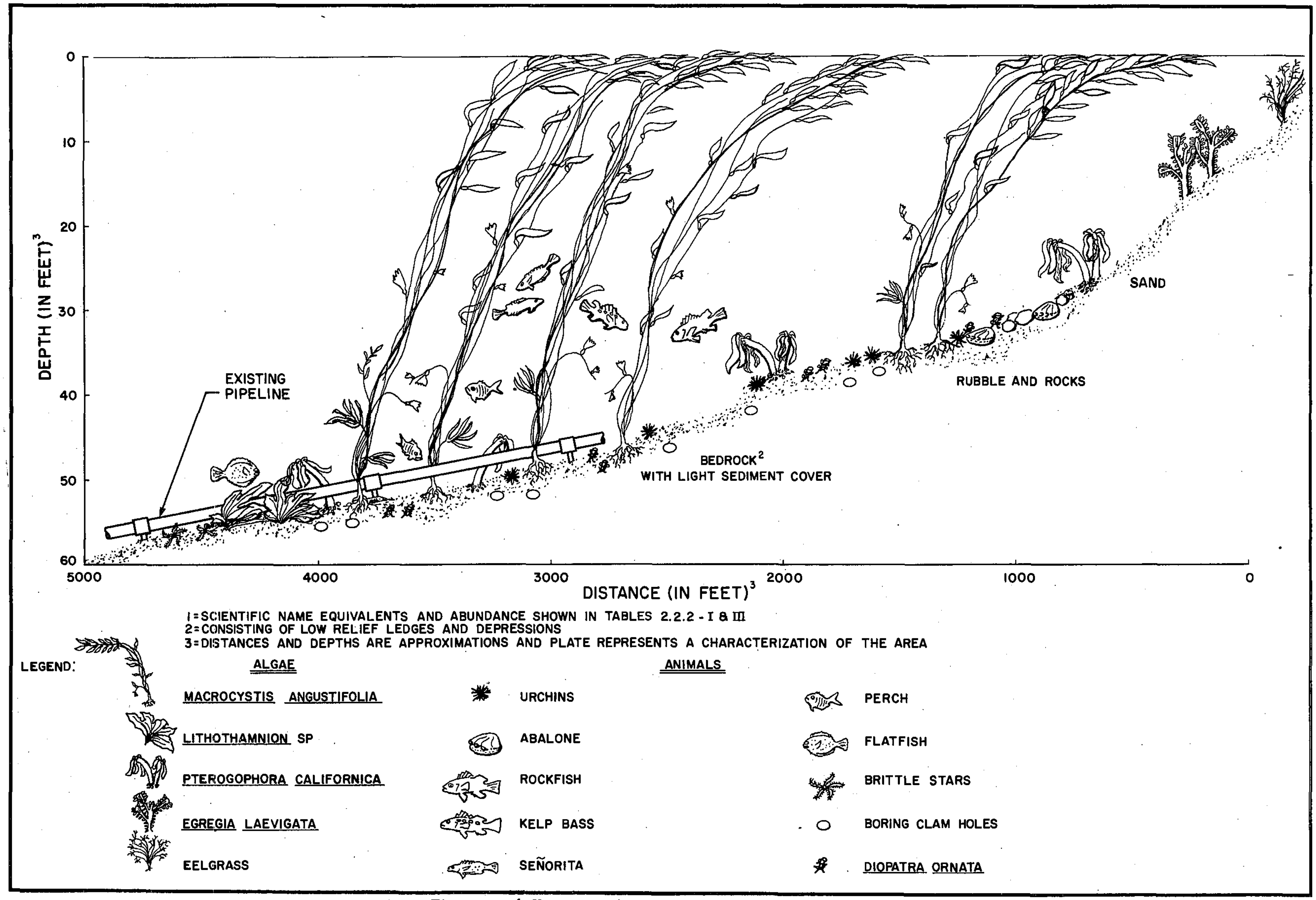


Figure 26. Transect A-Plant And Animal Distribution

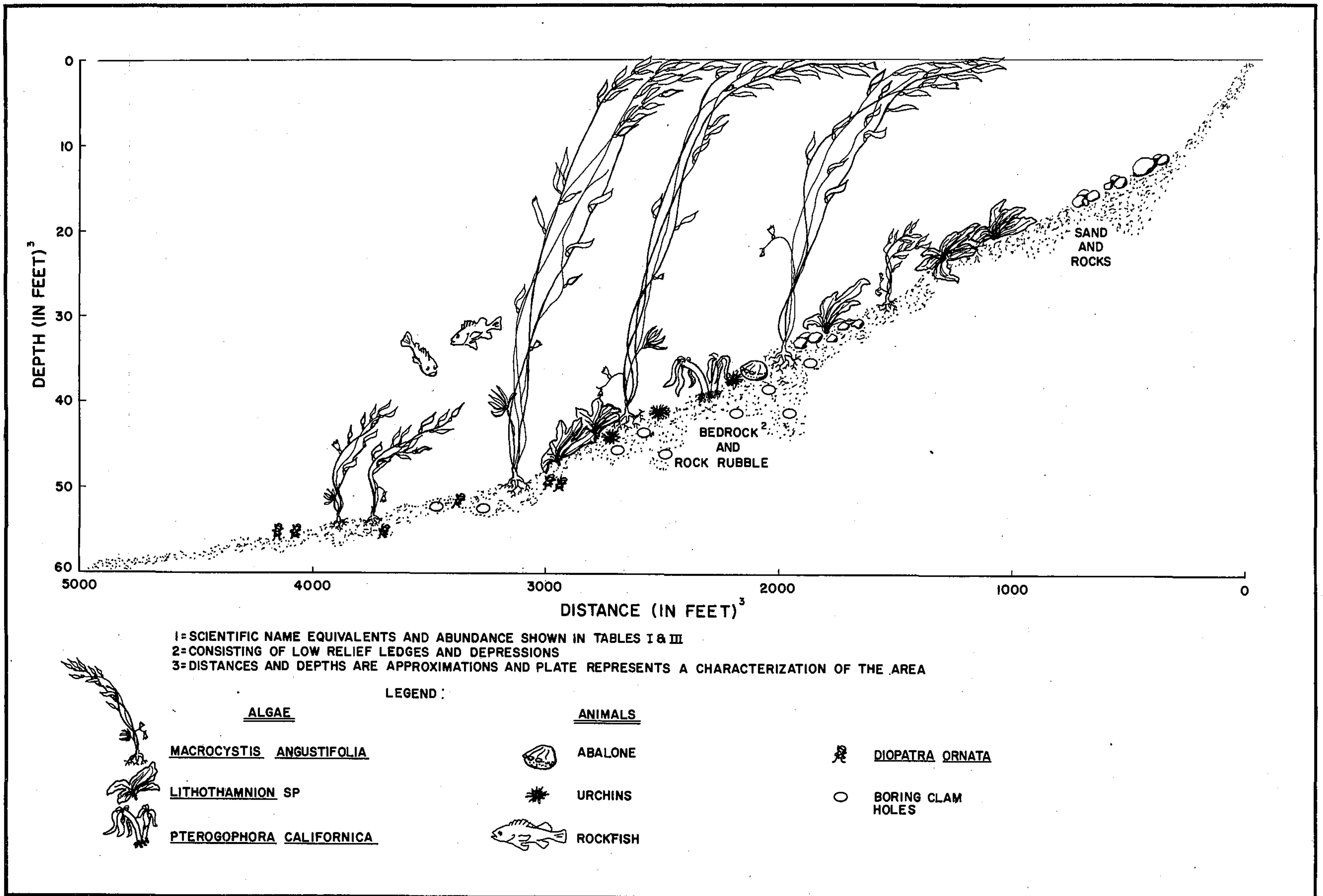


Figure 27 Transect B-Plant And Animal Distribution

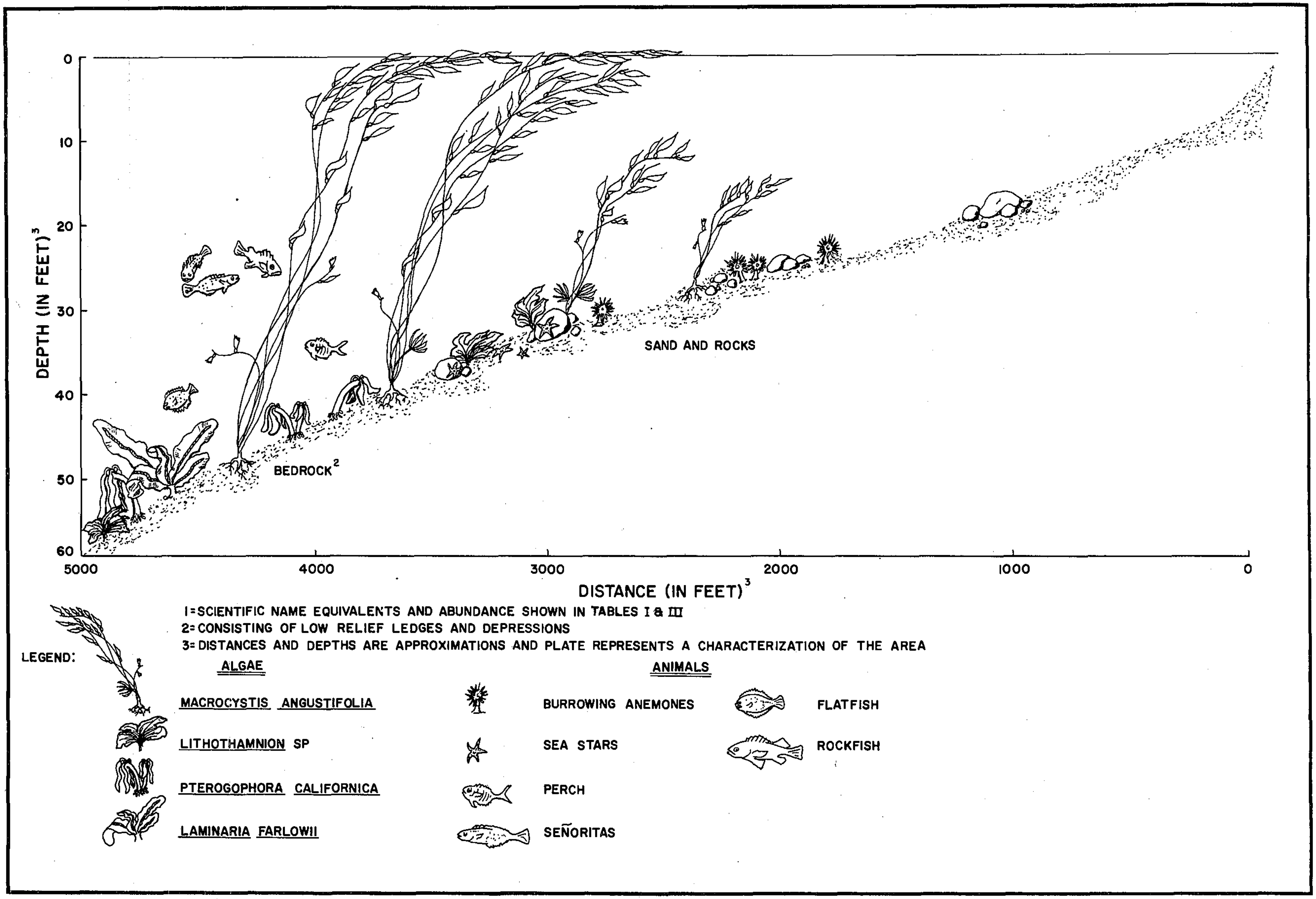


Figure 28 Transect C-Plant And Animal Distribution

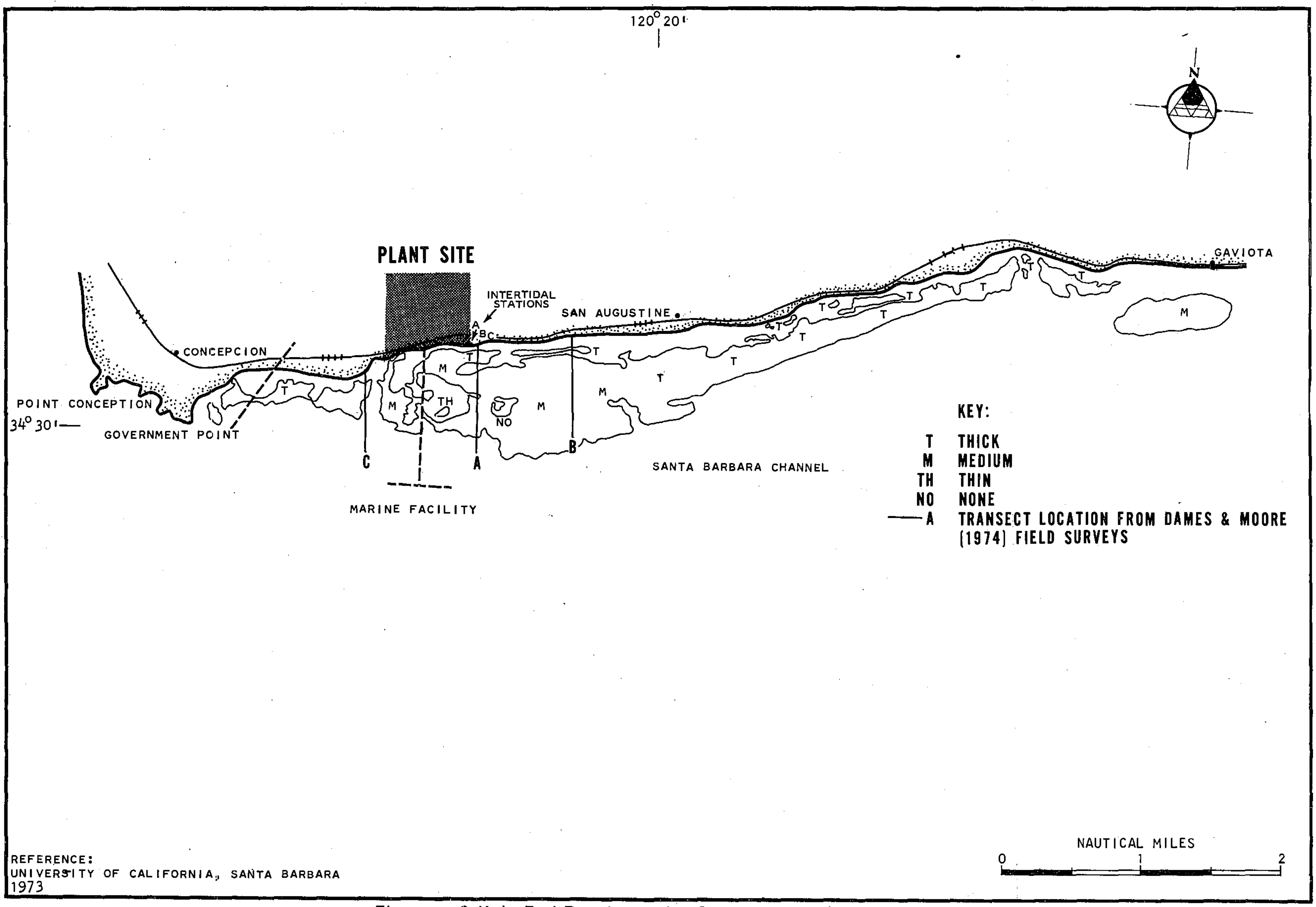


Figure 29 Kelp Bed Density: Point Conception to Gaviota

such as iodine bush, sea blite, sand spurry, and sea purslane. The proposed route may cross small alkaline flats ranging from 1 square yard to 1 acre in size with a similar composition.

c) Ecologically Sensitive Areas

The change in orientation of the coastline around Point Conception and the coincident east-west alignment of the Santa Ynez Mountains has produced a marked biogeographical boundary for both marine and terrestrial biota. In this area, many species with more northern or southern ranges reach their distributional limits, often producing mixed communities of unusual biotic diversity.

More species of fish (14) and invertebrates (20) are thought to reach their distributional limit in the marine waters off Point Conception than at any other single location on the coast, which lends additional importance to the kelp beds and benthos of this area.

On the northern slopes of the Santa Ynez Mountains, stands of north coast woodland at its southern range limit may be found. Tanbark oak, wax myrtle, salal, currant, and oso berry are trees and shrubs dominating this woodland. The proposed pipeline would cross stands of this relictual vegetation a few miles north of the site on the north slope of the Santa Ynez Mountain ridgeline. The pipeline may encounter additional stands on hills above 1,200 feet between MP 5 and MP 15.

Oak woodland is the most sensitive of the widespread plant communities in this area. The area of oak woodland has greatly declined since settlement of California due to fire, grazing, the spread of agriculture, and other disturbances. This community is also among the best of wildlife habitats and is slow to recover from disturbances.

7. <u>Wildlife</u>

a) Terrestrial Biota

i. LNG Plant

Though most of the Point Conception site and nearby lands are currently used for cattle grazing, the area still maintains a diverse and interesting fauna. The site's remoteness from dense human populations, the lack of easy access, its location along a biogeographic boundary, and the remaining tracts of woodland and other relatively undisturbed land create favorable conditions for many species.

Most wildlife species are associated with a particular habitat type. However, some species, especially the larger mammals and birds, utilize a variety of habitats for cover and foraging. Based on this habitat preference, the fauna at the proposed site can readily be classified according to their occurrence in the four major habitat types found on the property: ocean and coastal strand, coastal sage scrub, herbland, and woodland.

The open waters of the Santa Barbara Channel and the narrow coastal strand are used by many birds for feeding and resting. Point Conception is considered as a "funneling area" for many migratory seabirds and waterfowl, and during certain times of the year, major population segments of some species (e.g. black brant and pink-footed shearwaters) occur offshore. Gulls, terns, phalaropes, alcids, shearwaters, cormorants, herons, egrets, grebes, scoters, and brown pelicans are found offshore among the kelp beds and beyond. Along the narrow coastal strand, various shorebirds such as willet, sanderlings, and plovers hunt for invertebrates and gulls scavenge for carrion and refuse. Some inland species such as the water pipit, common crow, and assorted swallows also frequent the strand.

Many species of cetaceans and pinnipeds occur along the coast of southern California, some as residents but most as migrants. Because most marine mammals are migratory, population numbers in any particular area fluctuate seasonally. Whales and dolphins common along the Santa Barbara coast are the California grey whale, the common dolphin, Pacific striped dolphin, Pacific pilot whale, killer whale, and the Dall porpoise.

California sea lions, Steller seals, harbor seals, northern elephant seals, and northern fur seals occur in the Santa Barbara Channel. Only the harbor seal would be expected to visit the coastal strand regularly.

The coastal sage scrub, including the coastal bluffs, and the woodland are extremely important in maintaining the abundance and diversity of wildlife along the coast. These two habitats have been relatively undisturbed by the low intensity grazing which occurs over most of the site and provide suitable habitat for many native species.

The coastal sage scrubland support a fauna representative of similar communities along the Santa Barbara Channel. Mule deer, bobcats, coyotes, skunks, raccoons, and many small rodents have been observed in this habitat. Redtailed hawks, marsh hawks, barn owls, great-horned owls, burrowing owls, and white-tailed kites are attracted to the area by the high rodent populations. Numerous species of smaller birds are also found in the scrubland.

The woodlands contain the greatest number of vertebrate species of any habitat on the site. They provide cover and food for mule deer, coyote, bobcat, and raccoon, as well as many smaller mammals. The trees in this habitat provide hunting perches and nest sites for raptors such as the great-horned owl and white-tailed kite. Woodpeckers, warblers, titmice, flycatchers, vireos, and sparrows froage among the trunks and limbs or on the ground beneath the trees.

Many of the birds and mammals which depend on the scrubland and woodland for breeding and cover use the extensive areas of herbland for feeding. Other species, notably birds such as the western meadowlark, horned lark, lark sparrow, and savannah sparrow, are closely associated with the herbland vegetation. The herbland habitat at the site possesses a limited value to wildlife in itself, but where it is interspersed with more natural habitat, its wildlife value is greatly enhanced.

The proposed powerline between Point Conception and Goleta would be constructed across the coastal terrace and the Santa Ynez Mountain Range. The predominant wildlife habitats along the proposed route are coastal sage scrub, chaparral, oak woodland, and riparian woodland. Grassland is less abundant than at the proposed terminal site. Wildlife found along the proposed route is essentially the same as that at Point Conception except that woodland-chaparral-scrub species are more prevalent in the coastal mountains.

The existing Hollister Ranch road, which would be improved by the applicant, crosses habitats that are similar to those in the vicinity of the proposed terminal site. Most of the route would cross grassland but coastal sage scrub and woodland would also be traversed primarily in the vicinity of the coastal drainages between Point Conception and Gaviota. Wildlife associated with these habitats is similar to that previously discussed for the proposed site.

ii. Pipeline Route

As the proposed pipeline route moves inland from the coast, the vegetation and its associated wildlife make a transition from the moister, coastal environment to the hotter, drier, and flatter environment of the San Joaquin Valley. Also, the influence of intensive agriculture, grazing, drainage, and oil and mineral development becomes more apparent in the Carrizo Plain-Temblor Range-Joaquin Valley region.

Most species of wildlife occurring along the proposed route between the terminal site and the beginning of the semi-desert environment in the Carrizo Plain at about MP 65 are similar to those found at the proposed terminal site. However, since there is a significant decrease in the proportion of woodland to scrubland and grassland, the species associated with the latter habitats become more prevalent.

A significant change in the wildlife occurs in the Carrizo Plain-San Joaquin Valley. Much of the fauna there is characteristic of the desert regions of the southwest. Large areas of the San Joaquin Valley have been converted to intensive agriculture or are heavily grazed. This habitat modification has caused corresponding decreases in many species of native wildlife.

Common birds in the remaining areas of scrubland and grassland include horned larks, ravens, mourning doves, and loggerhead shrikes. The California ground squirrel, black-tailed jackrabbit, pocket mouse, and kangaroo rat are among the most abundant mammals.

The small stands of scrubby woodland remaining in this region support populations of mourning doves, California quail, California thrasher, brown towhee, scrub jay, plain titmouse, and phainopepla. Common mammals are the desert cottontail, California ground squirrel, pocket mouse, and deer mouse.

Before the development of intensive agriculture earlier in this century, the San Joaquin Valley contained extensive stands of freshwater marshland. This marshland has been reduced to a small fraction of its former abundance; however, the remaining marshes, reservoirs, irrigation canals, and temporary pools attract one of the largest populations of wintering waterfowl in North America. The proposed pipeline would not cross any marshlands; however, agricultural reservoirs, canals, and temporary pools may occur on or near the proposed route.

Areas along the route of particular significance to wildlife are woodlands, natural springs and artificial catchment basins, two wildlife management areas, and Soda Lake. Woodlands in general are considered the most valuable wildlife habitat within the project area. They support the greatest number and diversity of animal populations. Approximately 6.1 miles of southern oak woodland and valley oak savanna, almost all in the Santa Ynez Mountains, would be crossed by the proposed route.

The proposed right-of-way would pass within 500 feet of Willow, Buck Cove, and Gifford Springs, two unnamed springs, and 11 artificial water catchment basins. All are located along the first 75 miles of the proposed route. Located in an area of extreme variation in annual precipitation, these springs and catchment basins are extremely important to local wildlife populations.

The Point Conception-to-Gosford pipeline would pass near the Caliente National Cooperative Land and Wildlife Management Area in the Caliente Range and would cross the Temblor National Cooperative Land and Wildlife Management Area in the Temblor Range. These areas are managed by the California Department of Fish and Game and the U.S. Bureau of Sport Fisheries and Wildlife to increase and stabilize wildlife populations, especially chukars, California quail, mourning doves, and mule deer.

Soda Lake, a large ephemeral lake, is located about 1 mile north of the proposed pipeline route. Geese, ducks, shorebirds, and up to 15,000 lesser sandhill cranes winter in its vicinity. The U.S. Bureau of Land Management and the U.S. Bureau of Sport Fisheries and Wildlife have proposed that Soda Lake be designated a Wildlife Management Area or Wildlife Refuge. These plans would include the acquisition of some surrounding lands.

iii. Rare and Endangered Species

Thirteen species of mammals, birds, reptiles, and fish designated as rare, endangered, or fully protected are found in the vicinity of the proposed LNG terminal and/or pipeline route. These species and their distributions within the project area are listed in table 20.

b) Aquatic Biota

i. Marine Biota

Marine Vertebrates

The Point Conception area is biologically unique due to the overlap in distribution of both northern and southern species and the presence of species that are unique to this zoogeographic transition zone. While this transition zone extends over 4^{o} of latitude, Point Conception is at the approximate center of this area. While this unique area extends north and south of the Point Conception area, the ecological conditions change in both directions. To the north, the coastline is exposed to colder water and rougher open ocean conditions. The region to the south of the proposed siting area becomes gradually more populated and more exposed to intensive agricultural and industrial stresses.

Seventeen of 268 species of marine fish which could be present in the area have a northern or southern range limit at or within 10 miles of Point Conception. Therefore, 251 of the 268 species probably occur in the region.

TABLE 20

RARE, ENDANGERED, AND FULLY PROTECTED ANIMALS AT POINT CONCEPTION AND ALONG THE PROPOSED PIPELINE ROUTE

Species	Status 1/	Distribution Within Project Area	Habitat
San Joaquin Kit Fox	F - Endangered C - Rare	San Joaquin Valley east of Branch Mountains; including the Carrizo Plain and Temblor Range	Native vegetation; low hills with open, low grass and brush
Ringtail	F - * * C - Fully Protected	Point Conception and mountain ranges along pipeline route	Shrubland with rocky outcrops
California condor	F - Endangered C - Endangered	Mountainous parts of San Luis Obispo, Ventura, and Santa Barbara Counties	Mountains with chaparral and rocky outcrops; oak savanna in hills
California least tern	F - Endangered C - Endangered	Point Conception coastal strand and offshore; no nesting sites at terminal	Nests on sandy beaches
California brown pelican	F - Endangered C - Endangered	Point Conception coastal strand and offshore; no nesting sites at terminal	Coastal strand and ocean; nests on Channel Islands
American peregrine falcon	F - Endangered C - Endangered	Sierra Madre Mountains, especially Cuyama River	Grasslands, cliffs, and rocky area near woodland and water
Southern bald eagle	F - Endangered C - Endangered	Sierra Madre Mountains	Low mountains near rivers and lakes
Aleutian Canada goose	F - Endangered C - * *	Some wintering in San Joaquin Valley	Agricultural fields and marshlands
Golden eagle	F - * * C - Fully Protected	Sierra Madre Mountains	Open mountains and foothills
White-tailed kite	F - * * C - Fully Protected	Point Conception area, including terminal site	Hunts in herblands; nests in woodlands
Sandhill crane	F - * * C - Fully Protected	Winters in San Joaquin Valley	Mixture of cropland, grassland and marsh
Blunt-nosed leopard lizard	F - Endangered C - Endangered	San Joaquin Valley east of Branch Mountain, including Carrizo Plain and Temblor Range	Very open, barren alkali flats and undisturbed native grasslands; canyon floors, plains away from dense brush
Unarmored threespine stickleback	F - Endangered C - Endangered	Santa Ynez River and San Antonio Creek	Rivers and streams

1/ F--Federal, C--California, * *--Not listed.

Sources: U.S. Fish and Wildlife Service, Endangered and Threatened Wildlife and Plants, 1976.
California Dept. of Fish and Game. At the Crossroads, 1976.

Dames and Moore, environmental consultant for Western Terminal, has completed two 1-week marine field surveys in the area of the proposed LNG terminal. These two quarterly surveys were conducted from February 25 to March 1 and from May 30 to June 4, 1974. Additionally, nine quarterly surveys of approximately 1 week each were conducted between September 1974 and September 1976.

The staff has reviewed the studies performed by Dames and Moore and has found them to contain the most complete information available. Because of the size of this report, the following summary is provided:

Figures 26, 27, and 28 depict the characteristic biota along the transects A, B, and C, respectively.

The first survey was conducted over the three transects from intertidal zones to 60-foot depths. The May survey concentrated on the central transect (Transect A, figure 26) and was extended to include the 100-foot contour.

Substrata along the transects are characterized by low relief and gently sloping shale bedrock interspersed with thick, sandy patches and occasional ledges. A thin layer (less than 4 inches) of silty mud overlays bedrock in isolated patches at the 100-foot station. Because of the paucity of high-relief areas, large populations of kelp-bed fish are not expected to occur in the area. A Macrocystis (giant kelp) bed, running along the entire frontage of the site area, provides most of the cover for free-swimming fish. The most dense giant kelp growth occurs in depths from 30 to 60 feet on rocky, low-relief areas.

A total of 46 taxa 1/ were observed in both Dames and Moore field surveys. The May-June 1974 survey recorded 36 taxa of fish; 26 were observed in the February survey. Twenty of the 36 taxa observed in May were not observed during the February survey; similarly, 10 taxa observed in the February survey were not seen in May. Increased sampling and the addition of the 100-foot station, plus the use of gill nets, probably accounts for the increase in the number of species recorded.

The observed aquatic fauna of the entire site area were relatively scarce, with rockfish most common. Blackeye gobies and Pacific sanddabs characterize the benthic fish fauna. Little change in the species composition was found over the depth range sampled by biologists, although several species association with deeper water (such as rosy rockfish) were observed at the 100-foot station.

1/ "Taxa" is a general term describing a valid biological grouping without regard for its technical taxonomic classification. For instance, one group of organisms which technically forms a class, a second group which technically forms a genus, and a third group which is technically an order may be referred to collectively as three taxa.

The area having the greatest number of individuals and species of fish was immediately surrounding the 6-inch diameter pipeline, which traverses diagonally across Transect A in about 40 feet of water. Six species of rockfish, black perch, senoritas, kelp bass, California sheephead, and lingcod were observed within 30 feet of the pipeline. Other areas supported a less varied fish fauna, with flatfish generally being most numerous. Angel and swell sharks were observed occasionally at depths ranging from 40 to 100 feet. Three lingcod were observed along the transects in 40 to 60 feet of water. Along Transects A and C, in depths of 20 and 40 feet, small schools of senoritas were observed. These schools were within the kelp forest approximately 10 feet above the bottom.

Marine Invertebrates

From the field surveys in February and May 1974, 481 taxa of benthic biota have been recognized. A survey of existing marine biological literature for the site area revealed 514 taxa, of which 194 are shared with the Dames and Moore survey findings. Combining the literature and field results yields a known biota of 853 taxa, of which 676 are invertebrates, 176 are algae, and 1 is a flowering plant.

Ectoprocts (moss animals, 8 percent), gastropod molluscs (snails and nudibranchs, 15 percent), and polychaetous annelids (bristle worms, 24 percent) account for nearly half of all the invertebrates reported.

From six other taxonomic groups, more than 20 taxa have been reported for the site area (sponges, coelenterates, clams, and three groups of crustaceans). The relatively ample representation (87 species, 13 percent) of microcrustaceans (amphipods, isopods, cumaceans, ostracods, and tanaids) is indicative of the contribution to the biota from sediment inhabitants. The pelecypods (clams, 49 species, 7 percent) are also indicative of the availability of viable sedimentary habitat.

Along the transect at the proposed pier location (transect A, figure 26), three distinct subtidal biotic assemblages exist. From depths of 6 to 20 feet, the bottom has a relatively high relief, compared to the remainder of the transect, with isolated boulders and rock piles to about 6 feet high. Sand patches are numerous and are probably coarser than those farther offshore. Invertebrates are starfish, abalone, hydroids, and anemones. Lobster and rock crabs are less common.

From 30 to 55 feet deep, areas characterized by the presence of Macrocystis (giant kelp), the benthic macrofauna, appear more varied than those farther inshore. Conspicuous invertebrates are abalone, sea urchins (which occur in tightly packed patches of up to more than 100 individuals and dominate all raised relief areas), cowries, boring clams (especially Parapholas), tube building worms, chitons (particularly the genera Isachnochiton and Tonicella), rock crabs, and the same starfish as in shallower water. Less common are the snails Kelletia, Mitrella, and Calliostoma, several varieties of nudibranchs, solitary corals, colonial anemones, hydroids, hermit crabs, and the starfish Mediaster.

The transition zone from the kelp bed to open bottom occurs from water depths of 55 to 70 feet. The substrate and macrofauna continue to be similar to that of the kelp areas, even though the Macrocystis fails to create a canopy (that is, reach the surface) in this depth range.

The deeper area from 70 to 105 feet has no dominant benthonic species. Most numerous are solitary corals and boring clams, especially Lithophaga. The most conspicuous invertebrates are large anemones and sponges, occasional rock crabs and abalone, patches of sea urchins, the tectibranch mollusc Tochuina tetraquetra, and starfish. The white anemone, an iridescent red alga (Drouetia), and the California sea cucumber were unique to this depth range. All three are characteristic of deeper water in southern California.

The lateral continuity of the communities was investigated by surveying transects approximately 4,000 feet up and down coast parallel to the proposed pier location. These observations were made to determine gross macrofaunal similarities. The upcoast transect (Transect C) has more sediment and shale shingles offshore (55 to 65 feet) than Transect A. The down-coast transect (Transect B) is similar to Transect A but with less available sediment. The substrate is nearly solid shale pavement with almost no rocky vertical relief. The extensive solid substrate allows a high degree of development for epifaunal species, but the available sediment is still sufficient to permit a varied infaunal component along all three transects.

Intertidal Invertebrates

The intertidal zone in the immediate area of the proposed LNG terminal encompasses three more or less distinct habitats: sand, sand and bedrock, and exposed rocky areas. To assess the macrofauna of each habitat, three intertidal sampling stations were established. These stations, identified as Station A, B, and C, were located west to east, respectively, in the area of transect A. Of the 88 taxa of intertidal organisms identified from the Dames and Moore surveys, 54 were invertebrates. Previous studies of intertidal biota in the region have centered on the rocky areas at Government Point (approximately 2 miles west of the site) and at Gaviota (approximately 10 miles east of the site). Snails (20 percent), bristle worms (22 percent), and crustanceans (20 percent) dominate the intertidal invertebrate species. Echinoderms are represented only by two species (Strongylocentrotus purpuratus and Pisaster ochraceus), and both of these are found low in the intertidal zone.

Intertidal Station C, characterized by a large rocky area exposed to wave action and supporting both tide pool and exposed face fauna (figure 28), supported the most varied fauna of any of the surveyed areas.

Table 21 gives the distribution of space utilization on the only two large reef rocks in the site area which are located at intertidal Stations B and C in figures 27 and 28. Mussels are the dominant invertebrates. The barnacle Chthamalus fissus is the only other invertebrate species recorded with more than 10 percent coverage. Coverage is used as a dominance criterion, since space is usually the limiting environmental factor in habitable rocky intertidal areas.

The lower rocky intertidal levels were characterized by boring clams, snails, and hermit crabs. The midtidal rocky assemblage was dominated by the mussels and barnacles. Mobile fauna were represented by species of the limpet genus Collisella, the snails Tegula and Littorina, the chiton Mopalia, and the shore crab.

On the lee side of the reef rock at C, a large patch of the sand tube building worm has developed.

Twelve taxa of invertebrates in the intertidal zone have a high relative abundance. Half of the 12 more abundant invertebrates are snails, 3 of the abundant species are the sand dominants discussed earlier in this section, and the others are a mussel, a sand tube building worm, and a stalked barnacle.

The sandy beach fauna had three dominants in the May samples: the beach hopper, an isopod (Excirolana), and the sand crab, In the February samples, no dominant sandy beach species were found at the lower levels. The beach hopper was dominant in the dry sand.

TABLE 21

PERCENT COVERAGE BY INTERTIDAL REEF ROCKS[1]

Category	Percent Coverage[2] B	C
Enteromorpha spp. (green algae)	11.1	0
Ulva spp. (green algae)	0	26.8
Chondria nidifica (red alga)	0	1.8
Porphyra perforata (red alga)	0	1.8
Anthopleura elegantissima (colonial anemone)	0	1.8
Collisella digitalis (limpet)	5.6	0
Mytilus californianus (mussel)	2.8	69.9
Balanus glandula (barnacle)	0	1.8
Chthamalus fissus (barnacle)	13.90	10.7
Tide Pools	5.6	7.1
Uncolonized Rock Surface	61.0	17.9
	100.0	139.6[3]

[1]Reference: Dames & Moore Field Survey (May 1974). See Figure 29 for locations of these two reef rocks.

[2]Percent coverage based on point samples taken two every meter along transects from the midpoints of the reef both parallel and perpendicular to the wave direction; 36 points at b and 56 points at c.

[3]Coverage figure of >100% at c arises from epizoic habits of *Chthamalus fissus* and *Ulva* spp.; 34% of samples were occupied by two species.

Plankton

Table 22 lists the dominant southern California nearshore zooplankton species.

Generally, zooplankton volumes for the California Current region are maximum from May through July when fish larvae constitute a large portion of the settled volume. California Cooperative Oceanic Fisheries Investigations (CalCOFI) data for an area offshore from the proposed site indicate a median settled zooplankton volume from 1951 to 1960 of 133 cubic centimeters per 1,000 cubic meters of strained seawater. Median zooplankton volumes for this period ranged from 63 to 234 $cc/1000\ m^3$.

To augment existing data, the plankton at Point Conception was surveyed in June 1974. Four stations along a transect extending from approximately the eastern boundary of the proposed plant site to a depth of 100 feet and parallel to the proposed marine trestle were occupied. The results of volume studies for stations PC-100 (100 feet), PC-1 (60 feet), PC-2 (35 feet) and PC-3 (20 feet), are provided in table 23.

A list of the phytoplankters collected at inshore stations within the region of Point Conception is shown in table 24. The diatom *Nitzchia closterium* was the most widespread in samples of the region. Phytoplankton biomass and composition data for the site are unavailable.

Rare and Endangered Marine Species

No list of rare or endangered species for algae or marine invertebrates exists. None of the fish species listed by the U.S. Department of Interior or the California Department of Fish and Game are expected to be found on the site or in the immediate marine vicinity.

The National Marine Fisheries Service states that all marine mammals are protected or that their harvesting is at best managed. With the exception of the harbor seal, no marine mammals are expected either to use the site as hauling-out grounds or to appear regularly on the site.

Many species of rare or endangered marine mammals are found along the coast of southern California. Species and population numbers fluctuate seasonally because most of the marine mammals are migratory. Between October and April, the

TABLE 22

DOMINANT SOUTHERN CALIFORNIA NEARSHORE MACROZOOPLANKTON*

COPEPODS
- *Acartia tonsa*
- *Labidocera trispinosa*
- *Paracalanus parvus*
- *Corycaeus anglicus*
- *Oithona similis*
- *Clausocalanus* spp.
- *Euterpina acutifrons*
- *Oncaea* spp.

CLADOCERA
- *Evadne nordmanii*
- *E. tergestina*
- *E. spinifera*
- *Penilia avirostris*

THALIACEA
- *Oikopleura* spp.

LARVAL FORMS
- barnacle nauplii
- decapod larvae
- cyphonautes
- mysid larvae
- furcilia (euphausiid larvae)

CHAETOGNATHA
- *Sagitta euneritica*

CTENOPHORA
- *Pleurobrachia bachei*

---

*Reference: Barnett (1973).

Note: An estimated 80% of the species of nearshore macrozooplankton are included on this list.

Nearshore = within 3 km of shore.

TABLE 2 3

MICROZOOPLANKTON BIOMASS, POINT CONCEPTION

(June 2-4, 1974)

(cubic millimeters volume/cubic meter)

Station	Sheathed Oligotrichs	Tintinnids	Other Ciliates	Total Ciliates	Foraminifera/ Radiolaria	Total Protozoa	Naupliar Copepods	Post-naupliar Copepods	Other Metazoa	Total Metazoa	Total Microzoo-plankton
PC-1											
0 ft	38.8	6.2	23.7	68.6	0	68.6	5.5	0	69.6	75.1	143.7
10	18.3	7.7	21.2	47.2	0.6	47.8	323.3	0	16.5	339.8	387.6
20	28.4	7.3	26.2	61.9	0	61.9	14.1	44.3	0	58.4	120.3
40	17.8	8.2	32.2	58.3	0	58.3	82.9	57.7	0	140.6	198.8
60	4.1	0.6	16.3	21.0	0	21.0	88.4	0	0	88.4	109.5
PC-2											
0 ft	9.2	6.6	17.2	33.0	0	33.0	0	0	0	0	33.0
10	23.0	2.6	10.0	35.6	0	35.6	42.1	0	5.1	47.2	82.9
20	6.6	4.9	9.4	20.9	0	20.9	6.2	0	18.4	24.6	45.5
30	7.7	2.3	17.1	27.2	0	27.2	18.2	0	9.0	27.2	54.4
PC-3											
0	9.4	7.8	3.1	20.3	0	20.3	33.4	0	0	33.4	53.7
7.5	15.6	6.6	6.7	28.9	0	28.9	50.8	0	69.4	120.2	149.1
15	4.0	2.0	3.4	9.5	25.4	34.9	0	0	0	0	34.9
PC-100											
0	49.0	7.3	48.8	105.2	2.0	107.2	18.5	0	56.3	74.8	182.0
10	57.4	10.2	51.2	118.9	0	118.9	84.7	128.3	59.3	274.2	391.3
30	18.5	7.7	79.2	105.6	0	105.6	144.2	0	98.3	242.5	348.0
60	4.9	0.5	5.5	10.9	0	10.9	0	0	0	0	10.9

TABLE 24

PHYTOPLANKTON OF THE POINT CONCEPTION REGION[1]

Scientific Name	Common Name[2]	Range[3]
DIVISION CHRYSOPHYTA: YELLOW-GREEN ALGAE		
CLASS BACILLARIACEA: DIATOMS		
Bacteriastrum delicatulum		Temperate
B. hyalinum[4]		Cosmopolitan
Chaetoceros affinis		South temperate
C. compressus[4]		Boreal-south temperate
C. decipens[4]		Arctic-boreal
C. pendulus[4]		
C. sp.		
Dactiliosolen mediterraneus		Cosmopolitan
Ditylum brightwellii[4]		South temperate
Eucampia zoodiacus[4]		South temperate
Guinardia flaccida[4]		South temperate
Hemiaulus haucki[4]		Temperate-tropical
H. siniensis[4]		South temperate-tropical
Leptocylindricus danicus		North temperate
Nitzchia closterium		Cosmopolitan
N. pugens var. altanica		Temperate
N. sp.		
Rhizosolenia alata		Temperate
R. castraceni		Tropical
R. styliformis		North temperate
Thalassiosira rotula[4]		South temperate
Thalassiothrix mediterranea[4]		South temperate
Unid. Naviculoids		
Unid. Diatoms		
CLASS HETEROKONTA		
Dictyocha fibula		
Syracosphaera sp.		
PHYLUM PHRRHOPHYTA		
CLASS MASTIGOPHORA		
Ceratium furca		
C. fusus		
Eutreptia lanowii		
Goniaulax polyhedra		
Gymnodinium spp.		
Peridinium spp.		
Prorocentrum micans		
Unid. Flagellates		

[1]References: State of California (1965).
[2]Scientific and common names in accordance with State of California (1965).
[3]Reference: Bolin and Abbott (1963).
[4]Phytoplanters observed in less than 5% of the samples (State of California (1965).

most numerous species in decreasing order of abundance are the common dolphin, the Pacific white-sided dolphin, and the northern right whale dolphin. The Pacific pilot whale, the Pacific bottle-nose dolphin, and the Dall porpoise are less abundant, occurring in about equal numbers. The gray whale, the blue whale, and the finback whale are found in the area and are listed as endangered species. There is little firm information available on whale population numbers in the channel. Sea otters are also found in this region. Additional information on the marine mammal populations along coastal southern California is available in a report by the Department of Commerce.

Several species of pinnipeds including the California sea lion, Stellar sea lion, harbor seal, northern elephant seal, and northern fur seal occur in the Santa Barbara Channel.

ii. Freshwater Biota

Approximately one dozen ravines containing small, mostly intermittent streams are located along the Hollister Ranch Road between Canada del Cojo and Gaviota. Two of the streams, Gaviota and Santa Anita Creeks, have been classified as "anadromous fish streams" by the California Coastal Zone Conservation Commission. Both streams also have small coastal lagoons which support important populations of small fishes and invertebrates.

The proposed powerline route would traverse numerous small streams and drainages. Among them are Tecolote Creek, Dos Pueblos Creek, Rufugio Creek, and Arroyo Hondo. These four watersheds rank as some of the most natural and biologically rich streams remaining in Santa Barbara County. The California Coastal Zone Conservation Commission has classified three streams that would be crossed by the powerline as "anadromous fish streams": Tecolote Creek, Gaviota Creek, and Santa Anita Creek.

The proposed pipeline route would cross or closely parallel 14 rivers and creeks, most of which are dry during the summer. The larger streams such as the Santa Ynez, Sisquoc, and Cuyama Rivers, which have year-round flows, support small populations of warm water species such as bass, crappie, sunfish, catfish, carp, and minnow.

8. Socioeconomic Considerations

a) LNG Site Vicinity

The proposed LNG plant site is situated on a narrow coastal terrace at the foot of the Santa Ynez Mountains in southwestern Santa Barbara County.

The socioeconomic trends of Santa Barbara County have closely paralleled historical land use patterns. During the early 1800's, the local economy and trade centered on agriculture, livestock production, and occasional trade with Spanish, Mexican, and American ships passing through the area. American acquisition of California substantially increased the rate of settlement in the county and resulted in more intensive agricultural and livestock development. The late 1800's and early 1900's saw the first concerted exploration for the county's various mineral resources and an associated change in the area's economy, but the rate of population growth remained relatively low in comparison to the rest of California. Even with active oil production in the 1930's, the local economy and population remained stable until after World War II. However, in the late 1940's, with the development of new water supplies, location of a new University of California campus in Goleta, and the establishment of Vandenberg Air Force Base to the north of Point Conception, an unexpected high growth rate for Santa Barbara County occurred. Research and development and electrical component industries were attracted by the university and military base. These industries settled in the Goleta, Lompoc, and Santa Maria areas, bringing in new working populations which consequently increased the demand for housing.

In terms of population and density, Santa Barbara County ranks near the middle of California's 58 counties. According to the 1970 census, the county had 264,324 inhabitants and a population density of 96.6 people per square mile. However, the growth rate for the county as a whole, between the 1960 and 1970 census, was more than twice the state growth rate (56.4 percent as compared to 27 percent).

A breakdown of county growth statistics reveals that the most active area is Goleta Valley, which extends from the eastern boundaries of Goleta west to Gaviota. The only population centers within 15 miles of the proposed site are Gaviota and the city of Lompoc. The largest city within 50 miles is Santa Barbara. Historic and projected population figures for Santa Barbara County are provided in table 25.

TABLE 25

HISTORIC AND PROJECTED POPULATION--SANTA BARBARA COUNTY (1950-1990)

Year	South Coastal Region				Other County Areas					Total Santa Barbara County	Change	
	Santa Barbara	Goleta Valley[1]	Montecito-Carpinteria	Total	Santa Maria Valley[2]	Lompoc Valley[3]	Santa Ynez Valley[4]	Cuyama Valley	Total		Population	Percent
Actual												
1950	46,300	8,100	8,900	63,300	23,400	9,000	--	--	34,900	98,220		
1960	60,742	19,026	13,407	93,255	39,667	28,234	6,462	1,344	77,206	168,962	70,742[5]	72.0
1970	72,535	60,184	17,706	150,425	56,630	47,729	8,328	1,212	113,899	264,324	95,362[6]	56.4
1975	74,608	69,664	22,038	166,310	58,010	43,807	11,250	1,140	114,295	280,605	16,281[7]	6.2
Projected												
1980	79,688	71,062	23,750	174,500	61,124	49,594	10,688	1,313	122,719	297,219	16,614[8]	5.9
1990	84,687	78,000	27,313	190,000	64,688	52,625	12,210	1,406	130,929	320,929	23,710[9]	8.0

[1] Includes Goleta, Isla Vista, and greater Goleta Valley

[2] Includes Santa Maria, Guadalupe, and Orcutt

[3] Includes Lompoc and Vandenberg Air Force Base

[4] Includes Santa Ynez, Buellton, Solvang, Ballard, and Los Olivos

[5] 1950-1960 increase

[6] 1960-1970 increase

[7] 1970-1975 increase

[8] 1975-1980 increase

[9] 1980-1990 increase

Reference: U.S. Bureau of the Census, 1971; California Department of Parks and Recreation, 1972; Santa Barbara County Planning Department, 1973; and Santa Barbara County Planning Department, no date (a).

Note: Figures for 1975 from November 15, 1975 Special Census. Santa Barbara County population projections for 1980 and 1990 have not been revised or updated to reflect the results of that special census.

Within the immediate site vicinity, the population distribution is minimal, averaging one person per square mile within a 10-mile radius of the site. Very little residential development presently exists in the local area. Approximately three residences occur within 2 miles of the proposed site. Several residences occur in and around Point Conception, which is 3 miles west of the proposed site.

The Hollister Ranch is the most significant local entity in terms of land acreage and potential future development. The 135 parcels (each a minimum of 100 acres) are being sold as exclusive home sites. No population projections exist for the specific site area.

The principal components of Santa Barbara County's local economy today are agriculture, construction, mineral production, tourism, and government.

Agriculture is one of the major economic activities. Agricultural production in 1975 amounted to over $157 million. Vegetables, valued at nearly $49.5 million in 1975, were the county's major crop, contributing approximately 31.4 percent to the county's gross value of agriculture production. The fruit and nut crop, valued at $27.9 million, was the county's second major agricultural category in 1975, followed by livestock and poultry valued at $22.0 million. Major products of the fruit category are lemons, strawberries, and avocados.

A history of Santa Barbara County construction activity is presented in table 26.

The estimated value of mineral production in Santa Barbara County for 1972 totalled $98.7 million. Of this total, petroleum production accounted for $44.5 million, natural gas for $18.8 million, and natural gas liquids, sand, gravel, diatomaceous earth, lime, mercury, phosphate rock, and stone combined accounted for $33.6 million. Santa Barbara is one of the leading mineral producing counties in California.

The net income from tourism within the county is also substantial and can be expected to increase. In 1971, tourism provided $36.6 million in general expenditures in the prime Santa Barbara tourist area. In 1975, expenditures amounted to over $80 million for approximately 5.16 million visitor days.

The effect of Vandenberg Air Force Base on the county's economy has been very significant. This base is located approximately 10 miles northwest of the proposed plant site

TABLE 26

SANTA BARBARA COUNTY CONSTRUCTION ACTIVITY

1967-1974

Year	Total Building Valuation ($ million)
1967	48.7
1968	61.5
1969	66.1
1970	53.3
1971	60.4
1972	95.1
1973	104.2
1974	72.8
1975	N.A.

References: Security Pacific National Bank, Economic Research Department, 1970.

Security Pacific National Bank, Economic Research Department, 1974.

Security Pacific National Bank, Research Department, 1975.

and is Santa Barbara County's major Federal employer. Within 2 years following the Federal Government's decision in 1957 to construct and operate these facilities, the base was first in importance in the county's economy.

Currently, the estimated base work force is 10,600 persons. Annual payrolls amount to approximately $72 million. Payments made to 11,000 retired military and civil service personnel residing in the area amount to $45 million annually. The Lompoc and Santa Maria-Orcutt areas have and should continue to benefit from a great deal of the economic activities and associated services and industries supporting Vandenberg Air Force Base.

Retail establishments should be considered yet another active economic force which has a significant impact in Santa Barbara County. In 1976, the retail trade employed 21,000 persons. Preliminary estimates for that year place Santa Barbara County's taxable retail sales at nearly $737 million. General manufacturing employed 14,100 persons in 1976. Real estate and land speculation have historically been active throughout the Santa Barbara area. Within the last two decades, acquisition of land for residential and industrial development has become the major focus of the real estate market.

Employment in Santa Barbara County is relatively diversified, with no one occupation accounting for more than 20.1 percent of the total labor force. The total resident civilian labor force in August 1976 was 117,700 persons. Approximately 8,800 persons were listed in the unemployed category, which resulted in a seasonally adjusted unemployment rate of 8.2 percent. The U.S. Department of Labor classified the county as an "area of substantial unemployment." table 27 shows a breakdown of employment by industry.

The construction labor force within the county, as a percentage of total employment and population, has been diminishing for about 10 years. Construction of Vandenberg Air Force Base in the early 1960's increased construction employment to its peak of 6,400 persons. Since 1970, construction employment has never exceeded 3,600 persons (on an annual average basis).

Total nonagricultural wage and salary employment rose less than seasonally to 93,400 in May 1975 from 93,000 in April 1975. The annual growth rate in wage and salary employment over the May 1974 - May 1975 span was only 4 percent, the lowest in nearly 4 years.

TABLE 27

SANTA BARBARA COUNTY LABOR FORCE--AUGUST 1976

Total Civilian Labor Force[1]			117,700	(100%)
Unemployed			8,800	(7.5%)
Employed[2]			108,900	(92.5%)
Nonagricultural Wage and Salary Employment[3]			97,100	(82.5%)
Mining	700	(0.6%)		
Construction	3,300	(2.8%)		
Manufacturing	12,700	(10.8%)		
Transportation, Communications, and Utilities	3,000	(2.5%)		
Wholesale and Retail Trade	22,200	(18.9%)		
Finance, Insurance, and Real Estate	4,100	(3.5%)		
Services	24,100	(20.5%)		
Government	27,000	(22.9%)		
Agriculture			6,700	(5.7%)

[1]Total labor force by place of residence and including workers involved in trade disputes.

[2]Includes self-employed, unpaid family, and domestic workers.

[3]Employment by place of work excluding workers involved in labor disputes.

Reference: State of California Employment Development Department, 1976.

Total personal income of Santa Barbara residents has increased 37 percent between 1969 and 1973, reflecting an average annual rate increase of 9.3 percent. The county's total personal income is estimated at $1,603.3 million for 1974. On a per capita basis, 1974 personal income was approximately $5,784, up 10 percent from 1973's per capita income.

The economic trends of Santa Barbara County and the south coast in particular are closely associated with land use. Population growth is indirectly governed by the same plans, restrictions, and potential problems which occur with land use. Agriculture, which historically has been a prime land use of the county, has been gradually declining in the south coast economy. Conversion of agricultural land to residential and light manufacturing zones surrounding urban centers has been a main cause of the past decline. Unless agricultural production is maximized, the economic pressures for conversion to other uses will further decrease the importance of agriculture within the county.

Projected expansion of the University of California (Santa Barbara) and decreased military activity at Vandenberg Air Force Base will affect the research and development industries and services that depend on them. The growing southern California population levels have increased recreational activities and tourism. These forces will continue to play an important role in the county economy.

b) Pipeline Routes

i. San Luis Obispo County

The economic base of San Luis Obispo County is heavily dependent on the government, trade, and service sectors. Agriculture also plays an important role, but it is not as significant as in Santa Barbara or Kern Counties. Government accounts for over 32 percent of the county's total resident employment and will probably continue as a growth leader. However, manufacturing comprises only 5.5 percent of the total employment. Transportation cost disadvantages may preclude extensive development of manufacturing. The wholesale and retail trade category is expected to increase, due partly to local efforts which are being directed towards promoting the county as a regional trade center and towards increased recreational activities.

San Luis Obispo County has two distinct climatic zones (coastal and inland) which have influenced economic development, particularly in the recreational and agricultural sectors. The Pacific coastline provides the focal point of many of the recreation and tourist attractions and related services. The inland area accounts for lands with high agricultural productivity, and the mountainous regions favor grazing activity.

Total agricultural output jumped to a record level in 1976. The $93.3 million in valuation was more than 57 percent above 1972's production. The two major agricultural products were vegetable crops and livestock.

San Luis Obispo County construction activity in 1974 accounted for $43.1 million, as compared to Santa Barbara County, which accounted for $72.8 million in the same year. In San Luis Obispo County, nonresidential buildings accounted for less than 14 percent of the total 1973 valuation. In Santa Barbara County, nonresidential construction in 1973 accounted for approximately 28 percent of the total 1973 valuation.

The population of San Luis Obispo County in July 1974 was estimated to be 128,888 residents. Most of the residents live along the coastal region, with an urban population near 60 percent. The largest cities are San Luis Obispo, the county seat (31,900), Arroyo Grande (8,225), Morro Bay (7,875), and Paso Robles (7,550).

The county had a higher growth rate than the state averaged between 1960 and 1970. Since 1970, the population growth rates have continued to exceed the state average. From 1970 to 1973, the county's population increase was 10.9 percent greater than that of California.

The total resident civilian labor force in 1977 was 51,600, of which 2,600 were unemployed. The unemployed accounted for 4.2 percent on a seasonally adjusted basis. This rate is unusually low for an agricultural area and may be an indication of the relatively minor role played by seasonal agriculture in the county's economy.

ii. Kern County

The economy of Kern County will probably not change appreciably from a predominantly agricultural and petroleum production base. However, a slow evolution is taking place with one segment of the economy advancing as another one declines. At the present time, the number of persons employed in nonagricultural jobs is increasing at a faster rate than for agricultural jobs, with wholesale and retail trade, government, and services recording the largest numerical and percentage gains. While manufacturing and other nonagricultural activities increase in importance, they are not expected to do so at the expense of agriculture. Kern County has been included among the top five counties in the nation in total farm production for over 20 years, and there is no evidence which suggests any change in this status.

The population in Kern County continued to increase during 1974, the provisional mid-year total being 341,300 persons. This figure represents a 0.3 percent gain from the 1973 revised total of 340,400 and was 3.1 percent above that recorded by the 1970 census. The population is 40 percent urban, with 22 percent of the population living in Bakersfield (76,200), the largest city and county seat. Next ranking cities are Delano (15,200) and Ridgecrest (13,050). Ridgecrest is one of the fastest growing cities in the county.

Moderate population growth is projected in Kern County for the remainder of the century and should occur at a rate lower than the state in general. Bakersfield and other established communities would expand as a result of population growth in the area. Only minor growth is expected in areas near the proposed pipeline route. Several resort-type communities such as Stallion Springs have already been subdivided and partially developed in the region. In the past, such attempts have proven unsuccessful, but should these developments succeed, others are likely to follow.

Since Kern County is one of the richest agricultural areas in the world, stable economic growth is projected for the future. In 1976, agricultural production amounted to $874 million, a 17-percent increase over the previous year. In 1973, 809,578 acres were under production. At that time, predictions indicated that approximately 1.1 million acres of land would be under cultivation by 1980, largely due to the availability of water from the California State Water Project. It is not certain how the severe drought in late 1977 and early 1978 would affect these projections. In addition, gains in yield per acre are maximizing due to improved methods, plant varieties, new harvesting techniques, and more sophisticated management.

In the past, the value of mineral production exceeded agricultural production. However, with continued growth in agriculture, this trend is expected to reverse itself as mineral production stabilizes.

Two military installations, Edwards Air Force Base and the Naval Weapons Center at China Lake, account for approximately 83 percent of all Federal jobs in the county. Total civilian employment reached 160,100 persons in 1976, a 23-percent increase above the level registered in 1973. The seasonally adjusted rate of unemployment was 5.9 percent.

9. Land Use, Recreation, and Aesthetics

a) Land Use

The LNG facility would be located on a 209-acre site available from the Southern California Edison Company (SCE). SCE owns a 975-acre parcel in this srea, purchased from the Hollister Estate Company in August 1965. The utility had planned to construct a nuclear power plant on the site and so obtained permanent easements for a powerline right-of-way through the Hollister property to the transmission corridor, as well as a transportation easement over the existing Hollister Ranch Road to Highway 101. Subsequently, the Hollister Ranch Corporation was formed, and the ranch holdings were divided into 135 parcels, each a minimum of 100 acres. The parcels are being sold as home sites; however, cattle grazing will continue on much of the property in order to maintain the current agricultural preserve designation of the ranch.

Most of the ranch, including the proposed site, is zoned 100-AL-O (Limited Agricultural) by Santa Barbara County. According to the applicant, the county plan is currently being updated and "will include extensive consideration of the consolidation of oil and gas-related facility developments along the coast." Whether this will include provisions for an LNG terminal at Point Conception is not known; however, the California Liquefied Natural Gas Terminal Act of 1977 exempts the applicant from local permit (zoning) requirements.

The portion of the site lying between the mean high tide line and the base of the bluffs overlooking the ocean is zoned BD (Beach Development). The BD district is outside the SCE property, under state control, and would be affected only by the trestle. The zoning is highly restrictive in the uses it permits and is designed to protect the ocean beaches.

There is some minor development within the site vicinity. The developments around Government Point include a 55,000-barrel, white-pointed oil storage tank, equipment sheds, and a caretaker's shack. There is also a small beach cabana just to the west of the Canada del Cojo and 500 feet south of the site which is occupied intermittently during warm months. Residences, barns, and sheds are located at the Cojo Ranch, approximately 9,000 feet northwest of the site. In addition, a Southern Pacific railroad line parallels the coast along the edge of the site.

The majority of residential development in the area has occurred on the Hollister Ranch property. As of March 1, 1977, 85 parcels of the total 135 available had been sold to individual buyers. Homes and other improvements had been completed on 16 of the 85 parcels as of that date. Seven of these improved parcels are in the vicinity of the proposed site, as shown in figure 30. The proposed site is located below parcels 9 and 10 in this figure.

The Bixby Ranch is located immediately to the west of the SCE property (figure 31). This property has also been subdivided and will be sold in sections. It has been reported recently that the Bixby Ranch Corporation is currently planning to develop its coastal properties immediately adjacent to the proposed site.

Access to the Point Conception area is via private roads which are strictly controlled. The principal highway through Santa Barbara County is U.S. Highway 101, a multiple-lane highway which is one of the major north-south transportation routes for California. At its closest approach, the highway is approximately 10 miles east of the proposed site. Two of the proposed access routes to the site would utilize the Gaviota Beach exchange of Highway 101 and follow the existing Hollister Ranch access road or parallel the existing railroad right-of-way. The third alternative would involve Jalama Creek road, which exists from U.S. Highway 1 near White Hills.

Highway 101 is a heavily traveled thoroughfare in this area. The 1977 average annual daily traffic count (ADT) east of Gaviota was 17,100. This load is considerably higher in the summer, however, with a peak-hour traffic count of 2,550 and an ADT during the peak month of 26,000 cars. By contrast, Route 1 experiences very little traffic east of Lompoc. The 1977 average ADT was 3,100, with a peak month ADT of 4,250 cars.

The applicant also proposes to construct 112.4 miles of 34-inch diameter pipeline. If the proposed terminal is expanded to the legal maximum, an additional 45 miles of looped 34-inch diameter pipeline would be required. The majority of the proposed pipeline would traverse open fields primarily used for grazing. A summary of the land uses to be traversed, by county, is given in the following table.

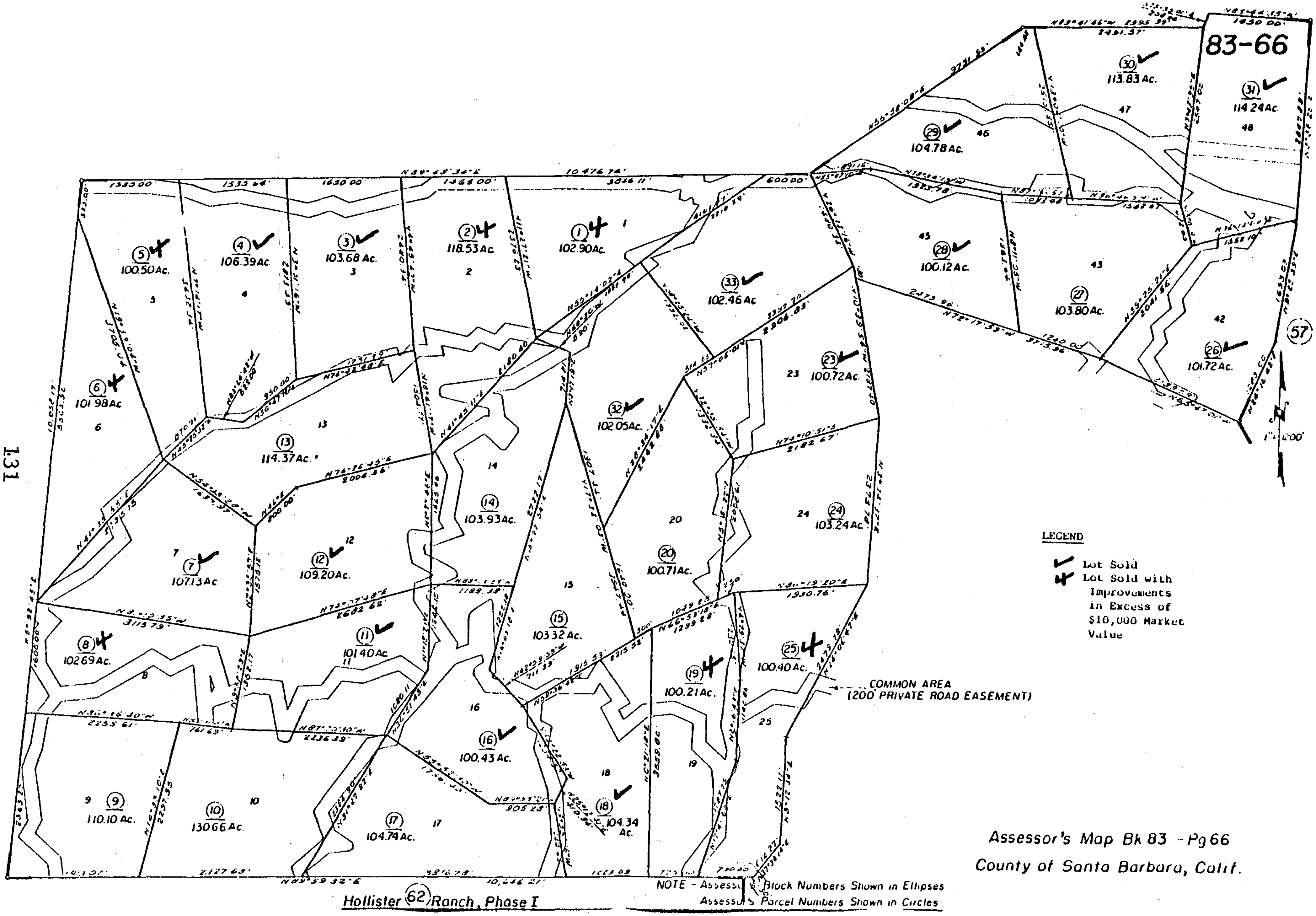


Figure 30: Properties Sold and Developed in Site Area

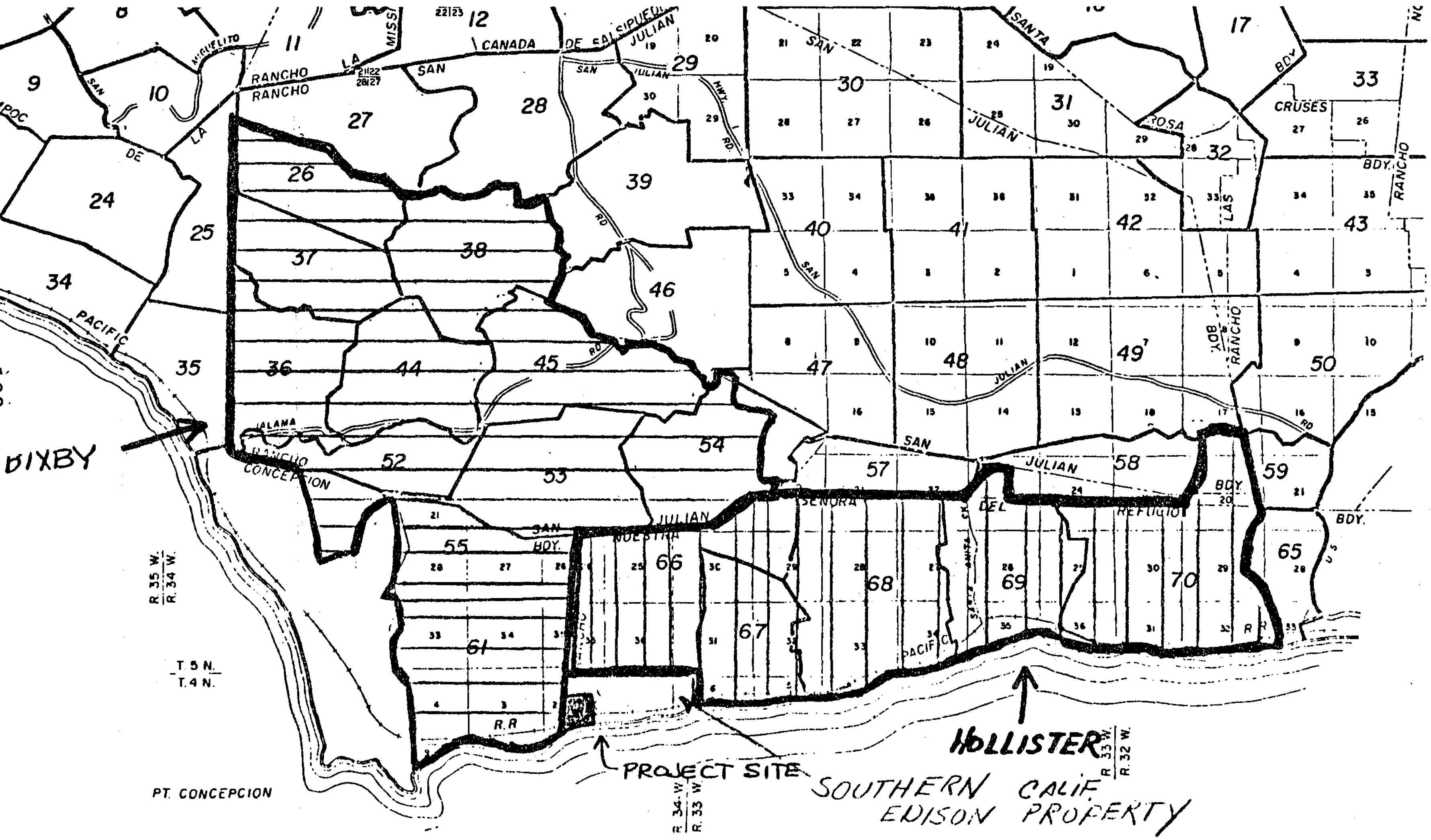


Figure 31: Hollister and Bixby Ranch Property Boundaries

TABLE 28

PERCENTAGE OF EXISTING LAND USES TRAVERSED BY PROPOSED PIPELINE

	Santa Barbara	San Luis Obispo	Kern
Open Space/ Grazing	88.5	92.7	39.5
Open Space/ Extractive	1.3	7.3	48.5
Agriculture	10.2	0.0	12.0

The pipeline would traverse several notable areas. At MP 40, the proposed pipeline would enter the Los Padres National Forest. Approximately 15 of the next 20 miles of pipeline would traverse National Forest Land. At approximately MP 87, the proposed pipeline would cross 14 miles of the former Elk Hills Naval Petroleum Reserve. This land is now administered by the U.S. Bureau of Land Management. Several small communities are located within one-half mile of the proposed pipeline, including Las Alamos (pop. 596), Derby Acres (353), and Dustin Acres (203).

b) Recreation

There are two ocean parks in the vicinity of the proposed terminal site. Jalama Beach County Park, located approximately 12 miles northwest, is a 23-acre facility. Camping, picnicking, fishing, and surfing are the major activities here. Ten miles east of the site is Gaviota State Park. This 2,776-acre park has 59 developed sites for camping and trailers. The major activities are fishing, horseback riding, and swimming.

Much of the coastline along Point Conception is privately owned, and access to the public is restricted. However, ownership extends only to the mean high tide line, leaving the beach available to those with water access. This is the case offshore of the Hollister Ranch, where several surfing beaches are accessible only by boat. The local beach immediately adjoining the proposed LNG site, Cojo Reef, has been ranked by the Western Surfing Association as "fair." Cojo Point, west of the site, is considered "classic." Lefts and Rights, east of Barranca Honda and Gato, is rated "good." 1/ Despite access restrictions, these beaches are regularly used by surfers.

Because of the land access restrictions, most of the unorganized recreation in the site area takes place offshore. Sport diving is popular here because of the concentrated abalone, spiny lobster, and fish populations. Sport fishing is also popular here, yielding approximately 32 percent of the total sport catch in the region from Gaviota to Surf. Both divers and fishermen make use of the boat-launching facilities at Gaviota State Park.

Along the proposed pipeline route, the major recreation area is the Los Padres National Forest. Approximately 15 miles of the proposed pipeline would cross National Forest lands; however, much of this area is in rugged mountainous regions of the forest with no regular means of access. No established recreational areas of the National Forest would be crossed by the proposed pipeline.

No other major Federal or state recreational areas would be crossed by the proposed pipeline, although several areas are within 1 mile of the proposed route. At MP 15, the pipeline would pass within one-half mile of Santa Rosa Park in Santa Barbara County. This 18-acre county facility is primarily for day use, with a picnic area and playground. At MP 86, the pipeline would be within 1 mile of Derby Acres Park in Kern County. This 3.8-acre facility is primarily a community park, with a baseball field, croquet court, and tot lot. Finally, at MP 100, the pipeline route would pass within one-half mile of the Buena Vista Golf Course.

1/ Classic - Often an internationally known location that has been surfed for many years, receiving a great deal of publicity in both the general media and surf publications, and, as such, playing a key role in the heritage and history of the sport of surfing in California. In addition, a surf break with waves whose potential for size, quality and frequency in relation to other surf spots makes it a unique surfing resource.

Good - Frequently provides waves of excellent size and quality.

Fair - Provides waves of lesser frequency and/or size and quality.

(Western Surfing Association, 1974)

c) Aesthetics

The proposed LNG terminal site is in an area of high aesthetic value. Despite its limited access, this stretch of coastline has long been known and praised for its lack of development and great scenic beauty. In 1966, the Santa Barbara County General Plan stated, "The shoreline that extends from Jalama Beach to Gaviota Beach is some of the most scenic in the county. At Point Conception, the view of rocky and rugged shoreline is comparable with any in the nation. In other sections there exist quiet coves with gently sloping beaches." In 1975, the California Coastal Plan noted that "three large properties around Point Conception provide the longest stretch of undeveloped coastline in Central California." This was updated in 1977 when the California Coastal Management Program designated the area from Point Arguello to Gaviota as a "Significant Coastal...Area" to be included within the coastal zone boundary. At that time the area was described as "the last open space segement of the Southern California coast." In 1978, the California Coastal Commission submitted its final staff report on power-plant siting in the coastal zone. Although the land area of Point Conception had not previously been designated as incompatible with a power plant, a large public outcry caused the Commission to designate the land area from Gaviota to the Vandenburg Air Force Base. Although the factors for designation are questionable (based mainly on recreational potential and scenic protection of the view from the railroad), the designation is symbolic of the continuing support of the California coastal agencies for the protection of this "semi-wild" section of coastline.

Because of its isolated location and the height of the coastal bluffs, this scenic view is not visible from anywhere but nearshore waters and beyond. Aside from Hollister Ranch and potential Bixby Ranch residents, the site is visible on land only to passengers of the Southern Pacific Railroad which crosses the Hollister Ranch twice daily. However, limited access and exposure only enhance the scenic beauty of this undeveloped area.

The majority of the proposed pipeline route would traverse open lands whose aesthetic value as a whole is minimal. Prominent and distinctive features of the landscape tend to be the most important aesthetic elements. Thus, such features as the peaks of mountain ranges and ridges and natural features such as Soda Lake have a high aesthetic value.

The proposed pipeline route would cross several designated scenic roads or corridors. These official scenic highways are designated by the state and administered by the county to protect and enhance adjacent roadside land. The state scenic highways traversed are:

California Route 1 (Scenic Corridor)	MP 8.5
Santa Rosa Road (Scenic Road)	MP 14.8
Tepusquet Road (Scenic Road)	Parallel

Tepusquet Road would be paralleled by the proposed pipeline a total of 6 miles between MP 33.0 and MP 43.4. In addition, U.S. Highway 101 has been proposed as a scenic corridor in the area of the pipeline crossing at MP 25.7.

In Kern County, the pipeline route would traverse an area serviced by three roadways eligible for county scenic highway status. These three roads--State Route 119, Elk Hills Road, and Tupman Road--are part of a 40-mile scenic circuit.

10. Archaeological and Historical Resources

To evaluate this project, the applicant and staff have consulted the National Register of Historic Places for historic properties at the proposed terminal site and along the proposed pipeline route. Only one National Register property is within 3 miles of the proposed facilities--the Los Alamos Ranch House, 2.5 miles from the proposed pipeline at MP 25. The applicant has checked the list of California Historical Landmarks; nearby properties on this list are the Tulamnia Indian Site, 3 miles from MP 100, and the Chapel of San Ramon, 0.25 mile from MP 33.5. The only local landmark near the facilities is the Point Conception Lighthouse, 2.2 miles west of the proposed terminal site.

Literature and field studies have demonstrated that there are numerous cultural properties in the vicinity of the proposed terminal and pipeline. Surveys have been performed for the applicant by the University of California at Los Angeles Archaeological Survey (UCLA) under the direction of William Clewlow. A study was also carried out for the California Public Utilities Commission (CPUC) by Chester King and Steven Craig. The results of these studies differ significantly.

Both surveys covered the eastern half of the Southern California Edison property between the northern Edison property line and the southern shore and from the western property line east for about 1.25 miles. However, the CPUC survey extended only about 1 mile eastward from the western property line and apparently omitted the western bank of Canada del Cojo. Neither survey used subsurface site identification techniques and instead relied upon a systematic surface inspection. The 7-person UCLA field crew covered the 600-acre area in 1 day (including transportation), an average of 85 acres per person. The CPUC study was much more intensive in this part of the Edison property: six 1-by 1-meter or 1- by 0.5-meter test pits were excavated to recover material from four of the five sites found, and another 43 small diameter tests were dug to locate the approximate site boundaires and depths. Site data are presented in table 29.

The locations and number of sites at the proposed terminal property reported by these surveys varies. The CPUC survey found three sites unreported by the UCLA survey. SBa-1525 was found in an eroded area overlooking Canada del Cementerio; this site is a 140- by 140-meter concentration of stone flakes and tools. SBa-1504 is a very light scatter of lithics approximately 10 by 20 meters; it is atop a prominent hill overlooking SBa-1501. The third site, SBa-1501, which is on

TABLE 29

HISTORIC PROPERTIES AT OR NEAR THE PROPOSED CHANNEL COAST FACILITIES

SITE NAME	TYPE	SIZE	DEPTH	BURIALS	DISTURBANCE	COMMENTS
CANADA DEL COJO AND CEMENTARIO DRAINAGE						
--Sites on the 209-acre Terminal Plot						
SBa-546	Village	270x125m	70cm	Probable	Erosion, Roads, RR	Part of Shisholop
-1500	Village	100x170m	110cm	Probable	Road	UCLA's PC-F
-1501	Sweat Lodge	17x13m			None	Unique Size, Preservation
-1502	Village	150x175m	60cm	Probable	Road	UCLA's PC-A
-1505	Village	130m diam	70cm	Probable	None	Long, Intensive Occupation
Lithic scatter all along Cojo, especially at confluence with Cementario, may indicate buried components						
--Other Sites on Western Half of Edison Property						
PC-D	Lithic Scatter	10x10m				
PC-E	Single Tool					
SBa-1504	Shrine Site (?)	10x20m				
-1524	Limited Activity	3x5m				UCLA's PC-B
-1525	Lithic Scatter	140x140m				
-1526	Limited Activity	20x60m				Probably UCLA's PC-C; Two Concentrations of Lithics
T-1	Small Habitation	30x70m			Railroad	
BARRANCA HONDA AND CANADA DEL GATO DRAINAGE						
--Sites on Eastern Half of Edison Property						
SBa-202	Village	105x125m			Some Erosion	UCLA's PC-5
-545	Small Habitation	35x100m			Grading	
-1476/1477	Village	80x160m		Yes	Road, RR, Grading	UCLA's PC-1 & -2
-1478	Lithic Scatter	3m diam.				UCLA's PC-3
-1479	Lithic Scatter	30x45m			Eroded	UCLA's PC-4
-1496	Small Habitation	10x50m				
ON OR NEAR RAILROAD PARALLEL ACCESS ROAD						
SBa-1491	Village			Probable		
-1492	Village	40x205m		Probable	On Periphery	Historic, Possibly Kastayet
-1493	Village	70x180m	35cm	Probable		
-1494	Village	55x280m	70cm	Yes	Mostly Intact	Historic, Possibly Tehaja
-1495	Village	35x375m		Probable		Historic, Possibly Lishil
Five additional village sites are known between Gaviota and Santa Anita Canyon						
A late 19th to early 20th century shipping port was located at the mouth of Gaviota Canyon						
ON OR NEAR IMPROVED HOLLISTER RANCH ROAD PROPOSED ACCESS ROUTE						
SBa-97	Village					On Row
T-4	Not Reported					On or Adjacent to Row
Also sites SBa-1491, -545, -1479 (above)						On or Adjacent to Row
ON OR NEAR PROPOSED POWERLINE ROUTE						
SBa-96	Village					Adjacent to Row

the proposed terminal property, is a large oval depression approximately 17 by 13 meters across and up to 80 centimeters deeper than its conspicuous rim. The site is covered by ankle-height grass and a sparse scattering of low shrubs and is crossed by cowpaths which have allowed erosion to notch the rim. In testimony, Clewlow has stated that this is not a particularly distinctive feature and that some people might think it is a cow wallow. The staff disagrees. The feature was observed during a staff field inspection of the proposed terminal site where it lies on the edge of the steep eastern bank of Canada del Cojo.

The structure at SBa-1501 is believed by King and the staff to be the remains of a late period sweat lodge. Generally, such structures are known to have been used by Native Americans in many areas of the continent, often in a ritual context for purification of the body. This example was probably a covered, semi-subterrainian structure. Ethnohistoric accounts relate that access to the lodge was through a smokehole at the top of the roof and then downward by ladder. Heated rocks or an open fire provided the heat. Access to the sweatlodge may have been limited according to the social structure of its builders--by sex, for example, or age, affiliation with a club, political, social, or religious position, etc.

While features of similar size are not uncommon in northern California, this large structure may be unique in the Channel Coast area and may be related to SBa-546, believed to be part of the remains of Shisholop, an historically documented political and trading center of the western Channel area Chumash Indians. Shisholop was within the westernmost range of the Chumash plank canoe, a vessel which facilitated seagoing travel along the Channel coast and to the Channel Island villages of San Miguel. The historic literature states that Shisholop participated in an economic system using beads as a form of currency. The importance of Shisholop was also enhanced by its nearness to Point Conception, from which the Chumash sent the souls of their dead to the West.

In addition to the sweat lodge and SBA-546, three other village sites are on the originally proposed terminal location. These are SBS-1500 (PC-F), a large shell midden and lithic scatter; SBa-1502 (PC-A), possibly the oldest site on the property; and SBa-1515, a probable early Middle Period settlement. 1/ The entire floodplain of Canada del Cojo from the

---

1/ UCLA's temporary designations were preceeded by "PC-"; CPUC's are assigned county designations, preceeded by "SBa-," and are the recorded locations in the Santa Barbara County site files.

sea to Canada del Cementerio is covered with a light lithic scatter. It is likely that cemeteries are associated with these villages. A purported chart tool was found 5.3 meters below the ground surface during recent geological trenching, but the manmade status of the object is debated.

The UCLA survey of the eastern half of the Edison property found four sites along the Barranca Honda and Canada del Gato drainages. A large part of this area was also covered by the CPUC, which confirmed most of these discoveries. The reports differ in that SBa-1526 (PC-C) is located farther south by CPUC than by UCLA; it is reported as a 3- by 5-meter lithic scatter by UCLA but as two areas of chipped stone tools by CPUC. The CPUC survey also discovered SBa-1496, which may have been east of the UCLA study area.

Although no burials associated with the ancient villages have yet been found at Cojo, the staff believes there is a reasonable probability that some do exist there. Accounts by the Spanish explorers indicate that cemeteries were placed both in and near coastal villages, and this has been confirmed archaeologically.

The Point Conception area had great spiritual importance to the ancient Chumash. Its placenames recorded by John P. Harrington, an ethnologist who collected Chumash oral traditions from 1912 to 1922, refer to the kak, giant ravens of the spirit world that peck out the eyes of the soul as they pass. Harrington also recorded a narrative describing the journey of the deceased: the soul wanders the earth for 5 days before it travels to Point Conception, where it bathes in a pool; there it sees a light to the west and goes toward it, reaching the land of the souls. The informant for this account maintained that in ancient times, no village was there, that people went to Point Conception only to make offerings at a major shrine. 1/ Upop, the daughter village of Shisholop, was the location of one of two religious centers on the Channel Coast. Every March a major gathering was held there, drawing participants from the other political province centered at Point Mugu. These ceremonials were apparently associated with bringing the solar and lunar calendars into agreement and had a counterpart in January at Mugu.

1/ SBa-204 is the only archaeological site recorded at Point Conception. County site records do not indicate its period of occupation.

The spiritual significance of the Point Conception area was the subject of a series of interviews with Native Americans sponsored by the CPUC and hearings sponsored by the California Native American Heritage Commission (NAHC). The "Findings" of the NAHC are presented in appendix O. One interview elaborates on the Chumash tradition of the gifted men recorded by Harrington. The seven were buried at the third little canyon northeast of Point Conception according to Victor Lopez, a Chumash born before the turn of the century. This would appear to be at Canada del Cojo.

The religious issue has become the focus of an emotional controversy highlighted by the occupation of a "spiritual encampment" at Canada del Cojo since July 1, 1978. Chumash traditionalists have expressed strong opposition to the proposed project because of the spiritual significance of Point Conception and because the proposed construction might disturb the graves and burial offerings of their ancestors. Representatives of the Luiseno, one of the more traditional Californian tribes, have acknowledged the sacredness of the area to their people in testimony before the NAHC. Local Chumash have been active in securing unearthed ancient burials and grave goods and reinterring them with the appropriate ceremonies. Unfortunately, it does not appear acceptable to mitigate the religious value of the site with a similar measure.

While traditionalist Chumash consider all land sacred, a significant area of concern is the part of the coast they call Ha Like, which includes considerably more than Point Conception itself. While this area has been kept relatively undisturbed, access to the Chumash has been tightly controlled. No ceremonial gatherings have occurred in the area for decades, but it is purported that individuals clandestinely visit for ritual activity and that a vision pit overlooking the Point and the proposed site has been in use for over 4 years. Sweats, dances, reburials, pipe ceremonies, and other ritual activities have had to take place elsewhere.

Ethnographic literature shows that the Chumash have long considered the earth sacred. Traditionalist Chumash hold that the scarring of the earth, the disruption of animal life, and the aesthetic intrusion of an industrial complex would destroy the spiritual balance of the Point Conception area. As Keepers of the Western Gate, they maintain that this door to the afterlife would be closed to their souls and to the reincarnation of their ancestors if an LNG terminal were built on the proposed site.

The present-day Chumash are not a reservation-based group. Their nonlanded status precludes the social interaction that comes from living in large communities sharing the same cultural values. In such a context, symbols of traditional life and the opportunities for cultural self-recognition afforded by religious activities assume even greater importance in maintaining an ethnic identity. Industrial development of the Point Conception area would debase a significant historic and spiritual feature of the Chumash religious tradition. Reducing the culture's religious content would impair its appeal to marginal participants and potential neophytes, undermining its prospects for survival

Because one offshore archaeological find is known 300 feet south of the proposed marine trestle and because the probability of underwater sites is increased by the proximity of onshore historic properties, an underwater survey was sponsored by the applicant. In this survey, a diver/archaeologist visually inspected the ocean floor along transects parallel to the shore. The systematic stratified sampling scheme was weighted toward areas more likely to have cultural material and covered 50 percent of two potential locations for trestle construction. Side-scan sonar charts were examined and revealed one modern shipwreck which is well away from any proposed construction area. No other resources were found.

Access routes to the proposed terminal have been assessed for cultural resources by the applicant for the improved Hollister Ranch Road, and by the CPUC for the route paralleling the Southern Pacific Railroad tracks. The newly proposed improved Hollister Ranch Road route was evaluated by a site file search and by a partial field survey, which was restricted to the railroad right-of-way, since permission to survey on private land was not granted. Five known sites may be affected by improvement of the Hollister Ranch Road (table 29), and others may be found by a complete field survey.

The access road originally proposed to parallel the Southern Pacific Railorad right-of-way was surveyed from the proposed terminal site to Santa Anita Canyon, and given a cursory inspection from there to Gaviota. At least five sites would be impacted between Gaviota and Santa Anita Canyon; another five sites between Santa Anita Canyon and the proposed terminal (table 29). In addition, SBa-202,545, and 1476/1477 on the Edison property would possibly be impacted. The railroad route is described by the CPUC as extremely sensitive.

Cultural resources were located by the applicant along the most recent powerline route proposal using a site file search. This proposed route would apparently pass near only one known site that could be impacted.

Parts of the proposed pipeline right-of-way were surveyed by the applicant and the CPUC. Combining their surveys provides nearly complete coverage. The UCLA study included a literature survey for the whole route and a walk-over survey from approximately MP 11 to MP 67 of a 150-yard wide corridor centered on the proposed route. The UCLA survey apparently did not include possible access roads, storage yards, and other ancillary construction areas. As in the terminal survey, the teams searched only for surface indications of human activity. Results of the literature search and field work are presented in table 30.

Chester King's study of the proposed right-of-way for the CPUC was similar to UCLA's field work, surveying a transect along the proposed route usually wider than 200 feet. The CPUC study investigated much more of the proposed pipeline route, covering from the Edison property to MP 12.3 and most of the proposed route from MP 26.7 to MP 112.4. The area between MP 12.3 and MP 26.7 was spot-checked with negative results. When sites were found, alternative routes which would avoid resources were surveyed within a corridor that could be used for construction. The results of the CPUC's work provide an inventory of sites on the present proposed route, sites near the proposed route that could be affected by deviating from it, and suggested alternative routes. Table 31 summarizes cultural resources identified by the CPUC along the proposed route. As with the terminal survey, the results differ considerably from those of UCLA.

At Jalama Creek, the route would cross SBa-1508, an area of lithic scatter that may have a subsurface component. Two other isolated finds were made between Jalama and Ytias Creeks. An alternative route to bypass SBa-1508, which would add 0.13 mile to the pipeline, was also checked.

The Ytias Creek drainage was an area of substantial aboriginal activity. The historic Chumash village of Itiyaqs, the likely center of this activity, is probably represented by SBa-242, which is neatly bisected by the proposed route. Other cultural remains would also be crossed by the proposed right-of-way. Neither SBa-242B nor another site reported in

TABLE 30

HISTORIC PROPERTIES IDENTIFIED BY THE APPLICANT'S LITERATURE SEARCH AND FIELDWORK

Site	Mile-post	Year Reported	Distance From Route	Comments
SBa-542	1	1950	0.8 mi.	Shell scatter
-206	4		0.95 mi.	Village, Jalama Crk.
-544	4	1950	0.8 mi.	Large scatter, Jalama Crk.
-242		1950	Not Given	Village
-242A	11	1974	200 ft.	242A-D are campsites; scatter may cover 1 mi. of Ytias Crk. drainage
-242B	11.5	1974	On ROW	
-242C	11.3	1974	On ROW	
-242D		1974	Not Given	
-74A	26.7	1974	On ROW	Campsite
SLO-336	67	1960	1.0 mi.	Pictograph
-79	68.5	1876	2.7 mi.	Known as Painted Rock
-105	70	1950	3.5 mi.	Pictograph and bedrock mortars
-AS-105	70	1950	3.5 mi.	Pictograph and bedrock mortars
KER-50	98	1926	0.4 mi.	Burial
-49	98	1926	Not Given	Burial
-119	100	1963	1.2 mi.	Midden, part of complex on Buena Vista Lake
-240	100	1959	1.0 mi.	Vandalized, on Buena Vista Lake
-241	100	1959	1.65 mi.	On Buena Vista Lake
-118	101	1963	1.75 mi.	Midden, on Buena Vista Lake
-44	102	1926	2.0 mi.	Village, excavated

TABLE 31

HISTORIC PROPERTIES ON OR NEAR THE PROPOSED PIPELINE ROUTE

SITE NAME	TYPE	SIZE	BURIALS	DISTURBANCE	LOCATION	COMMENTS
JALAMA CREEK						
SBa-1508	Lithic Scatter	25x57m			On ROW	Possibly a Small Buried Occupation
Two isolated artifact finds along Jalama Creek						
YTIAS CREEK						
SBa-242	Village	70x200m	Probable	None	On ROW	Historic, Probably Itiyaqs
-1510	Probable Cemetary		Probable		On ROW	Artifacts Include Probable Gravemarkers
-1498	Lithic Scatter				On ROW	
-1511	Lithic Scatter		Probable		On ROW	Artifacts Include Probable Gravemarkers
-242B	Camp				On ROW	King Could Not Relocate
-242C	Camp				On ROW	
-1509	Village	70m diam.	Probable	Erosion	Near ROW	Colluvial Deposition Over Parts
-1499	Village	80x100m			Near ROW	
-1512	Limited Activity	100x275m				Near Alternative Route
Barn and farmhouse remains						
Three isolated artifact finds on or near ROW; three on or near alternative route						
HOWARD CREEK						
SBa-74A	Camp				On ROW	King Could Not Relocate
TEPUSQUET CANYON						
--Sites Found By King						
SBa-1516	Village	100x150m			On ROW	Late Period
-1517	Small Habitation	75x50m			On ROW	
-1518		45x100m			Near ROW	1518, 1519, and 1520 Are Clustered
-1519		35x100m	Probable		Near ROW	Together; Mixed Ages
-1520	Quarry	25m diam.			Near ROW	
-1521	Small Habitation	35m diam.		Recent Constrn.	Very Near ROW	
-1531		36 sq. m.		Recent Constrn.	Near ROW	Buried Site, Possibly Much Larger
Five isolated artifact finds in canyon						
--Sites Reported By Local Residents						Many of These Sites are Buried
L1	Adobe				Near ROW	c. 1860
L2	Basketry Cache					
L3	Adobe				Near ROW	c. 1860
L4	Adobe				On ROW	c. 1860
L5	Poss. Habitation					Prehistoric; Bowls and Metates Reported
L6	Poss. Habitation					Prehistoric; Bowls and Metates Reported
L7	Poss. Habitation					Prehistoric: Metates Reported
L8	Poss. Habitation				On ROW	Prehistoric; Sandstone Bowl Reported
L9	Poss. Habitation				On ROW	Very Large Area, Possibly Two Sites
L10	Cemetary					Ontiveros Family Cemetary
L11	Poss. Habitation					Prehistoric
L12	Adobe				Near ROW	c. 1860; Probable Location

TABLE 31 (CONTINUED)

SITE NAME	TYPE	SIZE	BURIALS	DISTURBANCE	LOCATION	COMMENTS
BUCKHORN CREEK						
SBa-1532	Habitation				On ROW (?)	4 Bedrock Mortars, Poss. Housepit and Midden
GILLIAM SPRING						
SLO-821	Lithic Scatter	75x300m			On ROW	
WEST SIDE OF CARRIZO PLAIN						
SLO-822	Lithic Scatter	10x20m			Near ROW	
Three isolated artifact finds on ROW						
TEMBLOR RANGE						
SLO-823	Lithic Scatter	75x100m			Very Near ROW	Possible Buried Site
-824	Lithic Scatter	100x200m	Possible		On ROW	
BUENA VISTA CREEK						
KER-659	Hearth	5m diam.			Very Near ROW	Shallow Depth
-660	Hearths	28x15m			Very Near ROW	Shallow Depth
-661	2 Hearths	5x7m			On ROW	Shallow Depth
-662	3 Hearths	20x50m			On ROW	Shallow Depth
ELK HILLS						
KER-663	Camp	c. 10m diam.			Near ROW	
-664	Camp	c. 10m diam.			Very Near ROW	
-665	Camp	c. 10m diam.			Very Near ROW	
KERN RIVER FLOODPLAIN						
KER-666	Midden			Severe	On ROW	Lower Levels May Be Intact
-667	Midden			Severe		Lower Levels May Be Intact
-668	Village	75x250m	Yes	Partly Intact	On ROW	Dance House Intact, Unique in Region
-669	Midden			Severe	On ROW	Lower Levels May Be Intact

1936 which would lie on the proposed route could be confirmed by the CPUC survey. Nearby are two other sites which could be impacted if the route deviated from the proposed alignment and several areas where isolated artifacts were found. An alternative route with no cultural resources which would add 1.67 miles to the pipeline was surveyed by the CPUC survey. This alternative would pass near SBa-1512 and additional isolated finds.

In 1974, UCLA reported SBa-74A in Howard Canyon on the proposed route, but it could not be located by the CPUC group.

The proposed pipeline route would parallel Tepusquet Creek for 4 miles along a canyon that is about 0.2 mile wide. Rerouting to avoid significant areas in the canyon would be difficult. Although the UCLA study recorded no cultural resources in the Tepusquet Canyon area, the CPUC survey found indications of substantial and diverse activity. The CPUC survey discovered seven prehistoric sites and five other areas with isolated artifacts; it collected reports from local residents of an additional seven prehistoric sites and four historic adobe structures (table 31). Five of these would be crossed by the proposed route. The CPUC study suggests an alternative route along the steep eastern side of Tepusquet Road to avoid these sites, while the applicant has suggested a longer alternative route through rugged terrain west of the canyon.

Just north of the Tepusquet Canyon properties is another site recorded by CPUC, SBa-1532. This site is four bedrock mortars adjacent to the proposed right-of-way at MP 43.7. The area includes an alluvial terrace which may hold a housepit and other cultural material. The pipeline would thread the 100-foot wide gap between SBa-1532 and Tepusquet Road. Since no subsurface testing was done at this location, the right-of-way could pass over buried portions of the site. The CPUC survey endorsed no alternative route.

SLO-821 is an area of lithic scatter in the Los Padres National Forest; the suggested alternative to avoid it would add 0.18 mile to the pipeline. On the west side of the Carrizo Plain, the CPUC survey found SLO-822, a small site 300 feet south of the proposed route, and isolated artifacts in three other areas on or very near the proposed right-of-way. The Temblor Range sites are probably early period settlements or later seasonal camps which would require an extra 0.16 mile of pipeline to avoid. The four hearth areas at Buena Vista Creek would add 0.03 mile to the proposed pipeline if avoided. The three Elk Hills sites are concentrations of shells that probably represent ancient campsites. Three of the Kern River floodplain sites--Ker-666, -667, and -669--have been nearly destroyed by grading and agricultural land leveling, but may still have intact lower levels.

Ker-668 is a village that has been partially disturbed by a pipeline right-of-way and heavy machinery travel. The proposed pipeline would cross undisturbed portions of the village, including the remains of a community dance house, the only such structure known in the Kern River Plain of the southern San Joaquin Valley. Cremated human remains were found exposed in the floor of the dance house, and other human bones were found in the backdirt of the extant pipeline. Mussel shell and artifacts were scattered on a mound area near the dance house.

The applicant has proposed three possible locations to dispose of dredged materials from construction of the seawater system pipeline. Other than past shipwrecks, it is unlikely that there would be discoverable cultural resources in either of these offshore areas because of the sediment cover and water depth off the Edison property and the sediment cover off Drake. Filling a ravine on the Edison property would not be likely to affect cultural properties, although the associated haul road and docking facilities might cause an impact if not properly placed.

The Canada del Cojo sites are likely to be eligible for the National Register of Historic Places as a district. These properties, isolated from modern activity and thus protected from amateur collectors who have vandalized a large number of other coastal sites, remain exceptionally intact. They would likely reveal data on the organization of villages of several time periods in an area where not even a single dwelling has been fully excavated. Evidence on changes in the subsistence base could be expected, as well as information on local and distant trade relationships. Elements of social structure and religious beliefs could be inferred from the villages and the cemeteries that are probably associated with them.

For many of the same reasons, the Ytias Creek and Tepusquet Canyon area may also be eligible as a National Register District. The Ytias Creek sites are isolated and undisturbed. Both Ytias Creek and Tepusquet Canyon have fairly discrete concentrations of sites that may have functioned as miniature interaction spheres. The deposition of soils on many of the diverse Tepusquet Canyon sites probably has limited the effects of development on sites in the canyon. Because of the unique dance house at Ker-668, this site is also likely to be eligible for the National Register. The remaining sites identified along the proposed route require further evaluation to determine their eligibility for the National Register.

11. Air and Noise Quality

a) Air Quality

The proposed LNG plant and the first 80 miles of the pipeline route would be located in the South Central Coast Air Basin, an area comprised of Santa Barbara, San Luis Obispo, and Ventura Counties. The remainder of the pipeline route would be located in the San Joaquin Valley Air Basin.

Santa Barbara County is divided into two air basins with the Santa Ynez Mountains forming the boundary between the two areas. The Southern Santa Barbara County Air Basin, which includes the LNG plant site at Point Conception, is designated a "nonattainment area" for photochemical oxidants (PO_x), carbon monoxide (CO), and total suspended particulates (TSP), indicating that ambient concentrations of these pollutants currently exceed their respective ambient air quality standard listed in table 32. The Northern Santa Barbara County Air Basin is designated nonattainment for PO_x and TSP.

Ambient air quality data for the immediate vicinity of Point Conception are not available; however, 1976 data for several air monitoring stations in Santa Barbara County are summarized in table 33. The closest TSP monitoring station is in the northern air basin and located at Lompoc, about 13 miles north of the plant site. The annual geometric mean of 60 $\mu g/m^3$ equals the national secondary and California standards. TSP levels were within the national primary 24-hour standard, while the national secondary standard was exceeded once and the California standard 12 times in 1976. Lower TSP levels were recorded at Goleta, the nearest complete monitoring station in the Southern Santa Barbara County Air Basin, located about 32 miles east of the site.

Levels of PO_x in southern Santa Barbara County were monitored at Goleta (1976) and at two locations in Santa Barbara, about 40 miles to the east. As shown in table 33, all stations exceeded the national standard. However, the annual number of days exceeding the Federal standards has declined in recent years as a result of emission control programs for mobile and stationary sources. 1/ Complete data for 1977 indicate that the Federal PO_x standard was exceeded on 16 days at the State Street Station and 21 days at the Goleta station.

1/ Quarterly Report - April, May, June 1977, Air Pollution Control District, Santa Barbara County, California.

TABLE 32

NATIONAL AND CALIFORNIA AMBIENT AIR QUALITY STANDARDS

(Concentrations in ug/m^3 Unless Otherwise Noted)

	Pollutant	National 1/ Primary Standard 2/	National 1/ Secondary Standard 2/	California Standard
1)	Suspended Particulate Matter			
	Annual Geometric Mean	75	60	60
	24-Hour Maximum	260	150	100
2)	Sulfur Dioxide			
	Annual Arithmetic Mean	80	--- 3/	---
	24-Hour Maximum	365	---	131 (0.05 ppm) 4/
	3-Hour Maximum	---	1,300	---
	1-Hour Maximum	---	---	1,300 (0.5 ppm)
3)	Carbon Monoxide			
	12-Hour Maximum	---	---	11 mg/m^3 (10 ppm)
	8-Hour Maximum	10 mg/m^3	Same as Primary	---
	1-Hour Maximum	40 mg/m^3	Same as Primary	46 mg/m^3 (40 ppm)
4)	Nitrogen Dioxide			
	Annual Arithmetic Mean	100	Same as Primary	---
	1-Hour Maximum	---	---	470 (0.25 ppm)
5)	Photochemical Oxidants			
	1-Hour Maximum	160	Same as Primary	200 (0.10 ppm)
6)	Hydrocarbons (Non-Methane)			
	3-Hour (6 to 9 a.m.)	160	Same as Primary	---
7)	Particulate Sulfate			
	24-Hour Maximum	---	---	25
8)	Hydrogen Sulfide			
	1-Hour Maximum	---	---	42 (0.03 ppm)
9)	Lead (In Particulate Matter)			
	30-Day Average	---	---	1.5
10)	Visibility Reducing Particles (Instantaneous)	---	---	10 Miles at Relative Humidity Less Than 70%

1/ National standards, except those based on annual averages or annual geometric means, are not to be exceeded more than once per year.

2/ Primary standards are designed to protect the public health. Secondary standards are designed to protect the public welfare from any known or anticipated adverse effects of a pollutant.

3/ --- No standard

4/ When such levels are in the presence of either 1-hour oxidant levels greater than or equal to 0.10 ppm or 24-hour particulate levels greater than or equal to 100 ug/m^3.

TABLE 33

1976 AMBIENT AIR QUALITY DATA 1/
SANTA BARBARA COUNTY, CALIFORNIA
(Concentrations in ug/m^3) 2/

TOTAL SUSPENDED PARTICULATES:

Location	Number of 24-Hour Samples	Number Exceeding Standards: Primary	Secondary	California	24-Hour Maximum	Annual Geometric Mean
Lompoc	49	0	1	12	171	60
Goleta	46	0	0	1	102	55
Santa Barbara (State St.)	61	0	1	11	171	67

PHOTOCHEMICAL OXIDANTS: 3/

Location	Number of 1-Hour Samples	Number Exceeding Standard	1-Hour Maximum
Goleta	8,634	97	456 (0.23)
Santa Barbara (State St.)	8,085	58	297 (0.15)
Santa Barbara (Cath. Oaks)	8,270	95	476 (0.24)

NITROGEN DIOXIDES:

Location	Number of 1-Hour Samples	1-Hour Maximum	Annual Arithmetic Mean
Goleta	8,154	361 (0.19)	47 (0.025)
Santa Barbara (State St.)	2,389	361 (0.19)	65 (0.034)

CARBON MONOXIDE:

Location	Number of 1-Hour Samples	Days Exceeding 8-Hour Standard	1-Hour Maximum	8-Hour Maximum
Goleta	8,385	0	10.4mg (9)	3.8mg (3.3)
Santa Barbara (State St.)	8,381	13	25.4mg (22)	13.4mg (11.6)

1/ Data provided by the California Air Resources Board.

2/ Concentrations of gaseous pollutants are also shown in parenthesis as ppm by volume.

3/ Concentrations measured by ultraviolet photometry.

Nitrogen dioxide (NO_2) levels at the Goleta site and the State Street site in Santa Barbara were within both the national and California standards. Carbon monoxide levels measured at these two sites were within the national standards, with the exception of the State Street site where the national 8-hour standard was exceeded on 13 days in 1976.

While complete sulfur dioxide (SO_2) and particulate sulfate data are not yet available for Santa Barbara County, recent data for April, May, and June 1977 1/ suggest that these pollutants do not exceed their respective national and state ambient air quality standards. The high 1-hour and 24-hour SO_2 levels measured at the State Street site in Santa Barbara were 0.02 and 0.01 ppm, respectively. The Goleta monitoring site reported high 1-hour and 24-hour SO_2 levels of 0.03 and 0.01 ppm. High 24-hour particulate sulfate levels of 9.3 and 12 $\mu g/m^3$ were recorded at Lompoc and Santa Ynez Airport, located about 22 miles east-northeast of the plant site.

The monitoring stations identified in table 33 are all influenced by urban activities and indicate a poorer air quality than would be expected at Point Conception. The area is primarily agricultural, with ships and boats the primary, but relatively minor, sources of air pollutants. Therefore, the man-made contribution to TSP, SO_2, and CO levels is low. In remote areas lacking representative monitoring data and with no significant emission sources within the project's area of impact, EPA has suggested air quality levels which can be assumed as background for screening procedure estimates: SO_2 - 20 $\mu g/m^3$, CO - 1 ppm, NO_2 - .01 ppm, and TSP - 30 to 40 $\mu g/m^3$. The predominant westerly air flow should maintain a normally clean air environment at Point Conception and prevent the formation of high PO_x levels found at coastal locations to the east. However, the same wind patterns would transport project-related air pollutants into the more polluted areas of the air basin.

Point Conception is located within the South Coast Air Quality Maintenance Area for TSP, PO_x, SO_2, CO, and NO_2. This designation indicates that due to current air quality and emissions associated with projected growth and development, the area has the potential for exceeding the national ambient air quality standards for these pollutants within a 10-year period.

The proposed development of offshore oil and gas resources associated with the Department of the Interior's Lease Sale Number 48 could result in additional air pollution emissions in the Santa Barbara Channel with the potential for affecting onshore air quality in the 1980's. The effects of hydrocarbon

---

1/ Quarterly Report - April, May, June 1977, Air Pollution Control District, Santa Barbara County, California.

(HC) and nitrogen oxides (NO_x) emissions from three hypothetical levels of offshore petroleum development have been analyzed with a trajectory model to simulate the diffusion and photochemical reactions within a moving air parcel. 1/ Both a moderate and a heavy development scenario were analyzed and found to increase future PO_x levels at several receptor sites in Santa Barbara and Ventura Counties. Future PO_x levels were found to significantly decline under the scenario of existing facilities only. However, the precision of these estimates is limited by 1) the lack of adequate meteorological and air quality data in the study area, 2) inadequate and controversial emission factors for offshore petroleum facilities and tanker loading operations, and 3) uncertainties in the actual intensity and nature of petroleum development. The analysis also found that ambient SO_2 and hydrogen sulfide standards would be threatened by a large hypothetical treatment and separation facility.

Since the air quality impacts associated with the pipeline would be transient and limited to the construction stage, a description of the existing air quality along the proposed route is unnecessary to support this impact assessment. No compressor stations or other operational sources of emissions are proposed along the proposed pipeline route.

b) Noise Quality

A survey of background noise levels in the vicinity of the proposed LNG plant was conducted by Dames and Moore on November 1, 2, and 3, 1976. Sound level recordings were made for daytime (0700-1800 hours), evening (1800-2200 hours) and nighttime (2200-0700 hours) periods at the five sampling locations shown on figure 32. The data were then used to determine the 24-hour equivalent sound level, L_{eq} (24), and the day-night sound level, L_{dn}. As defined by EPA, 2/ the L_{eq} (24) represents the A-weighted sound energy averaged over a 24-hour period, while the L_{dn} represents the L_{eq} (24) with a 10 dBA weighting applied to nighttime sound levels (2200 to 0700 hours).

1/ Offshore Oil and Gas Development: Southern California, Volume I, Office of Planning and Research, Sacramento, California, October 1977.

2/ "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety," U.S. Environmental Protection Agency, 550/9-74-004, March 1974.

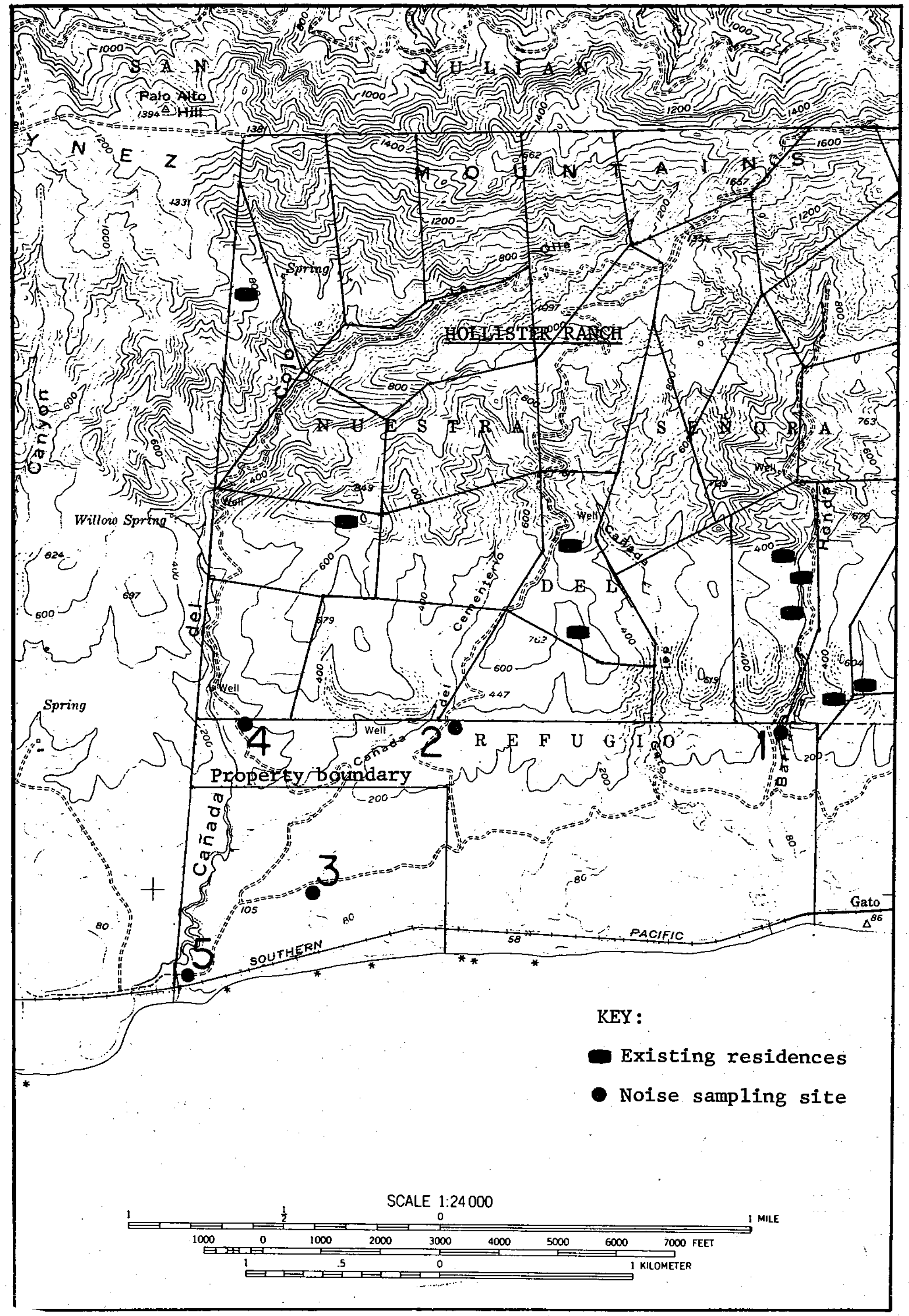


Figure 32
Noise Sampling Sites and Existing Residences
Point Conception

Table 34 lists the results of the noise survey for each sampling location. Noise levels measured to the north and northeast of the plant site at locations 1, 2, and 4 characterize the noise environment at the Hollister Ranch parcels located nearest to the proposed LNG plant. While undeveloped at this time, parcels 9, 10, and 17 are the nearest potential noise sensitive areas. The L_{dn} at these three locations ranged from 45.9 to 50.4, levels typical of a quiet suburban or rural environment. Similar noise levels were recorded at location 3 near the center of the plant site and at location 5 at the southwest corner of the site. The noise environment at all locations was dominated by insect activity and wave action, while railroad activity also influenced the noise levels at locations 3 and 5.

TABLE 34

BACKGROUND NOISE LEVELS
PROPOSED LNG PLANT SITE

Sampling Location	Noise Levels L_{eq} (24)	L_{dn}
1	41.1	50.4
2	42	47.4
3	42.7	49
4	44.5	45.9
5	46.1	48.9

The existing houses on the Hollister Ranch parcels in the vicinity of the plant site are identified on Figure 32. The residences on parcels 8 and 16 are the nearest existing noise sensitive areas and are located approximately 6,500 feet from the plant center. The future development of the parcels adjacent to the northern property line could place residences as near as 3,000 feet to the plant center.

C. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

1. Climate

The construction and operation of the proposed LNG terminal and pipeline should have an insignificant impact upon the climate of the region; however, the proposed site is subject to occasional extreme winds which could hamper LNG tanker operations. A maximum wind speed of 56 knots has been recorded at nearby Point Arguello in the period of record from 1949-1964. The applicant's consultant has indicated that winds of 25 knots would either prevent the tanker from berthing or cause an already berthed tanker to interrupt unloading and proceed out to sea to ride the storm out. In fact, it has been stated that tankers will leave the berth when extreme wind speeds are anticipated, rather than risk being trapped at the berth. The total downtime estimated by the California Public Utilities Commission (CPUC) is 10.1 percent annually, which includes approximately 4 percent of the year when berthing will be restricted due to poor visibility. CPUC has concluded that this amount of downtime is acceptable. Other severe weather would not be likely to impede construction or operation of the proposed facilities, except for short-term delays that might occur as the result of coastal storms.

2. & 3. Topography and Geology

The proposed LNG terminal and its associated pipeline would have a significant impact upon the topography and a limited impact on the geology of the areas in which they would be located.

Impacts to the topography would occur where grading or dredging would be required. Indirect impacts would be related to increases in erosion and mass movement which could cause local terrain modifications where the surface materials are prone to landsliding.

Direct modifications to the topography would occur within the boundaries of the terminal site where grading is expected to involve a balanced cut and fill of approximately 2 million cubic yards of material. The two arroyos which now drain the southern part of the site would be filled in and the eastern slope of Canada del Cojo would be significantly altered as the proposed site is brought to grade. Also, the conditions proposed by the CPUC to mitigate aesthetic impact could result in the movement of an additional 2 million cubic yards of terrace material and the formation of a new landform not natural to this coastline. This landform would be a ridge about 40 feet high surrounding the facilities.

Approximately 146,000 cubic yards of material, predominantly rock, would be removed from the ocean floor during installation of the seawater system pipelines. Blasting would be required. The applicant is considering applying for one of two ocean disposal sites for this material as the nearest approved dumping site is about 75 miles from Point Conception. One possible site is offshore of Drake at 34°27.2' N Latitude and 120°18.3' W Longitude; the other is offshore from the site at Latitude 34°25.5' N and Longitude 120°26.6' W. The former would allow the fabrication of an artificial reef with attendant environmental benefits resulting from increased habitat for, among other things, crab and lobster, and new substrate for kelp. The latter site would involve no significant environmental benefits and would potentially have a minor adverse impact on halibut trawl fishery.

Changes in the erosion regime of the site would constitute the greatest potential impact of the proposed facilities on the geology and soils of the area. The marine trestle would alter the existing pattern of longshore sediment transport. Preliminary analysis indicates that the trestle can be built to avoid significant impact on sediment transport.

Construction of an access road to the terminal site would also result in direct modifications to the topography and attendant erosion problems. However, since the existing private road through the Hollister Ranch from Gaviota would be only slightly modified, the impact would not be extensive. However, if an entirely new access road is built, then the effective impact of this site could be doubled.

Of the 112.4-mile pipeline corridor, approximately 60 percent is in terrain that may require ridge cuts. This leveling of the ridge crests would be the major direct impact of construction on the topography along the Point Conception-to-Gosford pipeline. Where such extensive terrain modification takes place, the resulting disequilibrium contours could not be easily maintained. This is especially true since many of the areas which might require ridge cutting are within regions of relatively high rainfall.

Removal of the natural vegetation at the proposed site and along the proposed pipeline route and access roads would increase the potential for erosion tremendously. Construction operations would also promote increased runoff by decreasing the surface permeability. This would result in increased erosion of areas on or adjacent to rights-of-way and the plant area.

The proposed pipeline system would require the crossing of two permanent streams, the Santa Ynez River and the Sisquoc River. The former would not be significantly affected because the river normally carries moderate sediment loads. Sediment added to the Sisquoc River would be deposited within a relatively short distance because of the generally low flow. However, during periods of high water, increased amounts of sediment could reach gravel pit operations downstream.

All other streams which would be crossed are intermittent, so that increased sedimentation and turbidity may be avoided by proper scheduling of the construction, i.e., during the summer months.

In most of the areas traversed beyond MP 102 of the pipeline, there would be little adverse effect in terms of increased sediment load. During the infrequent periods of sediment transport by water, the sediment load is naturally high, and an additional increment would probably not be critical. It should be noted, however, that erosion within the pipeline right-of-way might be serious even if the additional sediment load in adjacent streams is not a cause for concern.

Water used for hydrostatic testing could have significant erosion impact if improperly released. In addition, such discharge upon the surface within the San Joaquin Valley could create engineering problems with the expansive and collapsible soils of these areas.

The only other impact to the geology is in terms of mineral resources. The proposed pipeline would pass through unconsolidated deposits over most of its length. These are important sources of construction materials. Although construction of the proposed facilities might mean that greater care would be required during future extraction of these materials, such operations would not be seriously hindered. There would be no significant impact upon subsurface mining or drilling from construction of the proposed facilities in spite of the fact that several oil fields and the old Naval Petroleum Reserves 1 and 2 (now administered by BLM) would be crossed. Normal operation of the proposed facilities would have no impact upon the topography or geology of the area.

The geology of this region has more potential for serious impact upon the proposed facilities than vice versa. These hazards are discussed below.

The primary hazards due to earthquakes--ground shaking and ground displacement--would both be a problem should this site be utilized. The peak bedrock acceleration at the site would be approximately 0.7g for the maximum credible event at the closest portion of the Santa Ynez fault (North Branch). Events on seven other faults could result in site acceleration ranging from 0.2g to 0.5g. (See table 7.) A San Andreas fault event would probably result in 0.1g accelerations at the site, with most of the transmitted energy occurring in long-period vibration. The existence of one active and another possibly active fault on the site presents a potential hazard of ground or bedrock displacement under the site.

Dames and Moore [1/] has conducted a probability analysis resulting in estimates of the mean recurrence rate of mean peak seismic accelerations at the site. The following table is based on that study and takes into account contributions from most of the faults listed:

Acceleration (g)	Return Period (years)
0.20	30
0.25	85
0.30	270
0.40	1,700
0.50	10,200
0.60	58,400
0.70	320,000

1/ Dames and Moore. Technical Appendix A. Supplement. 1978.

On table 7, however, the maximum credible earthquake values used by Dames and Moore were generally not the same. The seismicity of the region was also taken into account but the uncertainty of the locations of several large historical events caused them to be excluded from the study. Because of these factors and because Dames and Moore did not consider the North or South Branches of the Santa Ynez fault to be of major significance, the staff believes that the return periods suggested by Dames and Moore may be too long.

Along the Point Conception-to-Gosford pipeline, horizontal accelerations of 0.7g could be experienced at each of 14 active or potentially active fault zones which would be traversed. Within the 14 zones, the proposed route crosses 22 mapped fault traces. All of these are significant hazards to the proposed pipeline.

The applicant has indicated that the pipeline trench would be wide or shaped with sloping sides, to lift rather than sever the pipeline in the event of fault rupture. In addition, the material selected to fill the trench would have low cohesion and would be loosely packed so that it would deform, thereby reducing the stress transmitted to the pipeline. Such procedures would mitigate some of the seismic hazard to the pipeline. However, Bonilla (1970) notes that the maximum width of the main zone of faulting in strike-slip faults is less than 0.06 miles (about 330 feet). And so a strike-slip fault capable of 6 feet of total displacement on the main fault would be able to exceed the pipeline design stress. There would be 15 fault traces within eight fault zones crossed by the pipeline which could achieve this displacement. All of these zones could conceivably experience ground displacements in excess of 3 feet in 120 feet which would presumably rupture the pipeline. This assessment is based on the assumption that the proposed pipeline could accommodate displacement on the order of 1 foot in 120 feet of length before exceeding the design stress and that 1 to 3 feet of displacement could probably be accommodated without rupture.

In addition to the primary effects of earthquakes, the possible secondary effects include soil liquefaction, settlement/subsidence, mass wasting, tectonic subsidence, and tsunamis. Only mass wasting and soil liquefaction would be of significance for the proposed pipeline.

When a soil liquefies, it loses its ability to sustain a shear stress. It acts as a liquid and consequently may flow down very slight grades. Fortunately, only soils which are granular, relatively unimodal, and saturated are subject to liquefaction. Such soils should be removed or avoided during construction of important facilities in highly seismic areas. However, removal of large quantities of soil is generally not feasible for a pipeline. Final alignment of the pipeline should avoid as many problem areas as practical.

An unconsolidated soil may settle into a more compact configuration when shaken. This may result in settlement of several feet, depending upon the depth of the original deposit and the severity of the shaking. Proper foundation engineering can eliminate most of the problems associated with this phenomenon.

Various mass wasting processes including rock falls, landsliding, and slumping may be triggered by shaking. Problem areas are not difficult to discover and avoid or mitigate the hazard therefrom.

Tectonic subsidence involves the vertical motion (up or down) of large portions of the surface due to readjustment of the earth's crust during and after an earthquake. However, regional elevation changes would probably have negligible impact upon the proposed facilities due to the large area involved.

The "Palmdale bulge" [1/] is an example of regional uplift which of itself would have no deleterious effects on any of the proposed facilities. The currently defined borders of the effected region extend as far as the proposed project. However, this phenomenon may presage a major earthquake along the San Andreas fault and therefore may indirectly represent an earthquake hazard.

Tsunamis are long-period waves formed by large-scale displacements of water. These displacements are generally due to vertical motion of a portion of the sea floor along a fault, although landslides into bodies of water may cause waves of concern to local land areas. The proposed site is not likely to be subjected to the latter type of wave.

1/ Castle, R.O., "Aseismic Uplift in Southern California," Science, Vol. 192, pp. 251-253, 1976.

Close to the source of an earthquake-induced tsunami, the maximum wave heights are experienced along a coast which parallels the fault, while at a distance refraction of the wave front may considerably alter the direction of the wave.

Faults whose activity might trigger tsunamis near the proposed site are located in the Santa Barbara Channel. The coast at the proposed Point Conception site is parallel to the probable generating faults and would experience the maximum locally generated waves. While no adverse effects would be expected at the onshore portion of the proposed facilities, the marine terminal would be vulnerable to wave forces. Furthermore, it is unlikely that there would be enough time to warn or remove a docked LNG tanker to a safe distance from the facilities before the wave arrived.

The Point Conception area would be expected to be relatively sheltered from tsunamis generated in the northern Pacific, but not those coming from the southern Pacific. It is expected that, in the event of a tsunami generated outside the offshore California area, ample warning would be supplied by the U.S. Coast Guard.

Other geological hazards include floods, erosion, expansive soils, collapsing soils, subsidence, and volcanic activity. Due to its elevation and the lack of a major drainage, the Point Conception site is extremely unlikely to be flooded.

Sheet erosion caused by storm runoff could be a problem at the proposed Point Conception site; however, proper grading and drainage of the site should be able to deal with this problem effectively.

Along the proposed pipeline route, the western mountainous areas are the most likely to be affected by flooding. However, it is conceivable that this could be a problem along the entire route, since flash flooding is not uncommon in this area.

Soils containing appreciable quantities of the clay minerals kaolinite or montmorillonite are known as expansive soils. When exposed to water, these soils may increase their volume substantially, moving retaining walls, lifting foundations, and adversely affecting the associated structures. Such soils must be identified and, ideally, should either be removed or avoided.

Collapsing soils, soils which are susceptible to hydrocompaction, are hard, dry, low density soils that compact when saturated with water. They are extremely common in the San Joaquin Valley, where they have posed severe construction problems. The proposed pipeline would cross such areas north of Taft. It would be essential that the proposed pipeline be routed so that there would be no tendency for water to pond in subsidence-prone areas. Ideally this routing would be such that no natural drainage is intercepted or blocked (Curtin, 1973). See the Soils Section for more discussion of soil-related impacts.

Non-tectonic subsidence may result from withdrawal of fluids (usually water or oil) from beneath the land surface. The Arvin-Maricopa area of the southern San Joaquin Valley has experienced major subsidence due to groundwater withdrawal. A measurable amount of subsidence has resulted from hydrocarbon extraction, but the magnitude is less than that resulting from water withdrawal.

The proposed pipeline traverses the northwestern border of the Arvin-Maricopa area. Subsidence along the route was no more than 0.25 foot during the period 1965 to 1970, and the average rate of subsidence was no more than 0.05 foot per year. Since the beginning of the current decade, when the state began to import irrigation water into the area, the rate of subsidence has leveled off. Even if the current rate continues over the life of the pipeline, it would not constitute a significant hazard to the pipeline.

There are no active volcanic centers in southern California. The last known activity occurred during Pleistocene time, but no extrusives as young as this are located within 50 miles of any of the proposed facilities. The Tertiary history of the southwestern U.S. records a steady movement of volcanic activity from west to east. Danger from volcanic activity appears to be remote at the proposed site.

4. Soils

Project construction would have the potential for major impacts to the soils of the proposed project area primarily through increased erosion and by altering the soil profile through trenching and backfilling. Conversely, many soil features could also have an effect on pipeline construction and right-of-way revegetation. A soil map of the proposed LNG terminal site is presented in figure 14. Table 9 presents selected suitabilities and limitations of the soil series found on that map. Table 35 presents the limitations of the soils on the proposed route that affect pipeline construction and revegetation of the right-of-way. Severe limitations noted for certain soils are not intended to mean that the project should not or could not be constructed in that area; they simply indicate the degree of that limitation and that it would be reasonable to expect that construction costs and impacts might be greater in these areas.

Once the proposed terminal site, pipeline right-of-way, and all access roads have been cleared of vegetation and graded, the hazard of erosion would be a function primarily of slope, soil texture and structure, and rainfall amount and intensity.

Conception and Botella soils make up a large percentage of the terminal site and have a moderate to severe hazard of erosion. Site grading and excavation would increase erosion and sediment loss to the major drainage channels on the site, the coastal erosion gullies, and Canada del Cojo. Onsite slopes, however, are rather gentle, and site grading would probably further reduce the relief, with the exception of any cut banks formed during excavation. As a result, site erosion and the resulting sedimentation should be temporary and controllable through the use of erosion control devices such as diversion ditches. These structures could intercept offsite runoff from adjacent areas having the potential to invade the site and divert onsite runoff to a suitable outlet such as a sedimentation pond. The applicant has stated it would channel storm runoff from the site into a holding system prior to release during plant operation. Construction of the seawater exchange pipeline and cryogenic LNG transfer line would also contribute to increased amounts of sediment released to the coastal waters.

Landfilling, along with ocean dumping, is being considered for disposal of approximately 180,000 cubic yards of dredge material from construction of the seawater pipeline. A ravine on the Southern California Edison Company property would be utilized as the fill site if land disposal were chosen. This alternative would require a coastal docking area to offload barges and a haul road for truck transport of the material to the disposal site. Construction of the haul road would present the same type of erosion-related problems characteristic of access road construction throughout the area. Controlling

TABLE 35

LIMITATIONS OF SOIL FEATURES THAT AFFECT:

Soil Associations	Mileposts	PIPELINE CONSTRUCTION: Slope	PIPELINE CONSTRUCTION: Trenchwall Stability and Soil Workability	PIPELINE CONSTRUCTION: Soil Depth Rocks and Stones	PIPELINE CONSTRUCTION: Shrink-Swell Potential	PIPELINE CONSTRUCTION: Corrosivity	RIGHT-OF-WAY REVEGETATION: Soil Depth	RIGHT-OF-WAY REVEGETATION: Runoff	RIGHT-OF-WAY REVEGETATION: Erosion Hazard 1/	RIGHT-OF-WAY REVEGETATION: Inherent Fertility	RIGHT-OF-WAY REVEGETATION: Available Water Capacity 2/	Vegetative Group 3/	SUITABILITY OF SOIL AS A SOURCE OF: Sand	SUITABILITY OF SOIL AS A SOURCE OF: Gravel
Santa Barbara County														
Marina-	0-1	slight	severe	slight	slight	moderate	slight	moderate	moderate	severe	droughty	B	poor	unsuited
Oceano			severe	slight	slight	moderate	slight	slight	moderate	severe	droughty	B	fair	unsuited
Shedd-	1-2	moderate to severe	slight	moderate to severe	moderate	moderate	moderate	moderate	moderate	slight	adequate	E	unsuited	unsuited
Linne				moderate to severe	moderate	moderate	moderate	moderate	moderate	slight	adequate	E	unsuited	unsuited
Los Osos-	2-3	moderate to severe	moderate	severe	severe	moderate	moderate	severe	severe	moderate	adequate	E		
San Benito	4-11	severe	moderate	severe	moderate	moderate	slight	moderate	severe	slight	adequate	A	unsuited	unsuited
Rockland-	3-4	severe	slight	severe	slight	slight	severe	severe	severe	severe	droughty	F	unsuited	unsuited
Rough Broken Land	39-40		slight	variable	slight	slight	severe	severe	severe	severe	droughty	F	unsuited	unsuited
Santa Lucia-	11-16	moderate to severe	severe	severe	moderate	moderate	moderate	moderate	severe	moderate	droughty	E	unsuited	unsuited
Crow Hill (15-50% slopes)			slight	slight	moderate	moderate	moderate	moderate	severe	moderate	adequate	E	unsuited	unsuited
Santa Lucia-	21-24		severe	slight	moderate	moderate	moderate	severe	severe	moderate	droughty	F	unsuited	unsuited
Crow Hill (50-75% slopes)	38-39 40-43	severe	slight	slight	moderate	moderate	moderate	severe	severe	moderate	adequate	F	unsuited	unsuited
Sorrento-	15	slight	slight	slight	moderate	slight	slight	moderate	slight	slight	adequate	A	unsuited	unsuited
Salinas			slight	slight	moderate	slight	slight	moderate	slight	slight	adequate	A	unsuited	unsuited
Arnold-	16-17	moderate to severe	severe	slight	slight	moderate	slight	moderate	moderate	severe	droughty	F	fair	unsuited
Marina	26-27		severe	slight	slight	moderate	slight	moderate	moderate	severe	droughty	F	fair	unsuited
Sorrento-	17-21, 30	slight	slight	slight	moderate	slight	slight	moderate	slight to moderate	slight	adequate	A	unsuited	unsuited
Mocho	33-34 35-38		slight	slight	moderate	slight	slight	moderate	slight to moderate	moderate	adequate	A	unsuited	unsuited
Chamise-	24-25	moderate to severe	moderate	slight	moderate	moderate	slight	moderate to severe	moderate	moderate	droughty	E	unsuited	unsuited
San Andreas	27-33		slight	slight	slight	moderate	moderate	moderate to severe	moderate	moderate	droughty	E	unsuited	unsuited
Mocho-	25-26, 27	slight	slight	slight	moderate	moderate	slight	moderate	slight to moderate	slight	adequate	A	unsuited	unsuited
Salinas			moderate	slight	moderate	moderate	slight	moderate	slight to moderate	moderate	adequate	A	unsuited	unsuited
Riverwash	34, 55-56	slight	severe	variable	slight	slight	slight	slight	severe	severe	droughty	F	variable	
Pleasanton-	34-35	slight	slight	slight	moderate	moderate	slight	moderate	slight to moderate	moderate	adequate	A	unsuited	poor
Ballard			slight	slight	moderate	slight	slight	moderate	slight to moderate	moderate	droughty	A	poor	poor
Contra Costa-	43-44 45-49	severe	moderate	severe	severe	moderate	moderate	moderate	severe	moderate	adequate	F	unsuited	unsuited
Graviota			slight	severe	slight	moderate	severe	severe	severe	slight	droughty	F	poor	unsuited
Mollic Haploxerales-	44-45 49	severe	slight	severe	moderate	severe	moderate	severe	severe	moderate to severe	-		-	-
Lodo-			slight	severe	slight	slight	severe	severe	severe	moderate to severe	droughty	F	-	-
Milsholm			slight	severe	moderate	slight to moderate	severe	severe	severe	moderate to severe	droughty	F	-	-
Modesto-	49-52	slight to severe	slight	severe	slight	slight	moderate	moderate	severe	severe	-	F		
Positas			moderate	moderate	moderate	severe	slight	slight to severe	severe	severe	droughty	F	unsuited	unsuited

TABLE 35 (cont.)

Soil Associations	Mileposts	Slope	Trenchwall Stability and Soil Workability	Soil Depth Rocks and Stones	Shrink-Swell Potential	Corrosivity	Soil Depth	Runoff	Erosion Hazard 1/	Inherent Fertility	Available Water Capacity 2/	Vegetative Group 3/	Sand	Gravel
Santa Barbara County (cont.)														
Exchequer-	52,	severe	slight	severe	slight	slight	severe	moderate to severe	severe	severe	droughty	F	unsuited	unsuited
Millertown-	54-55		slight	severe	slight	slight	severe	moderate to severe	severe	severe	-	F	-	-
Aqua Dulce			slight	moderate	slight	slight	slight	severe	severe	severe	-	F	-	-
Aqua Dulce-	52-54,	moderate	slight	moderate	slight	slight	slight	severe	severe	severe	-	F	-	-
Modesto	55	severe	slight	moderate	slight	slight	moderate	moderate	severe	severe	-	F	-	-
San Luis Obispo County														
Contra Costra-	55-56	severe	slight	severe	severe	moderate	moderate	moderate	severe	moderate	droughty	F	unsuited	unsuited
Lodo			slight	severe	slight	moderate	severe	severe	severe	severe	droughty	F	unsuited	unsuited
Exchequerio-	56-59	severe	slight	severe	slight	slight	severe	severe	severe	severe	droughty	F	-	-
Millerston-	60		slight	severe	slight	slight	severe	severe	severe	severe	-	F	-	-
Aqua Dulce			slight	moderate	slight	slight	slight	severe	severe	severe	-	F	-	-
Aqua Dulce-	57, 58,	moderate	slight	moderate	slight	slight	slight	severe	severe	severe	-	F	-	-
Modesto	59-60	severe	slight	severe	slight	slight	moderate	moderate	severe	severe	-	F	-	-
Balcom-	57	moderate to severe	slight	severe	moderate	slight	slight	moderate to severe	severe	severe	adequate	F	unsuited	unsuited
Nacimiento			slight	severe	moderate	moderate	moderate	moderate to severe	severe	severe	adequate	F	unsuited	unsuited
Modesto-	60-61	slight to severe	slight	severe	moderate	slight	moderate	moderate	severe	severe	-	F	-	-
Positas			moderate	moderate	moderate	severe	slight	slight to severe	severe	severe	droughty	F	-	-
Los Osos-	60-62	slight to moderate	moderate	moderate	severe	moderate	moderate	moderate	severe	moderate	droughty	A	unsuited	unsuited
Millsholm			slight	severe	slight	moderate	severe	moderate	severe	moderate	droughty	F	unsuited	unsuited
Vista-	62	severe	slight	moderate	slight	moderate	moderate	moderate to severe	severe	severe	droughty	F	unsuited	unsuited
Pinnacles			moderate	slight	severe	severe	moderate	severe	severe	severe	droughty	F	unsuited	unsuited
Nacimiento-	62-65	slight to moderate	slight	moderate	moderate	moderate	moderate	moderate	moderate	slight	adequate	A	unsuited	unsuited
Linne (9-30% slopes)			slight	moderate	moderate	moderate	moderate	moderate	moderate	slight	droughty	A	unsuited	unsuited
Nacimiento-	65-67	severe	slight	moderate	moderate	moderate	moderate	moderate	severe	slight	adequate	F	unsuited	unsuited
Linne (30-50% slopes)			slight	moderate	moderate	moderate	moderate	moderate	severe	slight	droughty	F	unsuited	unsuited
Panoche-	67-69	slight	slight	slight	moderate	slight	slight	moderate	slight	slight	adequate	A	unsuited	unsuited
Panhill	74-75, 77		slight	slight	moderate	moderate	slight	moderate	slight	moderate	adequate	A		
Simmler-	69-74	slight	severe	slight	severe	severe	slight	moderate	slight	severe	adequate	F	unsuited	unsuited
Chicote			severe	slight	severe	severe	slight	moderate	slight	severe	adequate	F	unsuited	unsuited
Kettleman	75, 76-78 79-80	moderate to severe	slight	moderate	slight	slight	moderate	moderate	severe	moderate	adequate	F	unsuited	unsuited
Tierra-	76	slight	moderate	slight	severe	severe	slight	moderate to severe	severe	severe	droughty	C	unsuited	unsuited
Atascadero	-		moderate	slight	severe	severe	severe	moderate	severe	moderate to severe	-	C	unsuited	unsuited
Rockland-	78-79	severe	slight	severe	slight	slight	severe	severe	severe	severe	-	F	unsuited	unsuited
Rough Broken Land			slight	variable	variable	variable	severe	severe	severe	severe	-	F	unsuited	unsuited

TABLE 35 (cont.)

Soil Associations	Mileposts	Slope	Trenchwall Stability and Soil Workability	Soil Depth Rocks and Stones	Shrink-Swell Potential	Corrosivity	Soil Depth	Runoff	Erosion Hazard 1/	Inherent Fertility	Available Water Capacity 2/	Vegetative Group 3/	Sand	Gravel
Kern County														
Kettleman	80-85 89-92 97-102	moderate to severe	slight	slight	moderate	slight	moderate	moderate	moderate	moderate	adequate	F	poor	poor
Hilmar- Mocho	85-86	slight	severe moderate	slight slight	slight moderate	severe severe	slight slight	slight moderate	slight slight	slight moderate	adequate adequate	D D	poor poor	unsuited unsuited
Panoche	86-89 105, 106-7	slight	slight	slight	moderate	moderate	slight	moderate	slight	moderate	adequate	A	poor	unsuited
San Emigdio- Hesperia	92-97 102-103	slight	slight slight	slight slight	slight slight	slight slight	slight slight	slight slight	slight slight	moderate moderate	adequate adequate	A A	unsuited unsuited	unsuited unsuited
Cajon- Tujunda	103-105 111-112	slight	severe severe	slight slight	slight slight	slight slight	slight slight	slight slight	slight slight	severe severe	droughty droughty	B B	poor fair	unsuited unsuited
Hesperia- Hanford	105-106 109-111 112-124	slight	slight slight	slight slight	slight slight	slight slight	slight slight	moderate moderate	slight slight	moderate moderate	adequate adequate	A A	poor poor	unsuited unsuited
Traver- Pond	107-109	slight	slight slight	slight slight	slight severe	severe severe	slight slight	slight slight	slight slight	moderate moderate	adequate adequate	D D	unsuited unsuited	unsuited unsuited

1/ Erosion hazard is an estimate of the degree of erosion to be expected if the soil is left finely tilled or if the protective vegetation is removed. This condition would be representative of a pipeline right-of-way after construction.

2/ Vegetative groups classify soils with respect to plant adaption and use. Soils within each group have similar properties and the groups themselves are distinguished by the one or two major limitations they provide to plant growth. These groups are used for selecting the best adapted plants for conservation practices and forage production.

3/

Vegetative Group	Major Soil Limitation
A	None
B	Droughtiness
C	Clay pan soils
D	Salinity or alkalinity
E	Shallow depth
F	Numerous severe limitations requires onsite recommendations for seeding

Limitation Ratings for Right-of-Way Revegetation

Soil Feature	Degree of Limitation: Slight		Moderate		Severe
Soil Depth	40"+		20-40"		-20"
Runoff	Slow		Medium		Rapid
Erosion Hazard	Slopes less than 0-9% subsoil permeability moderately rapid to rapid, weak profile development		Slopes 9-30% on soils with no to weak profile development and slopes of 9-15% with moderately developed profile		Slopes over 30% with no profile development and soils over 15% with moderate to strong profile development
Inherent Fertility	High		Moderate		Low
Available Water Capacity	Adequate: Soil depth (inches)	inches of water per inch of soil	Droughty: Soil depth	inches of water per inch of soil	
	60	.1	60	.1	
	60	.15	60	.15	

Limitation Ratings for Pipeline Construction

Soil Feature	Degree of Limitation: Slight	Moderate	Severe
Slope	0-15%	15-30%	30%+
Trenchwall Stability and Soil Workability	fine sandy loams, sandy loams, loams, silt loams, silty clay loams, sandy clay loams	silts; clay loams, sandy clays, all gravelly types	clays, silty clays, sands, organic soils, all very gravelly types
Shrink-Swell Potential	Low	Moderate	High
Soil Depth Rocks and Stones	no stones present, bedrock over 60"	profile stoney throughout, bedrock 36-60"	soil stoney and/or bedrock less than 36"
Corrosivity	Low	Moderate	High

surface runoff is important where construction involves filling ravines and other natural drainage areas. If surface water is not diverted away from the filled area until it is stabilized, heavy rains and concentrated runoff could cause considerable amounts of the fill material to be eroded away.

Some of the subsurface soils on the site are limited, to an extent, by their shrink-swell potential and low strength. Foundation design would prevent these soil features from affecting terminal facility structures. However, these soil characteristics along with a high susceptibility of the soils to erosion could cause some minor stability problems with dikes, embankments, and earthen structures. Localized slumping and erosion could occur until the structures were stabilized. The use of proper engineering and erosion control techniques should mitigate most of these stability problems. Workability of these clayey subsoils is poor and construction activities could be impeded during wet weather. Excavations in sandy, gravelly, noncohesive soils are subject to sloughing. Side wall instability can impede construction and more importantly endanger men working in the excavations. All applicable safety standards should be followed to prevent accidents.

Erosion on the pipeline right-of-way would have a greater potential for impact than it would on the terminal site. The hazard of erosion is most severe in the mountains and steeply sloping terraces located in the vicinity of mileposts 2 to 16, 21 to 29, 38 to 55, 62 to 65, and 75 to 80. (See table 35.) It is also in these areas that soil loss is most critical. These soils, especially in the upland areas, are shallow, and the rate of soil formation is slow. Extensive loss of soil here could cause significant problems with the ability of the area to support a vegetative cover. Where the proposed right-of-way would cross or parallel natural drainages, the hazard of erosion would be exceptionally high. Although not a common occurrence, severe flooding, should it occur, could have the potential to expose the pipeline or cause its rupture. Runoff on these steep areas can concentrate on a bare right-of-way, especially where the pipeline runs up and down (parallel to) the slope, and lead to gully formation. Ruts from the wheels and tracks of construction vehicles can help concentrate surface flow. Once started, erosion gullies are difficult to arrest, as evidenced by the highly dissected terraces throughout the region.

The erosion hazard of the soils in the valley and low-lying areas is much less than in the uplands. Since most agricultural operations are confined to these areas, erosion on the right-of-way through cropland should be manageable. However, some cropland and pastureland is located on the moderately sloping terraces. Care would be needed in these areas to prevent surface waters from collecting and forming gullies which could interrupt farming operations and cause significant deterioration to farmland.

Soils low in moisture and organic matter are susceptible to wind erosion and located along the coast and in the drier valley and basin areas. Wind erosion should not pose any significant problems throughout the project area.

The applicant has stated that pipeline construction would follow the tops of ridges in some of the mountainous uplands from mileposts 0.7 to 15.4 and 38 to 60. Since the soils on these ridgetops are extremely shallow, construction would likely result in a right-of-way composed primarily of bedrock. Disposal of any surface soil and excavated rock debris over the side slopes would create a visual impact, additional erosion, and surface disturbance to land areas not directly involved with the project. If surface soils were not stored for replacement after construction, the right-of-way would be extremely difficult to revegetate. Approximately from mileposts 45 to 61, the pipeline would pass through the Los Padres National Forest. Construction here would have to adhere to the standards of and require approval from the U.S. Forest Service. In other areas, construction procedures and restoration would have to be specified in right-of-way agreements.

The proposed right-of-way would cross approximately 66 miles of soils where bedrock is within 60 inches of the surface; for 58 of these miles, the soils are less than 40 inches deep. A large percentage of this bedrock is highly fractured or soft and is rippable with conventional excavation equipment. (See notation under column 7, table 9.) In areas where bedrock hardness would prevent ripping, blasting would be required. The applicant has stated that excavated rock material would be disposed of along adjacent portions of the route or transported to approved disposal sites.

Considerable pipeline padding material would be required in these areas of shallow soils. It would be obtained from borrow pits or nearby portions of the right-of-way. Areas utilized for the acquisition of padding would be impacted in much the same manner as the right-of-way.

Construction of access roads throughout the upland areas in this region of California has, in the past, caused significant erosion-related problems. 1/ The cut-and-fill method used to construct roads on hill sides creates steep cut slopes that are difficult to revegetate and fill slopes that are extremely erosive and difficult to stabilize. Controlling surface water runoff is a major problem. Runoff from road ditches must be channelled to a safe outlet, or the problem is compounded.

The applicant has stated that construction excavation on the terminal site and grading on the highly erodible ridge-tops would be completed during dry periods of the year. This would reduce the likelihood of erosion. However, the amount and significance of erosion that would occur throughout the proposed project area would depend primarily on the effectiveness of the erosion control practices used during construction and the timeliness and adequacy of right-of-way revegetation.

During the trenching operation, surface soils, which are generally higher in fertility, have a higher infiltration rate, and a more workable texture would be buried under or mixed with subsoil material. This process can have a number of adverse effects. Some soils, especially on the terraces, have dense clay subsoils. If these soils end up as final cover, workability of the surface would be reduced and compaction increased. If graded when wet, the surface would become hard upon drying and provide very poor conditions for seedling establishment. Surface soils also serve as a seed source for native plants to aid revegetation.

Simmler and Chicote soils located in the Carrizo Plain areas have saline subsoils. Inverting these soils during trenching operations could limit the future growth of certain types of plants.

Mixing soil horizons in agricultural lands would probably lower crop production in the disrupted area for a number of years, depending on the specific soils and crops involved. Increased fertilizer applications could at least partially offset this loss of productivity, and this factor should be considered in landowner agreements.

1/ United States Atomic Energy Commission, Environmental Statement: Nuclear Generating Station, Diablo Canyon (May 1973), pp. 4-7 to 4-10.

The applicant has not specified if it would compact backfill as it is being placed in the trench. However, the applicant has stated that it would crown the soil over the pipeline to accommodate settlement. This could result in a number of problems. Soils placed in the trench without some type of compactive effort during backfilling, especially during the dry season, would be susceptible to subsidence as winter rains percolate down through the soil. Gulleys and depressions formed by this type of settlement can collect runoff from heavy rains and result in considerable erosion where the right-of-way is located on sloping areas. If not repaired, this could lead to exposure of the pipeline.

Both a crowned trench and/or differential and extensive subsidence could cause adverse effects in agricultural lands, possibly restricting the movement of farming equipment and hindering normal field operations. In croplands irrigated with open ditches, the normal flow of irrigation water could be restricted both during and after construction. Should the applicant be required to repair subsidence after the pipeline is in operation, farming activities and the flow of irrigation water could again be disrupted.

Backfilling to the proper density is important in both irrigated and nonirrigated agricultural areas as excess compaction can interfere with plant root growth and adversely alter internal drainage and percolation.

In addition to the soil-related impacts on the terminal site and pipeline right-of-way, similar impacts could be expected from construction of the electric powerline right-of-way and its related access roads, any construction related work and staging areas, and the improvement of the existing Hollister Ranch Road which would provide access to the site. Of primary importance would be the increase in erosion and sedimentation from construction activities. Since right-of-way preparation for the powerline would be less extensive than for the gas pipeline, the resulting erosion should be less of a problem and thus easier to control. Improvement of the existing Hollister Road would result in widening the existing roadbed and straightening some curves in certain areas; it would also require a number of cut-and-fill operations. An effective erosion control plan would be required to control surface runoff, prevent unnecessary erosion and sedimentation, and assure that all disturbed areas would be adequately stabilized and revegetated.

Numerous minor soil-related impacts could be expected on the proposed terminal site and pipeline route. Small petroleum spills from construction vehicles are likely to occur along the route. The impact from these spills would depend on their size, the permeability of the soil, the position of the water table, and environmental conditions governing biological decay.

A pipeline rupture, although unlikely, could occur during project operation. The size of the crater thus created would depend on the surrounding soil conditions. A natural gas leak would exclude oxygen from the rootzone and possibly kill existing vegetation. Depending on soil conditions, a gas leak could migrate laterally from the pipeline trench and possibly affect vegetation or crops on areas adjacent to the right-of-way. LNG spills are unlikely but could occur on the terminal site. The soil would be frozen to a depth dependent upon soil moisture levels, soil permeability, and the volume of LNG spilled. As the temperature of the LNG increased, it would evaporate with no significant impact on the soil.

5. Hydrology

a) LNG Site and Pipeline

The LNG plant would be close enough to the shoreline so that construction wastes, spills, or leaks could reach the sea via the Canada del Cojo as runoff. Construction and site preparation operations would result in increased erosion and increase turbidity in nearshore coastal waters. It is expected that groundwater would be encountered during excavation of the proposed site and that some dewatering would be necessary. Local groundwater flow could be temporarily altered, and erosion could be increased due to dewatering discharges.

The use of onsite water wells to provide freshwater requirements to the plant could result in groundwater impact. Assuming wells would be drilled in the upper Monterey Formation (which is considered to be protected from seawater intrusion because it is stratigraphically below the relatively impermeable Sisquoc Formation), insufficient data is available to predict how much water could be withdrawn over a given time without overdrafting the aquifer. However, it is considered possible that degraded water from some not yet identified source or seawater could move into the aquifer if pumping were sufficiently intensive. According to the applicant's NPDES permit application, 93,600 gallons per day (65 gpm) of well water would be required. Alternatives to the use of onsite wells could include purchased water (Lompoc Water District or Mission Hills Water Company) or the desalination of seawater.

Surface water conditions in the eight basins that would be crossed vary substantially and therefore, the effect of additional debris produced by the pipeline construction would differ from stream to stream. In tributaries where sediment transport and turbidity are naturally low, the increase in sediment load due to construction could have a significant impact.

Information on the unmitigated siltation and erosion potential at the proposed stream crossings is presented in table 36. The list does not include all tributaries and small water courses crossed, but it appears that those not listed are intermittent streams of little hydrologic importance. As shown in the table, most of the crossings involve areas of moderate to high siltation and erosion potential, indicating the potential for significant damage at the crossings without implementing measures to protect, stabilize, or restore the streams. Erosion of right-of-way and subsequent siltation in the watercourses produce both physical changes to the streamcourse and chemical water quality changes. The physical changes come from particles which become suspended in the water settling out downstream as well as changing turbidity and possibly water color. The nature of the chemical changes depends upon the character of the materials introduced into the water. Biological impact would be caused by the physical and chemical changes as well.

Several means of mitigating the potential for significant impact are available, and could reduce the actual impact to short-term, relatively insignificant damage. The primary means of reducing erosion and siltation potential would be to construct the pipeline across the streams during no or very low-flow conditions. The applicant has agreed to schedule construction for the normal periods of low flow; at that

TABLE 36

SILTATION AND EROSION POTENTIAL
AT PROPOSED STREAM CROSSINGS

Stream Name 1/	Mile Post at Crossing	Stream Bank Angle	Siltation 2/ Potential	Erosion 2/ Potential
Canada del Cojo (P) 3/	-	-	-	-
Jalama Creek (I)	4.8	20°	High	High
Los Amoles Creek	7.4	6°	Moderate	Moderate
El Jaro Creek (P)	8.8	20°	Moderate	Low
Ytias Creek (I)	11.3	16°	Moderate	Moderate
Santa Ynez River (P)	15.4	4°	Moderate	Moderate
Santa Rosa Creek (I)	18.4	6°	Moderate	Moderate
Unnamed Stream (I)	24.2	16°	Moderate	Low
San Antonio Creek (I)	25.4	10°	High	High
Howard Canyon (I)	26.6	10°	Moderate	Moderate
Unnamed Tributary to Cat Canyon (I)	29.6	20°	Moderate	Moderate
Cat Canyon (I)	30.1	39°	Moderate	Moderate
Long Canyon (I)	31.3	22°	Moderate	Moderate
Olivera Canyon (I)	33.0	24°	High	High
Sisquoc River (I)	33.7	7°	High	High
Tepusquet Creek (I)	35.4	27°	Moderate	Moderate
Colson Canyon (I)	38.6	65°	Moderate	Moderate
Buckhorn Canyon (I)	43.9	15°	High	High
Miranda Pine Canyon (I)	45.5	22°	High	High
Aliso Creek (I)	47.7	22°	Moderate	Moderate
Clear Creek (I)	54.1	26°	Moderate	Moderate
Cuyama River (I)	55.3	6°	High	High
Gypsum Canyon	56.6	31°	Moderate	Low to Moderate
Barrett Creek (I)	61.6	11°	Moderate	Moderate
Crocker Canyon (I)	82.0	7°	Moderate	Moderate
Buena Vista Creek (I)	93.3	<2°	Moderate	Low to Moderate

1/ Intermittent - (I), Perennial - (P)

2/ Refers to siltation and erosion potential of the construction assuming pipeline constructed during periods of water flow. See Text.

3/ No information on this crossing was presented in the source.

Source: Adapted from the Western LNG Terminal Company response to staff request for additional information, dated time, most intermittent streams are in no-flow conditions. Presuming that no unexpected heavy rains occur during the construction, the applicant would only need to quickly regrade, restore, and protect the construction area after the pipeline was in place to insure minimum impact. However, unexpected heavy thunderstorms could result in significant, although short-term impact if contingency measures are not planned. As a minimum precaution, the staff suggests that plans be made and equipment readied for deployment at or near the construction sites with high potential for erosion and siltation to mitigate potential damage from unexpected natural events.

Two river crossings of particular significance are the Sisquoc and Cuyama Rivers, both with high siltation and erosion potentials. Downstream of the Sisquoc crossing are several gravel pit operations; downstream of the Cuyama crossing is Twitchell Reservoir. Without adequate protection, the event of an unexpected thunderstorm could cause significant amounts of sediment to settle in these areas. In the coastal drainages, pipeline construction would increase the amount of sediments transported directly to the littoral zone.

The other primary river crossing would be across the Santa Ynez River. Flow in the Santa Ynez is controlled upstream from the proposed crossing at the Lake Cachuma dam. The USDI Bureau of Reclamation has indicated that water is released from the reservoir on infrequent occasions during the summer when requested by farmers downstream. Maximum summer flow on these occasions would be 150 cubic feet per second. The Bureau indicated they would accommodate and cooperate with the pipeline construction schedule.

Recommendations on mitigating measures may be found in the "Conclusions and Recommendations" section of this EIS. It is expected that the USDA's Soil Conservation Service and Forest Service, as well as the California Department of Fish and Game would be involved in the final selection of site-specific construction and restoration techniques.

The groundwater should only be affected in areas where the local water table is near the surface. It is highly probable that excavations at stream crossings would encounter the water table very near the surface of the alluvium if construction operations were conducted during the winter. This would necessitate dewatering the construction site, which in turn would result in the lowering of the local water table and temporarily altering local groundwater flow.

Hydrostatic test water would be discharged either into catchments or into existing watershed areas. Improper water disposal would result in increased erosion and sedimentation at and downstream of the discharge area.

Several water supply plans have been or are being studied by local, state, and Federal agencies for the Santa Maria-Sisquoc area. There would not be any direct conflicts between these plans and the proposed pipeline from Point Conception to Gosford. Other projects which have been or are being studied include the Lompoc Dam and Reservoir and the Salsipuedes Dam and Reservoir. The Lompoc Reservoir would result from damming a portion of the Santa Ynez River and would result in inundation of the pipeline in the vicinity of the proposed Santa Ynez River crossing. However, at present, due to problems with the overall Lompoc Dam project and insufficient support from the Santa Barbara County Water Agency to the Bureau of Reclamation, no action is being taken with respect to the project. It does not appear that the Salsipuedes Dam and Reservoir project would have any direct effect on the proposed pipeline.

It is possible that future conflicts could develop if local water conveyance facilities are constructed in conjunction with the proposed extensions of the Coastal Branch of the California State Aqueduct. The environmental staff has made a recommendation concerning this matter.

b) Oceanographic Impact

i. General

Impacts from the proposed LNG facility construction on the physical marine environment would result from the marine facility construction and from discharges into the sea.

Piles would be driven into the undisturbed sea floor for the proposed construction of the permanent trestle, unloading dock, temporary trestle for placement of seawater exchange pipelines, and related facilities. This would result in turbidity due to the suspension of sediments.

Seawater would be used to hydrostatically test the two LNG tanks in the summer of 1981. About 14 million gallons (nearly 43 acre-feet) of seawater is needed for each tank and would be drawn through the fire control water system at a fill rate of about 7 million gallons per day. The seawater would be discharged over several days through the seawater outfall line with an initial discharge rate of about 4,900 gallons per minute (7.056 million gallons per day). The discharge rate decreases as the tank empties due to reducing hydrostatic head (pressure).

The inner tank surfaces would be descaled and swept out prior to testing to prevent introduction of contaminants into the seawater. No treatment of the seawater should be necessary but in any case, the applicant insures that the seawater would meet applicable (NPDES) water quality standards. Because the seawater would absorb some ambient heat (from the air and ground) through the tank and pipe walls, it could conceivably be slightly warmer than the ambient seawater temperature when discharged. This would cause the seawater to behave like a slightly buoyant effluent, tending to spread in a surface lens. The temperature increase is not expected to be great enough to cause any significant impact.

During operation of the proposed LNG facilities, the ocean discharge of cooled seawater from the LNG vaporizer, warmed seawater from the LNG ship's boil-off condensers, and onsite surface runoff would impact the marine environment. The impact of the cooled seawater discharge is discussed separately (in section C.5.b.iii) because the significance of that impact warrants an expanded discussion.

The LNG ships would use seawater to remove the latent heat of the exhaust system in the boil-off LNG condensers. While at sea, the ships would discharge about 67,000 gallons per minute (about 96 million gallons per day) at about a 5.9^{o}F temperature increase above ambient. The approximate gallons per minute discharge in port would be 12,000 (about 17 million gpd) at approximately 7.4^{o}F increase over ambient. It is expected that these would be continuous discharges.

While at sea, the turbulence created by the propeller and movement of the LNG ship would cause the heated water to mix quickly with ambient waters. The average temperature increase around the ship in transit is not expected to be significant and no significant biological impacts associated with this discharge are anticipated.

The warm water discharge from the ship in port would create a thermal plume in the area around the ship and the berthing end of the trestle. There is not enough information available to calculate the expected plume configuration and thermal regime, but some general comments could be made. Based on a review of thermal plumes studied at other facilities (the volume of water, thermal differences, and plume configurations), it is expected that the warm plume would affect only a small area near the trestle. In that area, biota may be affected by the slightly increased temperatures, colder climate species being more affected than warm climate types. However, this thermal impact is not expected to be significant and may only act to locally reduce the potential for an increase in species diversity which would develop on and around the created habitat of the trestle.

There is not expected to be any significant interaction between the cold seawater discharge from the LNG vaporizers and the ships warmed seawater discharge because of the distance between the ship berth and seawater system outfall. It appears that the two discharge points would be separated by 800 feet or more. The maximum expected length of the cold water plume is about 400 feet. Since both cold and warm plumes would be oriented downcurrent, little or no plume interaction would occur.

Both onsite and offsite surface runoff (rainfall) would be collected and routed through settling basins (three basins are planned) before being released to the ocean. No oily stormwater would be handled by these systems.

Oily water would be treated by an oil/water separater and coalescer before being discharged through the seawater system. According to the comments from the California State Water Resources Control Board, a limit on oil and grease of 25 mg/1 for a 30-day average and 75 mg/1 at any one time would be placed on the applicant by the California Regional Water Quality Control Board, Central Coastal Region in their NPDES permit. Grease and oil would be monitored before discharge to the seawater system. Sanitary wastes would undergo biological secondary treatment before discharge through the seawater system. Limits would be set in the NPDES permit on flow, BOD, settleable solids, suspended solids, and coliform bacteria. Those parameters of water quality would be monitored before discharge.

A tanker or barge collision or grounding in the area of the plant site could release Bunker-C fuel oil. The adverse effects would depend on spill size, spill location, and existing meteorologic and oceanographic conditions.

LNG spills and minor spills of materials incidental to construction and maintenance such as paint, solvents, and lubricating oils would also impact the marine environment. The extent of the impact would be dependent on the size and frequencies of spills.

ii. Dredging

An estimated 146,000 cubic yards (this is the in situ volume as opposed to 180,000 cubic yards, bulk volume which is the volume of spoil that would have to be disposed of) of material would be excavated from the ocean floor to construct the proposed seawater system pipeline trenches. The location of these pipelines are shown in figure 2.

The trench through the surf zone to a water depth of 8 feet (1,010 feet long) would contain all three conduits. The trench from the 8-foot depth to a depth of 30 feet (1,963 feet) would be 45 feet wide and would contain the intake and discharge conduits. The fish return conduit would bear to the southeast from the 8-foot depth to a depth of 20 feet (897 feet long) and would be contained in a trench 25 feet wide. From the 30-foot depth, the discharge conduit would extend directly offshore to terminate in 50 feet of water (2,467 feet long). Conduits in depths of 30 feet or less would rest on a graded gravel bed and be covered by imported quarry run and armor stone. At depths in excess of 30 feet, the discharge conduit would be laid in a shallow trench on a bed of gravel and covered by quarry run and armor rock.

The seawater system pipelines would be constructed through predominantly rocky bottom with intermittent areas of medium to coarse sediment. Trenching would require blasting to fracture the rock for removal by clam-shell dredge.

The blasting procedures would be as follows. A maximum of 30 holes per day would be drilled into the sea floor to a depth of 25 feet. Each hole would be charged with 156 pounds of Nitramon waterproof explosive. In the maximum case, there would be three parallel rows of 10 holes on 10-foot centers. Explosives would be detonated once at the end of each day. The center row of charges would be detonated first, and then the outer rows would be detonated after a millisecond delay.

The material to be excavated after blasting would consist largely of rocks averaging ½ to 1 foot in diameter with some medium to coarse grained sediments. Based on the nature of the material to be excavated and the remoteness of the site from known existing and historical sources of pollution, the spoil material meets the criteria set forth in section 227.13b of the Environmental Protection Agency Ocean Dumping Regulations and Criteria and as such is environmentally acceptable under this section for ocean dumping without further testing.

A barge-mounted clam-shell crane would transfer the material from the trench into a separate barge to be disposed of at another site.

No significant long-term impacts on the water quality of the marine environment are anticipated because of the proposed dredging operation. Blasting and other trenching activities would create some short-term turbidity.

At the present time, the preferred dredge disposal site has not been selected by the applicant. The Environmental Protection Agency Ocean Dumping Regulations and Criteria indicate that options are available for ocean dumping of dredged material subject to specific conditions of dredged material permits issued by the U.S. Army Corps of Engineers. The first option is to dispose of dredged materials at an approved designated dredged material site. The nearest approved ocean dumping site to Point Conception is located off Port Hueneme, California. This site is approximately 64

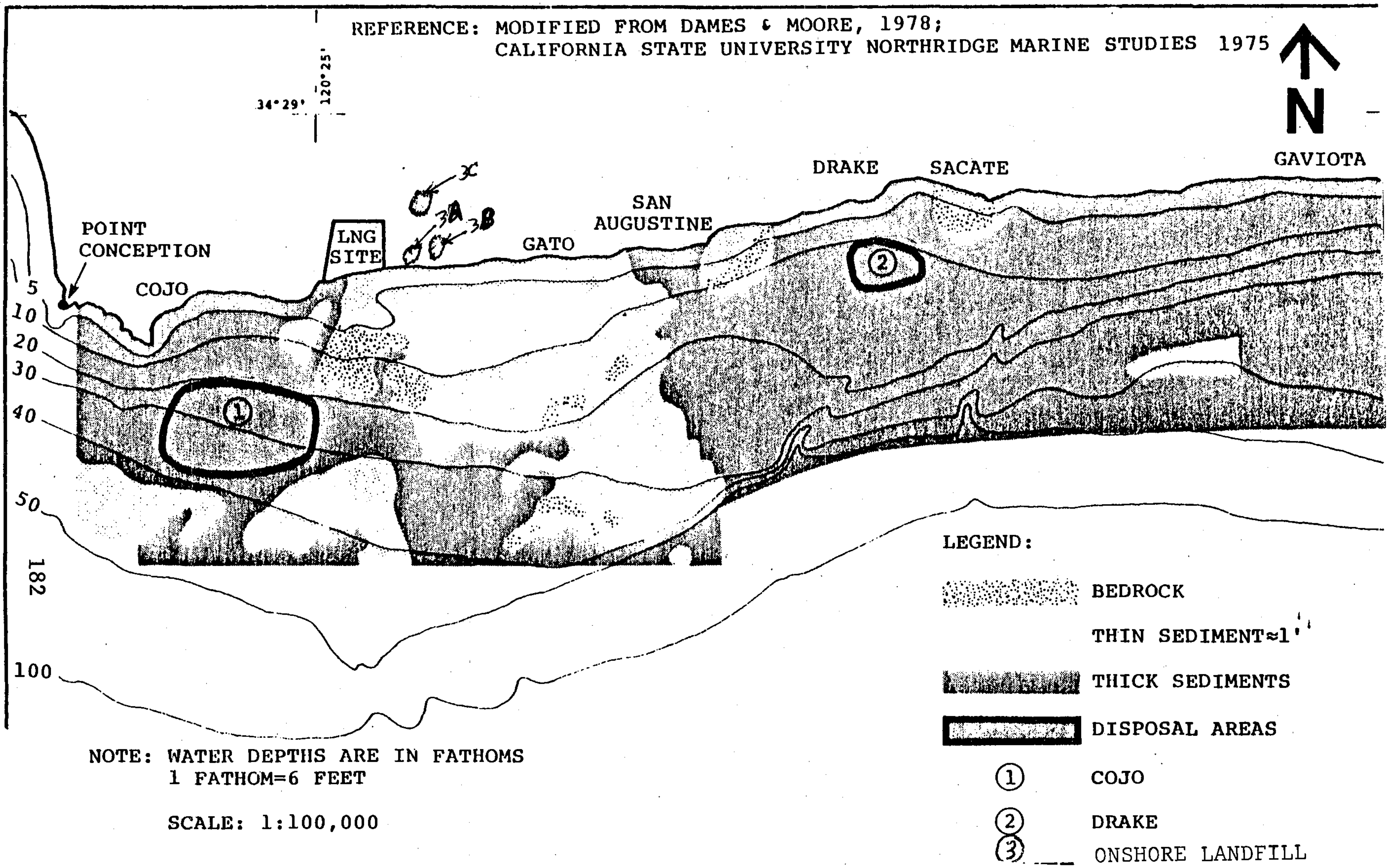


Figure 33: Potential Offshore Dredge Material Disposal Sites

nautical miles from the Point Conception site. Because of the considerable distance of this dumping location from Point Conception, the applicant has considered two other options. These include approved landfill sites and alternative ocean dumping sites.

From these two options, three alternative sites (figure 33) were examined, and were ranked by the applicant as follows:

1) Shallow water nearshore (Drake)

2) Deepwater offshore (Cojo)

3) Onshore landfill

The Drake alternative would be located in 60 to 90 feet of water about 5 miles east of the Point Conception site (Lat. 34°37.2', Long. 120°18.3'). The bottom is comprised of fine sand and silty fine sand. Sediment thickness varies from approximately 10 to 40 feet. Dredged material would be loaded on bottom-dump barges to be towed to the disposal site. The material would be deposited on the bottom to form a reef with significant relief.

The Cojo alternative would be located about 2 miles to the southwest of the proposed site (Lat. 34°25.5', Long. 120°26.6') in approximately 120 to 240 feet of water. The bottom is primarily fine sand and silty fine sand with sediment thickness of 10 to 30 feet. Bottom-dump barges would be used to dispose of the dredge material. Spoil would conceivably be dispersed over a larger area at the Cojo alternative than at the Drake site.

At the Cojo site, assuming that the spoil would pile up to the same height on the ocean floor as the height carried in the barge (9 feet), the area of ocean floor covered by 180,000 cubic yards of material would be approximately 65,000 square yards.

The disposal of spoil at either of the ocean alternatives would not result in significant long-term water quality impacts. Short-term increases in turbidity in and near the disposal area would occur.

The three onshore landfill sites considered are ravines on the Southern California Edison Company property adjacent to the proposed LNG site. No significant long-term hydrological impacts are anticipated with the filling of any of the considered ravines with ½ to 1-foot diameter rocks and coarse sediment.

Biological impacts associated with the proposed dredging and spoil disposal are discussed in sections C.7.a and C.7.b. A discussion of the disposal site alternatives is included in section H.

iii. Seawater Vaporizer System

Potentially, the most significant operational impacts that would occur are associated with the seawater heat exchange system. The proposed LNG plant would discharge 160,000 gpm (1.3 Bcfd case) of seawater chilled to 12°F below its intake temperature.

Because of the range of anticipated impacts associated with the proposed use of the seawater heat exchange system, the use of gas-fired baseload LNG vaporizers was considered by the staff. This issue was also considered by the California Public Utilities Commission (CPUC). The following comment (with which the staff agrees) was made by the CPUC staff in response to a recommended condition submitted to CPUC by the California Coastal Commission:

> Staff believes the use of gas-fired vaporizers is undesirable from an economic and energy conservation standpoint. (Exhibit A-40 or A-41). Also, air pollution (mainly NO_x) produced by the baseload vaporizers, as listed in the DEIR and Technical Report No. 4 (Exhibit A-87) would exceed the threshold level established by the Environmental Protection Agency (EPA), requiring a PSD (Prevention of Significant Deterioration) permit from EPA. This would require tradeoffs which might be very difficult to achieve in Santa Barbara County. Thus, the staff opposes the use of gas-fired baseload LNG vaporizers. This condition if adopted is almost guaranteed to cause lengthy delays or block the project completely.

The proposed seawater return outfall at Point Conception is shown in figure 34. It is proposed that the discharge be a simple open-ended pipe located in water about 51 feet deep at MLLW. The proposed outfall would be angled at 20^{o} above horizontal and would point in a general SW direction towards deeper water. Because of the reduced temperature of the discharge, the density of the discharge would be greater than that of the ambient seawater and would thus tend to sink. Given the limited depth, it is considered unlikely that the discharge would achieve neutral buoyancy before touching bottom.

An analysis of the temperature field due to the proposed cooled seawater discharge at Point Conception was conducted by List, Koh and Brooks. 1/ On the basis of mathematical analysis and hydraulic modeling of the proposed discharge, List concluded that:

1. The peak mean temperature decrement on the sea floor would not exceed 1.4^{o}F $\pm$ 0.3^{o}F.

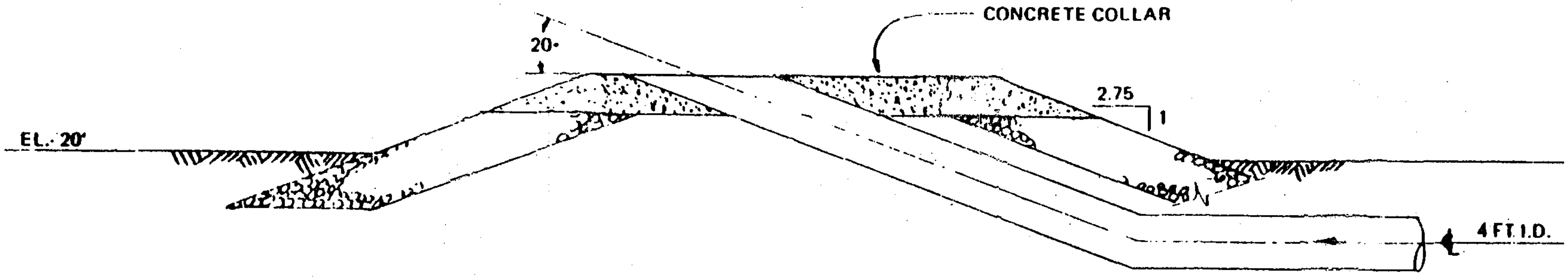
2. The peak temperature decrement on the sea surface would not exceed 3.4^{o}F $\pm$ 0.7^{o}F.

3. The peak surface temperature decrement would occur at approximately 150 feet from the point of discharge.

4. The mean dilution of the discharge anywhere on the sea floor would be greater than 8:1.

5. The primary surface manifestation of the discharge would be a surface current approximately 120 feet wide and having a peak velocity of 3.3 ft/sec at about 150 feet from the discharge. Beyond that the velocity would rapidly decay.

1/ P.J. List, R.C.Y. Koh, and W.H. Brooks, "Analysis of Temperature Field Due to Proposed Cooled Seawater Discharge at Point Conception," 1978.



FISH RETURN DISCHARGE

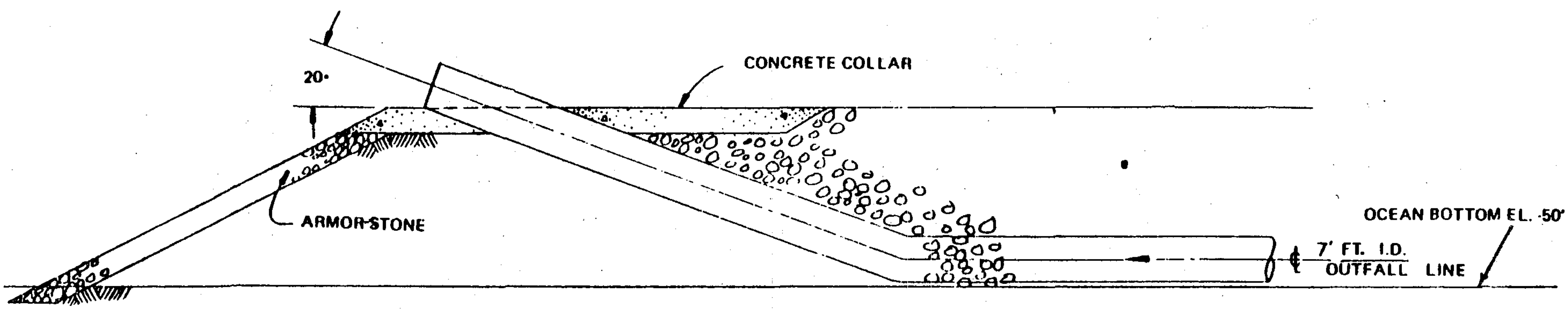


Figure 34: Seawater Outfall Discharge

6. The current would decay almost linearly with distance from the point of discharge and would have an estimated peak magnitude of about 0.5 ft/sec at a distance of 1,000 feet from the point of discharge.

7. The influence of ocean currents would be to increase the dilution of the discharge.

8. Winter conditions would reduce the net buoyancy flux of the discharge jet and increase the dilutions. This would reduce even further the magnitude of the temperature decrement on the sea floor.

It is proposed to control settlement and growth of biofouling organisms in the vaporizer system using continuous injection of chlorine. Very low level or exomotive chlorination (0.02 - 0.05 parts per million (ppm) residual) would be used in the intake conduit. Downstream of the seawater pumps, the level of chlorine would be raised to produce a 0.2 - 0.5 ppm residual.

Dechlorination would be achieved by the addition of sulfur dioxide (SO_2). The neutralization reaction is as follows:

$$S_2O_3^{=} + 4OCl^- + H_2O \rightleftharpoons 2HSO_4^- + 4Cl^-$$

The amount of neutralizing agent required would depend upon the level of chlorine residual in the seawater.

Chlorine is not an effective antifouling agent unless some residual level is maintained beyond the intrinsic chlorine demand. Three phenomena affect the ultimate concentration of chlorine in the seawater stream. First is the effect of chloride (Cl-). Second is the presence of inorganic materials which may reduce chlorine concentration. Third is the organic materials which may react with chlorine in solution. As a consequence of the effects of these phenomena, Arthur D. Little Inc. anticipates that the intrinsic seawater demand for chlorine would be roughly 1.0 to 1.5 ppm. That is, to obtain an intake residual of 0.02 - 0.05 ppm would require that chlorine be added at a concentration of from 1.02 ppm (1.0 ppm demand plus 0.02 ppm residual) to

1.55 ppm (1.5 ppm demand plus 0.05 ppm residual). These amounts would be increased downstream of the seawater pumps to produce residuals of 0.2 - 0.5 ppm. At an intake rate of 160,000 gpm, continuous chlorination would require the equivalent weight of sodium hypochlorite of 7,950 lbs/day to produce a 1 ppm chlorine concentration.

Reactions which result in chlorine demand of seawater are also important in that the chlorine compounds which are formed are toxic to varying degrees and may escape neutralization by the proposed addition of sulfur dioxide (SO_2).

Chlorine (as hypochlorite) attacks ammonia (although the concentration of ammonia is fairly low in seawater), forming several substances generally known as chloroamines. Chloroamines themselves are subject to further oxidation by hypochlorite, producing nitrogen, nitrogen oxide, and free chloride ion. A portion of the hypochlorite will be converted to hypobromite and hypoiodite. These compounds are not as effectively reduced by sulfur dioxide. Unless more sulfur dioxide would be added to effect the equivalent neutralization reaction as with pure HClO , a low level of residual toxicity would remain.

In addition, some organic compounds present in seawater, such as phenols, can be chlorinated or brominated in a reaction with $HCl\bar{O}$ or BrO (hypobromite), forming relatively stable compounds which are also toxic to marine life. The assimilation of halogenated organic compounds by living organisms would permit escape from dechlorination.

Table 37 provides information on the effects on seawater chemistry of adding chlorine (1.56 ppm = anticipated average) to a 156,000 gpm seawater flow and, subsequently neutralizing the chlorine with sulfur dioxide. At the time this table was prepared, the exomotive level anticipated was from 0.05 - 0.2 ppm chlorine.

In order to assure that complete chlorine neutralization would be accomplished, enough sulfur dioxide would be added to produce a residual. Based on the applicant's anticipated average residual of .654 ppm and the seawater discharge dilution calculations by List, residual sulfate concentrations would be less than 0.07 ppm beyond 400 feet from the discharge.

TABLE 37

CHLORINATION -- CHEMICAL INPUT AND OUTPUT

	Vaporizer[a] kg/day	Fish Return[b] kg/day	Total mg/l	Total kg/day
Chlorination				
Electrical energy[c] (MW.hr)	8.4			
N OCl (as Cl_2)[d]	1360	124	1.56	1484
H_2 (+)[e]	38	3	0.04	47
DeChlorination				
SO_2	298[f]	0[g]	0.31	298
Discharge (Change)				
Cl -[h]	- 5	- 4	- 0.01	- 9
Br -	- 167	- 26	- .20	- 193
I -	- 34	- 4	- .03	- 38
H_2SO_4	412	0	0.43	412
HCl	153	0	0.16	153
H_2SO_3[i]		0	?	?
NH_4SO_4	97	0	0.10	97
HCO_3	-200[j]	0		?
Cl_2O (+)	300[j]	0		?
Carbon (BOD)	- 1063	- 125	- 1.25	1188
Br/Cl Organics[k]	85	10	0.10	95
NH_2Cl	0	5	.01	5
$NHBr_2$	297	35	.35	332
IO_3 -	45	5	.05	50
OBr -	0	8	.01	8

NOTES FOR TABLE 37

NOTES:

Seawater	mg/l	Seawater	mg/l
Cl^-	1900	NH_3	0.05
Br^-	65	Carbon	
I-	0.04	BOD	1-2 mg/l
$So_4^=$	2500	COD	5 mg/l
HCO_3 -	140		

a At 1.3 BCF/D Gas Throughput Vaporizer Flow is 156,000 gal/min 850 x 10^6 l/day

b Fish return operation at 28,000 gal/m 65% of time = 99 x 10^6 l/d

c 6.2 KW.hr/kg Cl_2

d

Average Chlorination	mg/l
Seawater demand	1.25
intake residual	0.13
plant residual	0.35

(Average between Low and High in Table 3)

e Remains in solution

f Strict stoichiometric demand, actual dosage will exceed

g Fish return is assumed to receive no dechlorination

h Net change due to combination with other substances, source of chlorine is seawater.

i Unreacted SO_2 - amount depends on excess dechlorination.

j If vaporizer is well aerated, Cl_2O may escape otherwise it will be dechlorinated by SO_2 and HCO_3 is regenerated.

k As C_6H_5OHX X= 1/3 Cl, 2/3 Br

A 28,000-gpm fish return discharge containing a 0.02 - 0.05 ppm chlorine residual would not be neutralized. Based on the List studies and assuming the most conservative discharge concentration of chlorine (i.e., 0.05 ppm), the daily average concentration within 150 feet of the discharge would be about 0.005 ppm.

iv. Waves

Waves could cause impact on the berthing operation of LNG tankers. Waves influence berth availability in two ways:

1) by exceeding the operational limits of line-handling vessels, thereby making it impossible to moor the LNG vessel; and

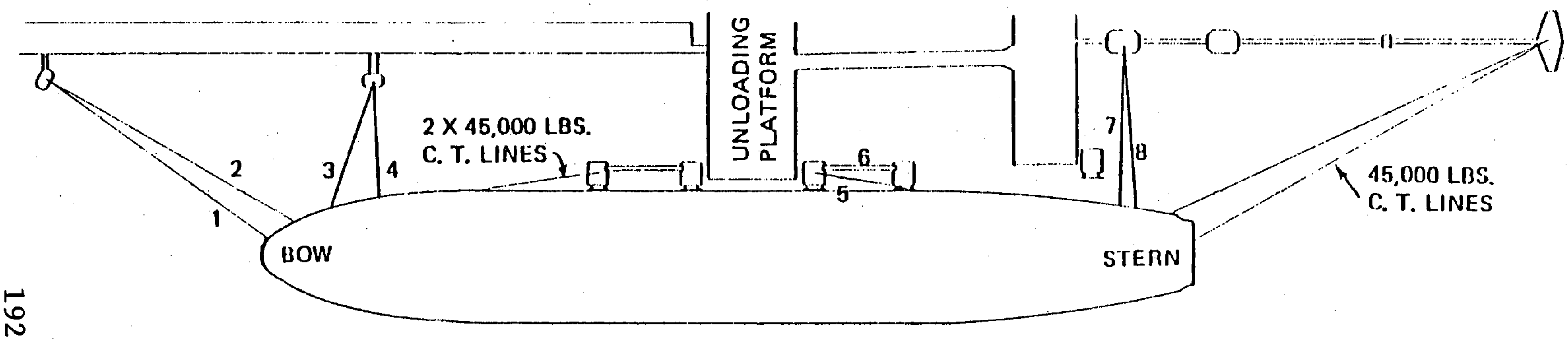
2) by inducing large motions or forces in the LNG vessel after it is moored, which either exceed the limits of the offloading equipment to compensate, or, in the extreme case, damage the terminal structure itself. The ship must cease offloading, and may be forced to leave the pier and wait for conditions to become more favorable.

The issue of berth availability is significant because if the project was implemented as proposed, berth unavailability in excess of some annual average percent would presumably jeopardize the facility's capacity for delivering required volumes of gas.

To minimize downtime resulting from the effects of waves on moored LNG tankers, Delft Hydraulics Laboratory (Delft) 1/ conducted modeling studies which would identify the optimum pier and mooring configuration for LNG tankers relative to the expected wave regime at the proposed site. Based on these studies, an L-shaped pier with the berth oriented at 255° was selected. The mooring configuration proposed is illustrated in figure 35. Associated with each mooring arrangement for a

---

1/ Point Conception Marine Terminal, "Berth Availability of an LNG Facility in Waves, Winds and Currents," Delft Hydraulic Laboratory R 1216, March 1977.



TOP VIEW

LINE 1, 2 1½" WIRE ROPE WITH NYLON TAIL

3,4 45K# PULLIN 90 K# PAY OUT

5,6 1½ WIRE ROPE WITH NYLON TAIL

7,8 45 K# PULLIN 90 K# PAY OUT

Figure 35
THE MOORING PATTERN OF A 130,000m^3 LNG SHIP

ship of a given size and configuration is a series of allowable wave heights. 1/ Movement or force limits which would be exceeded if waves surpass the allowable heights are indicated in table 38.

TABLE 38

MOVEMENT OR FORCE LIMITS
OF THE RECOMMENDED MOORING ARRANGEMENT

Motions of manifold	10 feet
Fender forces	300 tons
Line forces	50 tons
Sway of ship toward fore service platform	7 feet
Sway of ship toward aft service platform	14 feet
Sway of keel toward fender A or fender B	7.5 feet
Downward motion of keel	12 feet

1/ "Allowable wave height" is defined as the wave height which would exceed one or more of the mooring configuration movement or force limits if it occurred more than once in a 3-hour period. Allowable wave height varies both as a function of the wave period and the angle of approach relative to the ship. A relative angle of 0° would represent waves striking the bow of the ship, while 90° would represent waves striking the beam.

Figure 36 indicates the allowable wave heights for the proposed mooring arrangement for waves of selected periods. In a separate study conducted by Tetra Tech, Inc. 1/, this same type of information is provided (figures 37 and 38) for long period waves (18 to 300 seconds).

Some operating experience has lead to the rule of thumb that small craft cannot be effectively used for linehandling purposes in sea conditions which exceed a significant wave height of 6 feet. Based on Delft's studies, because the ship at berth would generally tolerate wave conditions in excess of those in which linehandling vessels operate effectively, the limiting factor for berth availability would appear to be the operating capabilities of the linehandling vessels during mooring.

Using the generally accepted wave limiting factor of 6 feet, and other factors which would reduce berth availability (e.g., high winds and low visibility), Arthur D. Little has prepared what is currently believed to be the best estimate of berth downtime. 2/ As previously indicated in section B.5.b.ii., because the only wave information which existed at the time of that report were estimates, it was recognized that the calculation of berthing downtime would also be estimates. Because a review of legitimate applicable wave and wind studies revealed a range of conditions, a range of berth downtimes was prepared. The results of these calculations are presented in table 39. This information is also represented graphically by month in figure 39. Winds greater than 25 knots and waves greater than 6 feet were used as conservative estimates of the limiting criteria. Since this report was prepared, the U.S. Coast Guard (see comments) has indicated that the visibility limit would be 1 mile.

1/ Allowable Wave Heights for Mooring a 130,000 Cubic Meter LNG Ship at Point Conception, California, Tetra Tech, Inc., Report No. TC-917, April 1978.

2/ Berth Availability, Technical Report No. 15.

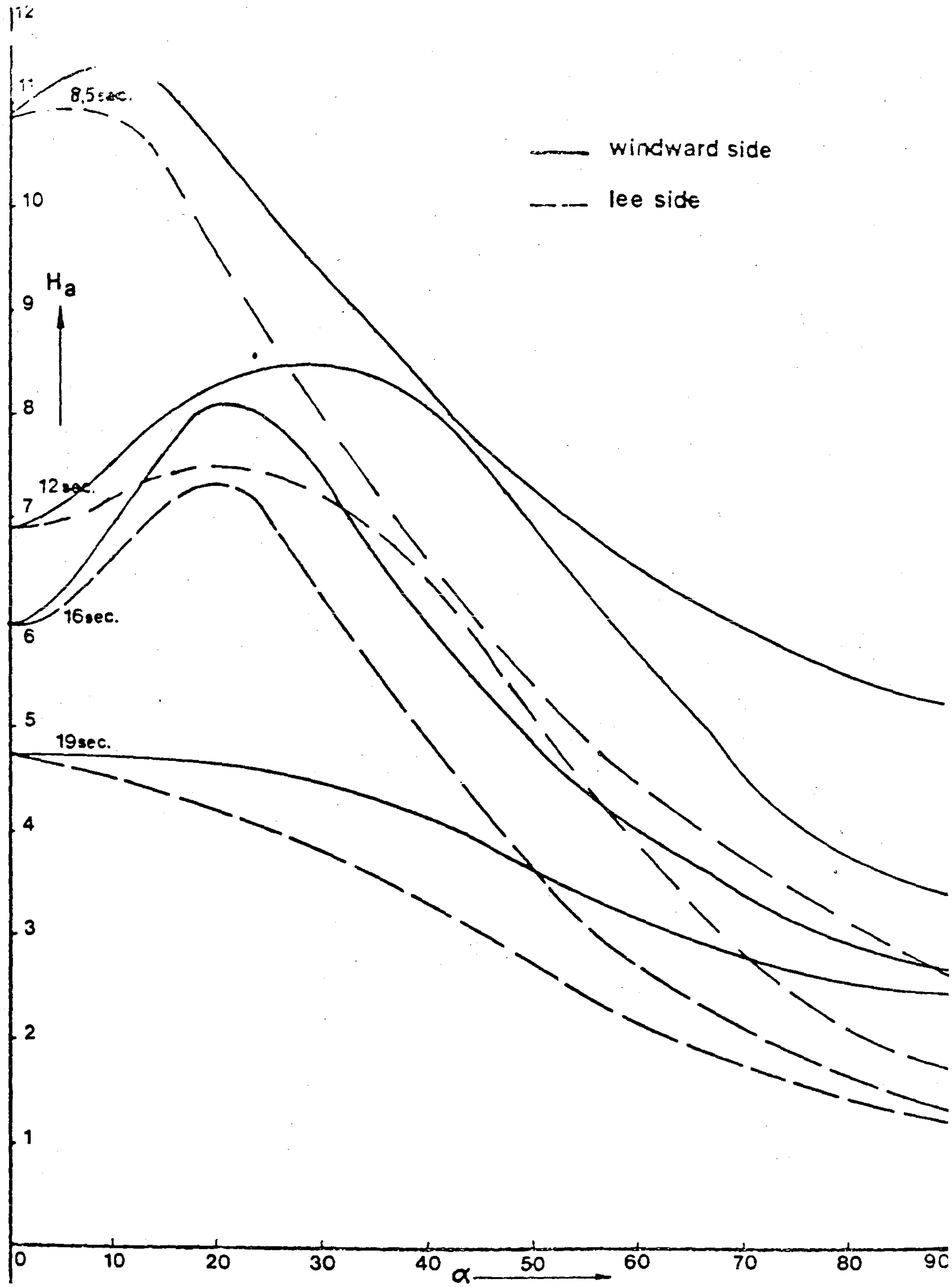


Figure 36: Allowable Wave Heights as a Function of Relative Angle, For Several Wave Periods

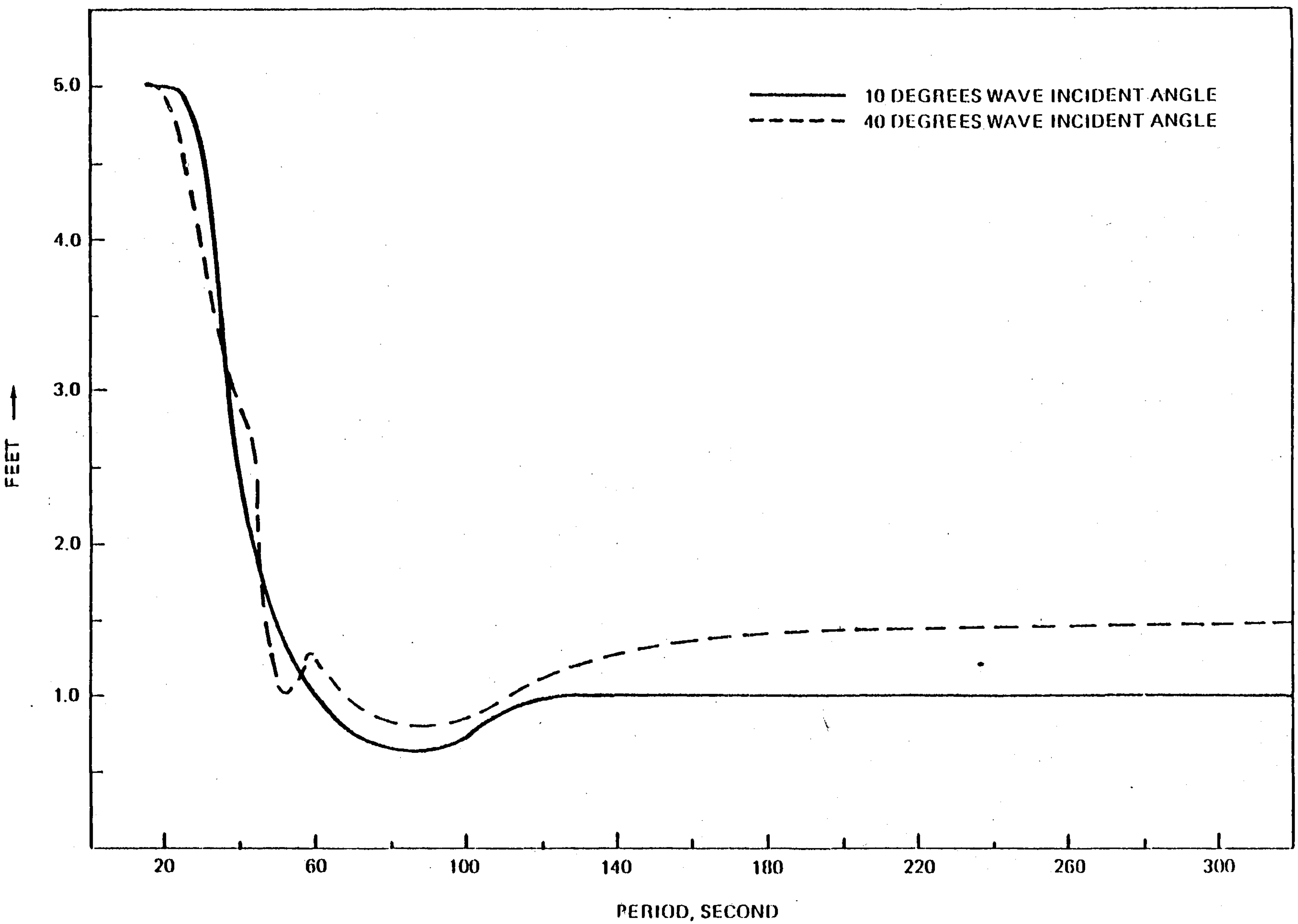


Figure 37: Allowable Wave Height as a Function of Wave Period

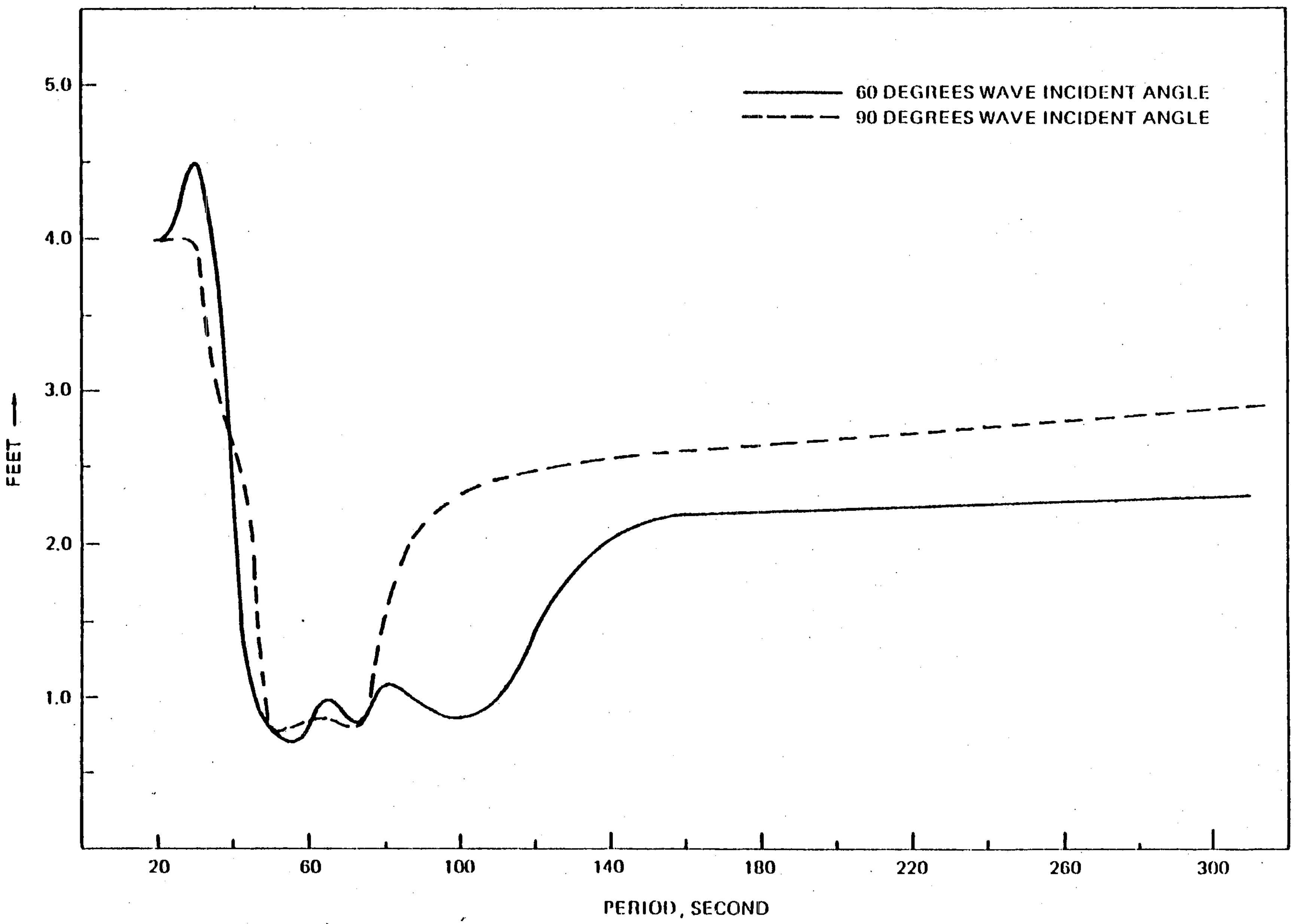
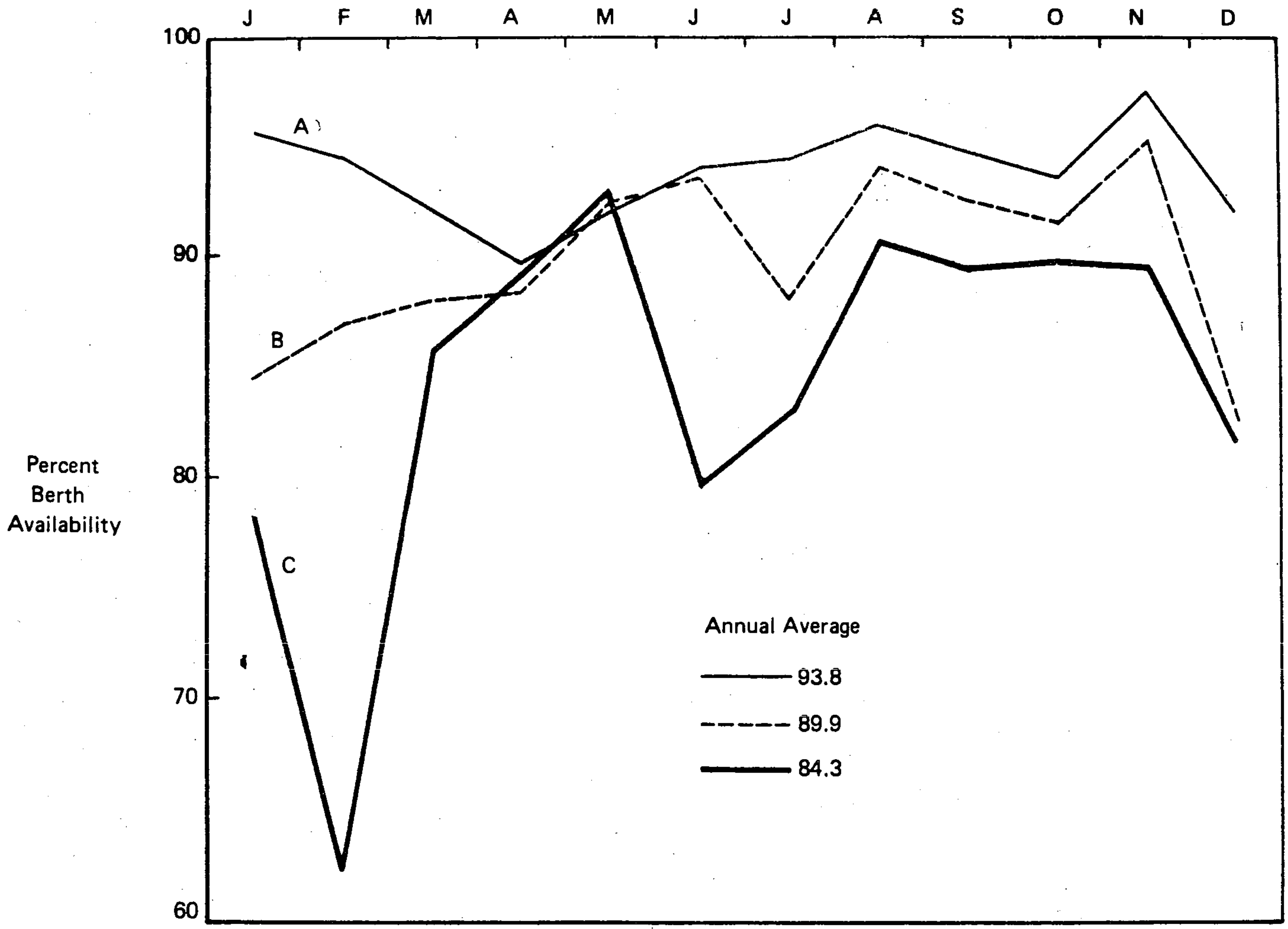


Figure 38: Allowable Wave Height as a Function of Wave Period



Curve	Waves (feet)	Wind (knots)	Joint Occurrence Correction	Visibility (miles)
A	$> 6^{(1)}$	$> 25^{(2)}$	Yes$^{(3)}$	$< 0.5^{(4)}$
B	$> 6, 0^{\circ} - 290^{\circ(5)}$	$> 25^{(2)}$	No	$< 1.0^{(4)}$
C	$\geqslant 6^{(6)}$	$\geqslant 25^{(7)}$	Yes$^{(3)}$	$< 1.0^{(4)}$

(1) OSI Hindcast, Table 3, February 1977
(2) OSI Hindcast, Table 1, February 1977
(3) Strange Hindcast, Table 4, October 1977
(4) Climatological Study (Square 8), March 1971
(5) Climatological Study (Square 8), March 1971, Corrected for direction of approach using DNOD wave roses (unpublished 1977)
(6) Strange Hindcast, Figure 9, October 1977
(7) Strange Hindcast, Figure 8, October 1977

Figure 39: Point Conception Berth Availability By Month

TABLE 39

PERCENT OF BERTH DOWNTIME BY MONTH
(Low, Medium and High Estimates)

	Waves > 6 ft[1] Wind > 25 kt[1] Joint Occurrence Corrn[2] Visibility < 1/2 mile[3]	Waves > 6 ft, 0°-290°[4] Wind > 25 kt[1] No Joint Occurrence Corrn Visibility < 1 mile[3]	Waves > 6 ft[2] Wind > 25 kt[2] Joint Occurrence Corr Visibility < 1 mile[3]
January	4.4	15.6	21.8
February	4.2	13.1	37.7
March	6.5	12.0	13.6
April	8.4	11.7	10.7
May	8.0	7.7	7.0
June	5.6	6.3	15.1
July	5.5	11.8	15.5
August	3.9	6.0	8.9
September	5.5	7.3	10.1
October	6.3	8.4	10.0
November	1.9	4.7	10.4
December	6.6	17.1	17.0
Annual Average	5.5	10.1	14.8

Notes: 1 - OSI Hindcast, February 1977
2 - Strange Hindcast, October 1977
3 - Climatological Study (Square #8), March 1971
4 - Climatological Study (Square #8), March 1971, corrected for direction of approach using DNOD wave roses (unpublished 1977)

With reference to the Tetra Tech _in situ_ study discussed in section B.5.b.ii., the Arthur D. Little report made the following comment even before the results of that study were available:

> Because of the natural variability in the frequency of occurrence of waves from year to year, direct comparison of a short record (i.e., a few months) of waves at the site with previous hindcast projections will only be marginally useful or reliable. Such a comparison could, however, serve to qualitatively substantiate the projections or raise concerns if measured and projected values differ greatly.

The staff agrees with this position. Although the measured data did differ substantially from the highest projected values for 3 out of 5 months, weather conditions were considered to be unusually severe during that period. This makes a comparison with projected values difficult. At present, too little measured data exists to know if to raise concern about the disparity between the measured and projected values is warranted.

Assuming that Little's estimated range of berthing downtime is essentially correct, the California Public Utilities Commission 1/ drew the following conclusions regarding the effects of downtime on the proposed LNG facilities' reliability in delivering required volumes of gas (1.3 Bcfd case):

> (1) The range of downtime percentages can be divided into three regions: 0 to 17 percent, 18 to 21 percent and 22 percent and over. It is very probable that the transportation system described in this study could maintain a long-term average throughput in excess of 1.3 billion cfd in the first range (0 to 17 percent). Similarly, it is probable that the system could not maintain throughput in excess of 1.3 billion cfd in the third range (22 percent and over). Long-

1/ Report on Berth Availability and Reliability, California Public Utilities Commission LNG Task Force, April 1978.

term capacity in the midrange (18 to 21 percent) is uncertain. It cannot be reasonably concluded that throughput in excess of 1.3 billion cfd can be maintained given the available information.

(2) Based on the criteria in (1), it can be concluded that weather-caused berth downtime will not seriously impair operations at the Point Conception site. The Rattlesnake Canyon site would not be capable of sustaining an average throughput at 1.3 billion cfd without a breakwater. It appears likely that Rattlesnake Canyon with a breakwater would fall in the middle category; throughput capacity in excess of 1.3 billion cfd is possible but not assumed.

(3) It is probable that the throughput capacity for a site in the midrange (18 to 21 percent) could be increased to over 1.3 billion cfd with the addition of one more LNG tanker or a second berth at the receiving terminal.

(4) Long-term average winter throughput can be maintained in excess of 1.3 billion cfd for either site.

(5) For sites with percentage downtimes in the 0 to 17 percent range yearly throughput will fall below 1.3 billion cfd 1 to 2 years in 10. For sites with 18 to 21 percent downtime yearly throughput will fall below 1.3 billion cfd 2 to 4 years in 10.

At the present time, it would appear that the wave regime at Point Conception would not seriously impair operations at the Point Conception site. However, this conclusion is based almost entirely on evidence utilizing data developed by hindcasting methods, and some disparity in results have occurred among various investigators because of differing interpretations of the source data. As a consequence, the staff believes that to assure that the proposed maritime operations at Point Conception would be safe and reliable in the delivery of required volumes of gas that in situ monitoring of meteorological and oceanographic conditions be continued by the applicant. See "Recommendations" (section I).

6. Vegetation

a) Terrestrial

i. LNG Site

Clearing, cutting, and filling activities would result in the removal of the majority of the vegetation on the 209-acre LNG site and on a 70-acre working area outside the site fence, but within the property. The northern third of the site and the Canada del Cojo would remain unaffected because they are located outside the site fence. The gullies on the site would be filled in, and essentially all of the site land would be lost as habitat for natural vegetation for the life of the project. It is estimated that about 90 percent of the vegetation to be removed on the site is grassland, with the remainder mostly coastal sage scrub.

Construction of the seawater lines would remove coastal bluff and strand vegetation on the beach and cliffs in an estimated 100-foot wide path between the ocean and the coastal terrace above. Disturbance of these unstable substrates during construction and plant operation would probably prevent native plants from revegetating this area for the life of the project unless the affected areas were artificially stabilized.

An estimated 72 acres of coastal terrace lands would be disrupted for construction of the access road to the site and the access staging area. Most of the vegetation disturbed by road construction would be valley grassland, with lesser amounts of coastal sage and riparian woodland communities. Adverse impact on the latter vegetation could be significant, because in the drainages, road construction would require cut and fill activities and deviation from the existing road. Erosion of cleared soil may inhibit revegetation in the arroyos. Certain plants uncommon in the area could be destroyed locally by construction of the access road. Grassland and coastal sage communities could be expected to recover rapidly where soil was conserved.

Construction of powerlines to the site would adversely affect sensitive plant communities if the existing powerline easement were used because oak woodland and stands of the relict north coast hardwood vegetation may be encountered along this route. Any north coast hardwood stands cleared away may not recover because of a paucity of seed source. Clearing for powerline construction in coastal California is often limited to the tower sites and access roads to them, but since the applicant has not submitted construction plans for the powerline, the proposed quantity and location of vegetation clearing is unknown. Upgrading the existing 16 kv powerline near the access road would, on the other hand, have little impact on vegetation, since access to the poles already exists.

The rare and endangered plant scrophularia atrata may be locally eliminated where clearing would occur in coastal sagebrush vegetation. Because the plant is endemic to west coastal Santa Barbara County and southern San Luis Obispo County, this could be of significant detriment to the species' viability. Nevertheless, the plant is considered endangered in only part of its range and elimination of the species through disturbance at Point Conception is unlikely. Chorizanthe Breweri might be encountered in oak woodlands along the proposed powerline right-of-way. This plant would probably not be seriously affected because it is not presently classified as endangered and the amount of clearing for powerline construction is expected to be limited.

Landscaping with trees, shrubs, and grass would offset part of the loss of primary productivity (production of plant material) on the site. The gaseous emissions from construction equipment and the proposed LNG facilities would not be concentrated enough to have a noticeable effect on vegetation in the vicinity of the proposed site.

Until the applicant completes landscaping, water runoff and erosion of the bare soil could lead to erosion of the soil beneath uncleared vegetation on the cliffs, beach, and the riparian areas. Onsite disposal of rocky debris dredged from the seawater pipeline trench, which also involves the construction of a barge dock, a haul road on site, and filling of a ravine with the debris, would all physically eliminate substantial vegetation. A large number of truck and barge trips would contribute emissions and dust to the atmosphere, possibly having a temporary adverse effect on plant growth.

ii. Pipeline

Construction of 112.4 miles of 100-foot wide pipeline right-of-way would require clearing at least 1,370 acres of vegetation. Additional acreage would be disturbed for construction access roads and temporary storage yards. The 45 miles of pipeline loop planned for ultimate development would require an additional 136 acres of cleared right-of-way.

Approximately 73 acres of oak woodland vegetation, 60 acres of chaparral, 327 acres of coastal sage, 181 acres of valley grassland, 273 acres of San Joaquin saltbush, and about 592 acres of agricultural and various types of open or disturbed lands would be cleared.

Vegetational recovery in oak woodland and riparian woodland communities would progress through three stages: first grassland, then shrubs, and finally trees would colonize the cleared right-of-way. In oak woodland, many of the shrubs would resprout quickly from root crowns or stumps. Nevertheless, it may take 100 years for the tree canopy of a mature oak or riparian woodland to form.

Succession in disturbed chaparral does not take as long, and this vegetation recovers readily when the soil is preserved. Annual plants would dominate for several years following construction. Shrubs, sprouting from root crowns and seed, would probably generate mature chaparral in 10 to 20 years, although the species mixture may be somewhat altered.

Coastal sage vegetation would require even less time to recover because many of its shrubs are natural colonizers of open areas. The backfilled pipeline trench would support a growth of annual herbs for several years until California sage, broom, and other shrubs of this vegetation achieved dominance through root crown sprouting and growth from seed.

Valley grassland communities should partially recover within the first 1 or 2 years after construction. Although many seasons would be required to restore the original diversity of plants found in some of these communities, many of the annuals (such as brome grasses and filaree) readily colonize disturbed soils; nearby seed sources would be abundant. A pioneer "valley grassland" vegetation would also precede reestablishment of the woody vegetation types as outlined above, and this vegetation would temporarily extend its area of dominance.

The arid saltbush lands would require a relatively long time, perhaps several decades, to regain their original shrub composition. They would, however, support thin stands of annuals after the first few rainy seasons.

Pipeline construction through the disturbed lands of the San Joaquin Valley and cultivated areas would have little adverse impact on vegetation, since these areas are essentially devoid of natural vegetation. Some loss of fertility of agricultural soils may result from mixing topsoil and subsoil.

The central hazard to disturbing the vegetation in this part of California is the potential for subsequent erosion. Successful recovery of the disturbed plant communities depends on the absence of significant erosion. If the thin soils were lost, the right-of-way would revegetate very slowly and for many years have the appearance of a sparsely vegetated scar across the landscape. This is presently observable on many rights-of-way in southern California because the combination of steep topography, thin soils, and unreliable rainfall patterns make many of the area's soils prone to erosion.

"Ridge-cutting," as proposed where the pipeline would follow ridgetops in the coast ranges, would probably remove all of the soil. Unless soil was redistributed on the right-of-way during backfilling operations, these ridgetop rights-of-way would remain essentially bare for long periods. They would, however, serve as firebreaks. Grading and other operations associated with pipeline construction may result in spillage of considerable soil and rock debris downslope of the ridgetops, possibly causing destruction of vegetation on the slopes and producing additional erosion.

The mixture of topsoil with subsoil during trenching operations would lower the fertility of soil in the backfilled trench. This would lengthen the time required for effective revegetation.

The rare and endangered plant species known to occur in the vicinity of the pipeline right-of-way (appendix N) may be impacted by clearing operations. Eliminating local populations or even individuals of such plants could, because of their rarity, impair the ability of the species to maintain a stable population in the area. However, the specific risk to these plants is not known, since the pipeline right-of-way has not been surveyed for the occurrence of rare plants.

b) Aquatic Vegetation

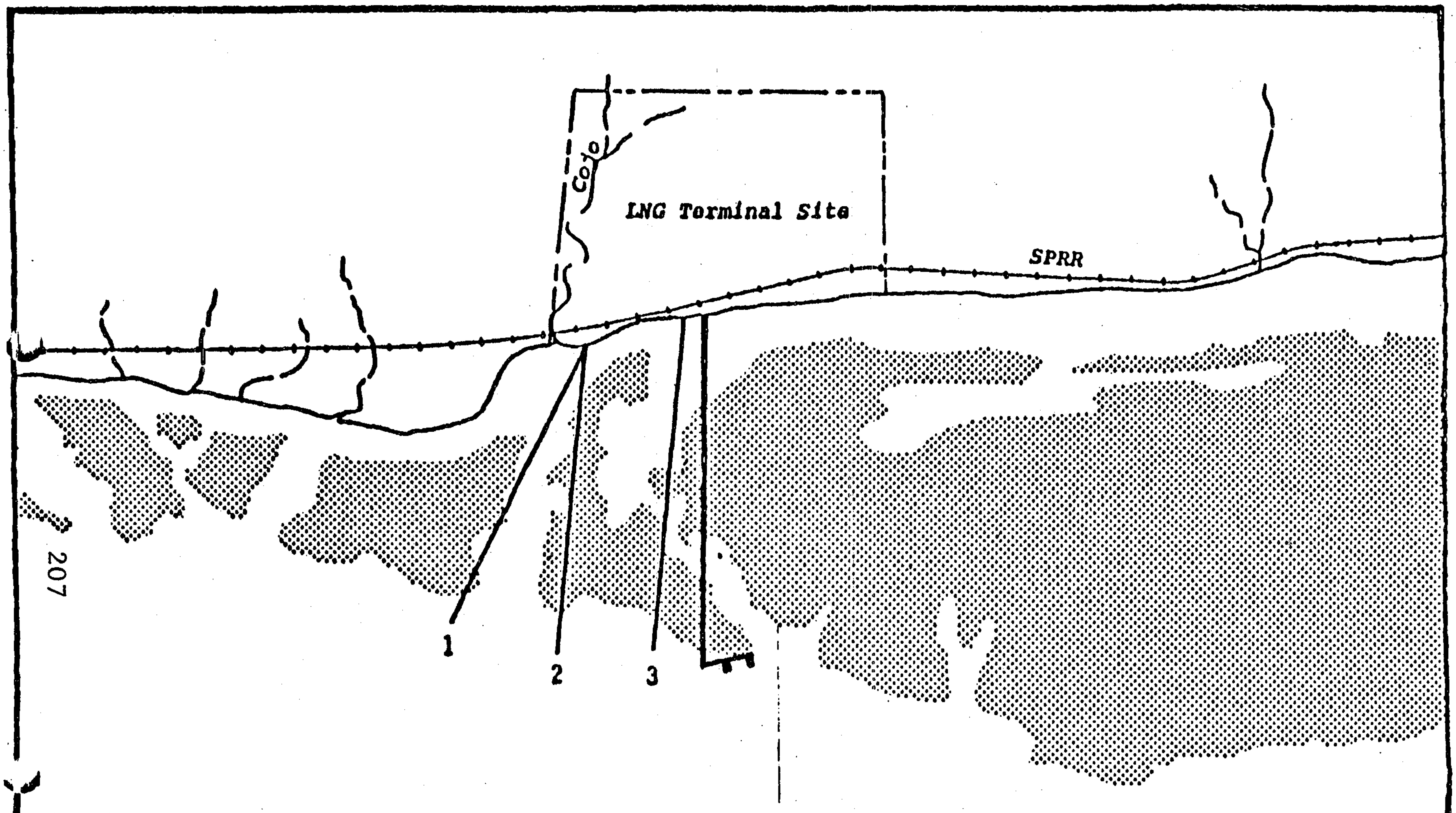
i. Marine

The proposed facilities that would impose construction and operation related impacts on marine vegetation include the 4,600-foot long pile-supported trestle and pier and the intake and outfall structures for the seawater system.

Trestle construction would involve placement of 400 pilings in the sea floor, causing the physical removal of benthic plants in the immediate area of drilling and the covering of nearby plants with debris. An estimated 7,400 square feet of bottom would be affected by the pilings. However, the impact of constructing pilings over the length of the trestle would not, in itself, constitute a significant threat to the populations of plants and animals in the vicinity of construction activities because the affected area is small compared to the size of the local benthic community and would be partially compensated for by the surface area of pilings themselves, which would add vertical substrate for the attachment of marine plants and animals. An estimated 32 acres of kelp beds would be removed or otherwise adversely affected during construction and an additional 205 acres may be severely disturbed by small craft activity during operation of the terminal. The location of the kelp beds in relation to proposed facilities is shown in figure 40.

The kelp beds off Point Conception are among the most productive in California--both biologically and commercially--and the area directly affected by terminal construction and operation amounts to a significant portion (about 7.7 percent) of kelp bed 32. This should be regarded as a maximum estimate of probable physical impact since small craft activity would be neither continuous nor complete over the 205-acre affected zone. Small craft propellers and hulls may cut or scrape kelp plants to about 10 feet below the surface when they pass over, but below this zone the plants would probably continue to grow. To minimize this impact on kelp, however, it would be desirable to confine small boat activities to the west side of the trestle to the maximum extent feasible. The 33 acres affected by construction would suffer complete loss of kelp cover and associated organisms. In waters shaded by the trestle for significant periods or where a firm substrate was not restored, the loss of kelp could be permanent. Kelp has the fastest plant growth rate

FIGURE 40 KELP DISTRIBUTION



KEY

Area of kelp

Proposed trestle

Seawater line alternatives:
1 - Cojo submarine ravine
2 - Previously proposed rocky reef
3 - Proposed locations

mi 0 .5 1
km 0 .5 1 1.5

NORTH

SOURCE:
Thomas Reid Associates, adapted from Western LNG Terminal Associates, Inc.

on record--as much as 10 to 15 feet per week. Mature stands are commonly reproduced just 4 to 5 months after harvest. Kelp areas disturbed during construction may therefore be expected to recover quite rapidly. A rare event such as an LNG spill or a large spill of fuel oil could have significant impact on a much larger area. However, the probability of such events occurring is very low and their effect would be temporary since they would not impair the ability of the kelp beds to regenerate.

Sedimentation and turbidity are the greatest hazards to marine plants resulting from construction activity. Where these occur, light attenuation reduces photosynthesis, and adverse effects may spread far beyond the immediate construction area. In the proposed project area, however, the substrate is largely rock, greatly reducing the possibility that significant sedimentation would occur. Further, active wave regimes at Point Conception would cause suspended fine particles to be carried rapidly to sea, eliminating prolonged turbidity problems.

Construction of the seawater lines would disrupt nearly one additional acre (estimating 100 feet of construction right-of-way) of kelp, located as shown in figure 40. If the lines were placed in the sediments of Cojo delta (location 1 shown in the figure), as was previously proposed, then kelp would not be physically affected, but sediments and turbidity from construction would temporarily disturb surrounding biota. When located in hard substrate, as now proposed (location 3, figure 40), the pipes would be buried and covered by rock, which would provide hard surface for attachment and growth of marine biota. Although sediments would not be a significant problem in this substrate, blasting would be required to excavate an adequate trench. Blast shock and debris could injure marine plants around the trench area.

Placement of the seawater intake line in a kelp area could prevent reestablishment of plants near the intake pipe mouth, but would otherwise have little effect on vegetation.

The seawater outfall line would be located beyond the main body of kelp beds and the pipe mouth would be angled upward, reducing the possibility of adverse impact on marine vegetation. Directing the cold-water plume upwards eliminates benthic scour and provides for substantial mixing before the cold-water plume reaches either the surface or the bottom, where most of the marine plant life occurs. Chemical products of the biocide and its neutralization reaction would be present at low levels in the seawater effluent, although the concentrations present under normal operation of the facilities should be far below levels that might affect marine plants.

Marine disposal of material dredged from the seawater pipeline trenches would, in the two marine locations under review, have limited impact on vegetation. Disposal of rocky debris at the "Drake site" in 60 to 90 feet of water would cover benthic algae in the area, while providing hard substrate for algae growth in a zone where light penetration is sufficient to encourage colonization. Whether a kelp bed would form on the rocky spoil is open to question because many of the rock particles may be too small (0.5 to 1.0 foot) to securely hold a giant kelp plant against the active wave forces. The rocks would at least supply substrate for some of the smaller benthic algae, however. Towing barges of spoil through the extensive kelp beds between the dredging area and Drake would adversely affect existing kelp and this practice should be avoided. Disposal of dredged material at the "Cojo site" in waters 120 to 140 feet deep would have virtually no effect on marine vegetation, since this is below the limit of light penetration.

Certain impacts possible from construction and operation of the LNG plant may be felt in the marine environment. The most serious of these would be erosion of the plant site and adjacent drainages, with deposition of sediments into the sea. Should this occur, kelp and other marine plant communities would be injured or destroyed in the turbid waters. However, proper drainage and stabilization of the site area by means such as the proposed settling ponds could reduce sedimentation below even natural levels.

Seawater used for the hydrostatic testing of the LNG tanks and any water collected from dewatering at the plant site would be discharged into the marine environment. Several million gallons of test water would be required for each tank and gravitationally discharged through the seawater outfall line. The discharged water would be slightly warmer than ambient, will meet applicable water quality standards, and should have no ill effects on the environment.

ii. Freshwater

The limited amount of freshwater vegetation encountered by the proposed pipeline would require several wet years to revegetate and recover from construction impact. If drainage patterns were altered by trenching so the areas could no longer retain moisture, then the wetlands would be lost and converted to grassland or saltbush scrub.

7. Wildlife

a) Terrestrial Biota

i. LNG Plant

The principal impact associated with the marine terminal and gasification plant would be a loss of wildlife habitat at the site. Approximately 140 acres of the 209 acres within the plant boundaries would be required for the facilities and construction work areas. According to the current plot plan for the terminal, 93 acres of grassland, 43 acres of coastal sage (including 13 acres occupied by ravines and coastal bluff), and 1 acre of coastal strand would be directly affected by construction. These areas would be permanently altered and their value as wildlife habitat completely destroyed.

The large coastal ravines with their relatively undisturbed coastal sage vegetation would be filled during preparation of the site. These ravines support a rich array of reptiles, birds, and small mammals, as well as providing essential cover for larger species such as coyotes, foxes, and bobcats which frequent the site. Most of the smaller animals would be destroyed; the more mobile species such as birds and the larger mammals would emigrate to any similar habitats. However, since coastal sage communities are scarce because of grazing and other human disturbance, local populations of wildlife species dependent on this habitat would probably decline.

The principal impact associated with the construction of the marine terminal, gasification plant, and ancillary facilities would be the loss of valuable wildlife habitat and the introduction of a major industrial complex in a remote, relatively unspoiled area. Vegetation would be eliminated from approximately 140 acres of the 290-acre site. An additional 70 acres outside the fenced area would be used as a construction work area. The majority of the wildlife habitat affected would be the less valuable grassland but two coastal ravines occupying about 13 acres and 1 acre of coastal strand would also be eliminated.

The riparian woodland and the adjacent coastal sage scrubland at Canada del Cojo is some of the most significant wildlife habitat at the site. Current construction plans, modified to protect the archaeological sites near the stream, would allow the preservation of the woodland and coastal sage habitats associated with Canada del Cojo.

The increased human activity and noise levels during construction would cause some species to avoid the immediate area. This would be most severe for large mammals such as deer, coyotes, and bobcats, and for raptors during the nesting season. Construction would curtail any use of the coastal strand by harbor seals.

Even though large numbers of marine birds and waterfowl migrate past the Point Conception area, it is unlikely that the construction and operation of the proposed terminal would have any significant impact on their populations. Specifically, there is a low probability that populations of black brant, sooty shearwaters, and pink-footed shearwaters would be seriously affected by the project. Black brant do not congregate to feed or rest near the proposed site, but on more sheltered areas with eelgrass beds. At any time during migration only an extremely small portion of the total population would be in the vicinity of the terminal site. Unlike the brant, shearwaters do concentrate in the immediate vicinity during the peak of migration. Although these concentrations occur, there is still little possibility for significant damage to shearwater populations. Large spills of LNG or oil are extremely unlikely and the smaller operational spills of oil, while more numerous, could be easily contained so only a small area would be affected.

Operation of the proposed facilities would have a comparatively minor effect on local wildlife populations. Human activity and industrial noise would be less than during construction, but several of the larger mammals and nesting raptors would continue to avoid nearby areas. The plant's security fence would cause a minor disruption of animal movements across the site.

The proposed project would require the construction of an adequate access road and an electric power transmission line. Depending on the final locations of these auxiliary facilities, their construction could have significant adverse impact on both terrestrial and aquatic communities along the coast.

Improvement of the Hollister Ranch Road would eliminate about 60 acres of wildlife habitat; an additional 12 acres would be required for the vehicle staging area near Gaviota. Most of the land that would be disturbed by construction is grassland, but some coastal sage and woodland would also be affected. Destruction of this amount of grassland would cause slight decreases in some small mammal and bird populations. This in turn would result in a reduction in the food resources available to raptors and predatory mammals. Since most of the valuable coastal sage scrub and woodland would be spared during road construction, overall wildlife populations along the coast would not be significantly reduced.

Filling one of the coastal ravines located on the adjacent South California Edison Company property is one of the alternatives being considered for disposal of the 180,000 cubic yards of dredged material generated during construction of the offshore seawater pipeline. A temporary dock for unloading barges and a haul road would be used to transport the material to the ravine. A special road segment would be needed to cross the Southern Pacific Railroad tracks and the coastal bluff.

This disposal alternative would destroy additional wildlife habitat associated with the coastal ravines and bluff, some of the most valuable types of habitat along the coast. Noise and human activity associated with construction of the proposed dock, haul road, and the 15,000 to 18,000 truck trips required to transport the material would be an additional disturbance to local wildlife.

Additional wildlife habitat, mostly coastal sage scrub, oak woodland and riparian woodland, would be eliminated or disturbed during construction of the proposed powerline and access roads required to reach tower sites. While this amount of habitat loss would not have a severe impact on local wildlife populations, the cumulative effect of the LNG terminal, powerline, access roads, and increased human activity could have a significant adverse impact on local wildlife during the construction phase.

ii. Pipeline Route

The major impact on wildlife from construction of the proposed pipeline and access roads would be the loss or modification of habitat, destruction of animals within the right-of-way and other construction areas, and disturbance from noise and human activity. Following construction, the use of the right-of-way and access roads by off-road vehicles could represent a long-term adverse impact on those species sensitive to continued disturbance.

The most important wildlife habitats encountered by the proposed route would be several miles of oak savannah and riparian woodlands. These habitats are especially sensitive because they support abundant and diverse wildlife populations and they require long periods to return to preconstruction conditions. Although the right-of-way would completely destroy the woodlands it crossed, the regional significance of this habitat loss should be small, since there are rather extensive stands of woodland in the area and only about 6.1 miles of woodland would be crossed. However, the riparian woodland which would be destroyed where the pipeline paralleled the Santa Rosa Creek for several miles, would still constitute a locally important loss of wildlife habitat.

Pipeline construction through coastal sage and chaparral scrub communities, grassland, and lands disturbed by agricultural development would cause only minor losses of wildlife habitat. In general, these habitats are common along the route, support sparse wildlife populations, or are capable of rapid recovery. The sparse desert-like salt brush scrub community of the San Joaquin Valley supports relatively low wildlife populations. However, this community is inhabited by the San Joaquin kit fox and the blunt-nosed leopard lizard, both endangered species. For this reason, the impact of pipeline construction may be considered significant.

The direct mortality of reptiles, small rodents, and the young of other species would be of minor consequence in most instances. The majority of these species are common along the route and have a high reproductive potential. Mortality along rare and endangered species would be an exception.

Natural springs and artificial water catchment basins are extremely important to wildlife in the semi-arid region to be traversed by the pipeline, which would pass within 500 feet of 16 of the water sources. The destruction of the springs and basins by construction or a reduction in their value to wildlife by vegetation removal, siltation, or increased human access would be a significant adverse impact on the local wildlife.

Operation of construction equipment and the movements of workers along the right-of-way would cause some animals to avoid the immediate area. The large, secretive mammals and raptors would be most susceptible to these disturbances. Raptors would be especially sensitive during the breeding season. The prairie falcon, which has several nesting sites near the proposed route, is one of the raptors most likely to suffer significant impacts from human intrusion.

After construction of the pipeline, the right-of-way and access roads could be used by off-road vehicles. Continued intensive use of these corridors by trail bikes and four-wheel drive vehicles could significantly impact vegetation and wildlife. The impact on species sensitive to human intrusion would be similar to that occurring during construction, but the impact of off-road vehicles could continue for many years. Vehicles using the right-of-way and access roads would increase erosion and hamper restoration of wildlife habitat disturbed during construction.

iii. Rare and Endangered Species

While the LNG terminal and natural gas pipeline would be within the geographical area where the species listed in table 20 would occur, most species would only be minimally affected by construction and operation of the proposed facilities. Only those species which could be significantly affected are discussed in this section.

The riparian woodlands at Canada del Cojo provide favorable habitat for the fully protected white-tailed kite. The value of the woodland for kite nesting would probably be severely reduced, especially during construction, by the increased human disturbance. This loss of nesting habitat would be important but not critical to the species. The impacts would not be as severe during plant operation.

The San Joaquin kit fox and the blunt-nosed leopard lizard might suffer significant adverse impact from construction and operation of the proposed pipeline. It is unlikely that any of the other rare and endangered species within the area would be significantly affected.

The proposed pipeline would cross a part of the Central Valley where particularly large numbers of San Joaquin kit fox dens remain. The major decline of kit foxes has occurred in the valley flatlands as a result of the conversion of natural lands to agriculture and other uses. Therefore, these denning sites and areas of natural vegetation are extremely important to the foxes remaining in the marginal habitat of the valley floor.

The blunt-nosed leopard lizard continues to lose habitat to agriculture and urban growth. The proposed pipeline would be constructed across an area of good lizard habitat. These lizards usually seek refuge in the burrows of small rodents and the clearing, grading and trenching required by pipeline construction would undoubtedly kill most of the lizards within the right-of-way. The right-of-way would remain unfavorable lizard habitat for several years following construction.

b) Aquatic Biota

i. Marine and Estuarine Biota

Impact on the marine environment would result from the construction of the marine trestle, ship berth and seawater system. Minor impacts from trestle construction would include the destruction of habitat at points of pile installation, short-term increases in water turbidity, the introduction of new high-relief substrate habitats, and the loss of some commercial fishing areas around the marine facilities. Construction of the seawater lines would result in temporary disturbance to the marine biological communities in a roughly 50 to 100-foot wide path along the route of the seawater lines. This would result in the elimination of about 5.8 acres of benthic habitat and associated benthic biota. Rapid colonization of the armor rocks placed over the seawater lines to anchor them would occur, however, by fauna of a normal rocky substrate community.

Underwater blasting for the construction of the proposed trenches could kill or stun bony fish in the immediate blast vicinity. The exact mechanism causing mortality is unknown, but fishes with air bladders swimming near the surface are primarily affected. According to the applicant, the use of Nitramon would minimize this type of impact. Research has indicated that the use of slow burning explosives (such as Nitramon) results in far less damage to fish because of the slower generation of the pressure wave accompanying the explosion.

Dredge spoil disposal in the marine environment would result in short-term and long-term impacts. Short-term impacts would include bottom disturbances with resultant slight local increases in turbidity. Accompanying increases in the biochemical oxygen demand and nutrient concentrations and decreases of dissolved oxygen could also occur. None of these impacts, however, are expected to be significant. The most significant short-term impact would be the loss of benthic fauna covered by dredge spoil. The applicant estimates that 2.0×10^8 to 5.0×10^8 organisms would be covered by 65,000 square yards of spoil. The magnitude of this impact would be reduced if a high relief artificial reef would be created because less area and fewer organisms would be covered.

Long-term impacts would include a permanent change from the existing natural benthic habitat to an artificial one. This would also be accompanied by a change in associated species composition. The creation of an artificial reef would generally be construed to be a long-term beneficial impact. However, it should be noted that to comply with criteria for the installation of artificial reefs given in the U.S. Army Corps of Engineers General Permit GP003 for Artificial Reefs (November 10, 1977), the use of large quarry rock is required. The proposed spoil is of considerably smaller diameter and would not provide large crevices or interstitial spaces among the rocks. Consequently, the full value typically associated with artificial reefs would not be realized with the use of the proposed spoil. Additionally, it has been indicated by the applicant that the location of both alternative ocean sites could conflict with designated California halibut trawl grounds.

No significant impacts on the marine biota are expected to result from the discharge of approximately 14 million gallons of seawater used for the hydrostatic testing of the LNG tanks (see section C.5.b.i.). Key species that would be affected by construction of the proposed marine facilities include abalone and spiney lobster. Although construction would have only short-term effects on local fish populations and the spiney lobster, several years could be required for the natural repopulation of the area by abalone.

Several aspects of project operation would significantly affect the marine environment, including the seawater system, antifouling of vaporizers, cold water discharge, and operation of auxiliary craft and LNG ships near the terminal. Spills of toxic materials or LNG could also produce impacts. The greatest potential impact on fish is their intake and destruction in the seawater system. At an ultimate plant vaporization capacity, 188,000 gpm of seawater would be taken in through a seawater intake located about 2,400 feet offshore in a kelp bed at a water depth of 30 feet. The velocity at the intake structure (velocity cap) is 1.5 feet per second (fps). Inside the intake conduit, the velocity would increase to 5.5 fps. The transit time through the entire system for the vaporizer stream would be approximately 35 minutes.

At the present time, no existing seawater system intake in southern California is located in a kelp bed. According to the applicant, considerable evidence is available from which it is reasonable to infer that fish entrapment would be less at the Point Conception site with a kelp bed intake than at an intake located in the offshore extension of the Canada del Cojo. The purported advantages of the proposal are based primarily on three major points: (1) that the types of fish most commonly entrapped by existing coastal power plants with offshore intakes would concentrate onshore-offshore movements in the Point Conception area, (2) that species which inhabit (but are not restricted to) the kelp beds appear to be less susceptible to intake entrapment, and (3) that the exceptionally large number of susceptible juveniles associated with kelp beds would typically be concentrated in the kelp canopy well beyond the influence of the intake.

The velocity cap proposed for Point Conception is developed after a San Onofre unit which incorporates the current understanding of optimum design. Arthur D. Little (1978), extrapolating from a generating station on Santa Monica Bay with a seawater flow rate believed to be similar to that proposed for Point Conception, anticipates that with the optimized velocity cap annual average fish entrainment would be 40,000 lbs. per year. The applicant, however, does not believe that the generating station selected by Little is technologically comparable to the proposed facilities, and in making their own extrapolations from El Segundo, Units 1-2 and Units 3-4 estimated an annual fish loss of from 3,000 to 15,000 lbs. (Critchlow).

To put the issue of entrapment of fish in perspective, Little indicated that the entrainment of an estimated 40,000 lbs. per year is not a severe impact in the Point Conception region, but does represent a significant quantity of fish and it is clearly desirable that this quantity be further reduced.

The staff agrees with A.D. Little and does not believe that the applicant's arguments favoring the kelp bed intake can currently be sufficiently substantiated by factual evidence to assure that the proposed intake location would further mitigate entrapment. Nor is the staff satisfied that potentially feasible intake alternatives promising entrapment reductions have been sufficiently investigated. Consequently, the staff has recommended that a thorough feasibility analysis (as suggested in the CPUC FEIS and also suggested to be conducted under CPUC auspices) of the offshore screenwell concept be conducted and consideration be given to the use of this intake system. It has also been recommended that studies be conducted that would be sufficient to factually demonstrate the desirability of locating the seawater intake in a kelp bed.

What appears to be an area of uncertainty is related to the mortality rate of the fish which would be entrapped. Critchlow, in testifying on the anticipated biological impacts associated with the proposed vaporization facilities, indicated that based on laboratory studies (which did not include a study of the fish return conduit) survivorship of entrapped fish was expected to be on the order of 90 percent.

Little identified several potential sources of injury to entrapped fish associated with the proposed facilities. Although fish exposed to exomotive chlorination levels for the expected residence time of fish in the fish return system (½ to 2 hours) would generally not show acute mortality, they would be affected and subviable upon discharge. Additionally, the fish could be exposed to far higher chlorine levels in the intake conduit in the course of chlorinating to meet the intrinsic seawater demand. Mixing of the amount of chlorine required to produce an exomotive residual would not be perfect, resulting in an irregular distribution of chlorine along a given length of the intake conduit downstream of the chlorine injection ports. Along this length of conduit, there would be portions where chlorine concentrations would be insufficient to prevent fouling, and there would be portions where entrapped fish would be subject to high chlorine concentrations. Little estimated that at the maximum plant development, possible chlorine overexposure would be limited to approximately 1 minute. Fish would also be subject to mechanical injury in their passage through the intake conduit, the screenwell, and the return conduit. Finally, through the combination of chemical and mechanical injury, there would be a reduced viability of the fish returned to the ocean environment making them more susceptible to predation, disease or abnormal behavior than other fish.

Although, as indicated by Critchlow, laboratory studies have been conducted, there currently exists no demonstrated effectiveness of the proposed unit in a large-scale operation. This, in the staff's opinion, makes an estimate of entrapped fish mortality rates largely speculative. If, for the 1.3 Bcfd case (with the fish return operating 100 percent of the time) fish mortality exceeds 85 percent, the impact on the fish population would be greater with the fish return in full-time operation than without it. This is based on a 15 percent increase in the quantity of fish potentially entrapped as the result of withdrawing 15 percent more water (28,000 gal/min used for the fish return system only) than is necessary for the vaporization of LNG.

The staff has recommended that the prototype San Onofre fish return system be studied in operation until sufficient information is available to accurately discern the efficiency and appropriateness of the proposed system for all anticipated throughput cases.

The impact of entrapment loss on commercial fisheries can range from almost none, if none of the fish lost would have been available to commercial fishermen, to high, if these fish are direct losses from the commercial take and also represent a high proportion of the catch. For most commercial species, the entrapment loss should not significantly affect the commercial harvests unless recruitment is also seriously reduced through meroplankton entrainment. Entrapment should have only minor impacts on local sport fishing.

Although the Point Conception area is at the present considered to be underutilized relative to sports fishing, it is anticipated that the present angler effort could more than double in the near future. As a consequence, some concern has been voiced about the impact of the proposed facility on the anticipated future of sports fishing in the area. The most serious project-related impact on sports fishing would appear to be associated with the exclusion of fishing boats from zones around the proposed marine facilities. Little predicts the maximum extent of these zones to be from 150 to 200 yards. It is expected that with exclusion zones of this extent that the impact on future sports fishing in the Cojo area would not be large.

To accurately predict the species that would be affected and the quantities of fish of commercial value that would be lost as the result of entrapment, is virtually impossible in view of uncertainties regarding the intake location, the amount of fish that would be entrapped annually and the survivorship of the entrapped fish. The staff has recommended that in conjunction with the entrapment studies recommended earlier, that studies of the impact of the proposed system on commercial fisheries also be prepared.

The following excerpt is from CPUC's DEIS and in the staff's view, accurately depicts anticipated entrainment impacts:

> Based on the abundance of phytoplankton and zooplankton at the site and vicinity, the LNG terminal will entrain, at the proposed intake rate, an estimated maximum of 112 metric tons per year of phytoplankton and 375 metric tons of zooplankton per year (using the statistical 95-percent upper confidence limit). At the rates of primary productivity measured at the site, 112 metric tons is equivalent to the biomass mass produced annually by between 30 and 1300 acres of ocean area, enough to directly support between 10 and 40 metric tons of zooplankton, or 0.1 to 0.4 metric tons of harvestable fish.

All phytoplankton are small enough to pass through the vaporizers. Nearly all zooplankton, with the exception of broad-bodied fish larvae such as mature jack mackerel larvae, are small enough to pass through the second-stage strainers and enter the vaporizers. Occasionally, some of these will be rejected because they exceed 0.3 cm in length, but will nevertheless be destroyed because all biological debris collected in the strainers will be disposed of in a sanitary landfill.

Data from power plants indicate that plankton survive transit through the intake conduit, screen well, and return conduit well, but most damage occurs once the plankton have entered the vaporizer stream. In this portion of the system, they are subjected to maximum shear and turbulence, a pressure increase of about three atmospheres inside the vaporizer pumps, and abrasion from contact with internal surfaces. In the vaporizers themselves, they are subjected to biocide toxicity as well as thermal shock from contact with temperatures near the freezing point of sea water at the boundary layer between the sea water and the heat exchange curtain. Mortality of plankton subjected to the seawater system in power plants have been recorded as between 50 and 100 percent. Except that the thermal shock is by heating rather than chilling, other stresses would be similar between the two systems. In this analysis, 100-percent mortality of entrained plankton is used to depict "worst case" impacts.

Using a 10:1 approximation for biomass conversion between adjacent trophic levels in the marine food chain, the estimated mean annual zooplankton entrainment could support 0.4 metric tons of harvestable fish. The maximum probable (95-percent confidence limit) entrainment could support 3.8 metric tons. In actuality, the loss, measured in these terms, will probably be smaller because mortality in the zooplankton mass is density dependent, and some components of the zooplankton should be able to reproduce rapidly enough to make up the entrainment losses. The effects of entrainment mortality will probably be the most important for fish and invertebrate larvae.

Dames and Moore's data and the plant entrainment rate yield an annual average entrainment of nearly 1 billion fish eggs and larvae, with a total biomass of 650 kilograms (kg), not including northern anchovy eggs and larvae. Entrainment of the latter is estimated at 64 million eggs and 137 million larvae, with a total biomass of about 100 kg. Flatfish larvae, which are far less common, would be entrained at the rate of 100,000 to 300,000 larvae per year (expectation). Maximum probable estimates (95-percent confidence limits) are for 200,000 to 4.7 million larvae entrained per year, depending on the species. These losses are high enough to potentially reduce the number of animals in each new generation, since fish spawning is limited to one or two seasons.

Nearshore species, including rockfish, sculpins, gobis, and flatfish such as California halibut and speckled sanddab, will be most severely impacted, since the adults may be significantly reduced during intake impingement, and their eggs and larvae will be destroyed during plankton entrainment. The precise population effects and the size of the "local" area affected cannot be determined, but the effects should diminish with linear distance from the intake. However, the LNG terminal would represent the first major source of "artificial" plankton mortality between Diablo Canyon and Mandalay Beach, a distance of 150 miles.

Reduction of the numbers of new young animals joining adult populations as a result of plankton entrainment mortality may make rare species (such as those at the limit of their range) more rare still, some to the point of local extinction. If this occurs, then the LNG terminal could diminish the diversity and, thus, the unique biological qualities of the Point Conception region.

The intake will also constitute a small hazard to marine mammals. Perhaps one sea lion or harbor seal per year will be entrained in the intake and die.

To place the anchovy entrainment impact in perspective, Dames and Moore calculates that the Point Conception facility would lead to a worst case mortality of 1.34×10^{-9} percent of northern anchovy annual egg production for the estimated southern California anchovy population.

A discussion of the cold water plume in terms of a description of its extent and its influence on the temperature regime of the ocean environment is also included in section C.5.b.iii. Based on the analysis prepared by List, Koh, and Brooks (1978), it is anticipated that the time of entrainment for marine organisms passively floating in the ocean would be small enough and the temperature differential would be small enough that little biological impact would result from the plume.

The activity of tugs and line handling boats would continuously disturb an area of approximately 400 acres. Roughly one-half of this area is kelp and some disruption of kelp-associated animal life would be expected through the mechanical injury from propeller blades. Bottom disturbance from propeller wash would also occur in ship maneuvering areas of less than 100-foot depth.

Bunker-C and diesel fuels could be spilled either as the result of vessel accidents or accidents associated with oil transfer operations. Prior to the operation of the proposed LNG terminal, the applicant would be required to submit an "Oil Spill Contingency Plan" to the Coast Guard. Consequently, it is anticipated that small spills associated with fueling operations would be contained and would result in little or no impact. Significant impact would only occur in the event of a large spill resulting from a vessel casualty or an operational spill sufficiently large to exceed the capacity of both dry and wet containment measures. According to studies conducted for the preparation of the CPUC FEIS, the probability of a large spill ("tens of thousands of gallons of oil") occurring over the 25-year project life is significantly less than 2 percent. If such a spill would occur, several miles of beach in the vicinity would be affected. Bunker-C fuel oil is persistent and is responsible for much of the fouling of marine organisms, particularly birds and marine mammals. Diesel fuel is chemically toxic and can injure kelp and intertidal organisms.

A large spill of LNG would chill the ocean surface almost to freezing and produce a dense, intensely cold cloud of methane vapor. Plankton in the upper surface layer could be killed by chilling, but the principal impacts would be on marine mammals and sea birds at the air/water interface. These animals could probably avoid the spill zone, but might be suffocated if trapped within the vapor cloud. If the spill ignited, the zone of hazard would be larger. Marine mammals could probably swim away from the fire zone, but since sea birds cannot easily avoid hot air currents, they would be destroyed by incineration.

ii. Freshwater Biota

Construction of the proposed pipeline across or parallel to rivers and streams would cause temporary increases in turbidity and siltation of aquatic habitats. Increased siltation could destroy the eggs and young of fish and other aquatic organisms, destroy aquatic plant growth, cause loss of food organisms used by fish, and degrade local spawning and nursery areas. These impacts would be restricted to the immediate area of the pipeline crossing and a short distance downstream. The present conditions at the proposed crossings and the relatively minor construction activities required for installing the pipeline indicate that these impacts should not significantly reduce the abundance and diversity of aquatic life. Population levels should quickly recover to their former levels.

Impact of pipeline operation would be limited to siltation resulting from erosion at stream and river crossings and from any portions of the right-of-way which are not stabilized and promptly revegetated.

Construction of the access road and the installation of the proposed powerline towers could have significant adverse impacts on the coastal streams along the two routes. Removal of soil-stabilizing vegetation, surface grading, and other disturbances to the area could increase sediment loads in the coastal streams to a point where their biological productivity is significantly reduced. These effects could be particularly severe in the anadromous fish streams and several other streams which still support especially rich populations of fishes and invertebrates.

8. Socioeconomic Considerations

A major socioeconomic impact of the proposed LNG terminal construction would be the increased demand for housing and social services caused by an influx of construction workers into Santa Barbara County. Construction employment on the proposed project is expected to average about 500 workers over a 4-year period, reaching a maximum workforce of 1,683 during the eighth quarter of construction. An additional workforce of approximately 250 would be required in the county during construction of the related pipeline facilities. Other major construction projects, such as offshore oil exploration and the development of a space shuttle facility at Vandenburg Air Force Base, would place additional demands on the available labor force. Estimates of the construction labor force required for these major projects are shown in table 40.

Local labor supply would not be able to provide the necessary number of workers required for the simultaneous construction of the LNG terminal, offshore oil facilities, and the Vandenburg Space Shuttle Base. A significant number of workers who presently live beyond daily commuting range would relocate when hired for one of these projects. This number of relocated workers would average about 1,200 (45 percent of the combined workforce) during the peak construction years of 1980 and 1981, with the LNG terminal construction directly responsible for approximately 500 of these employee relocations.

Approximately 6,200 transient housing units are located within reasonable commuting distance of all three projects. These units have average summer occupancy rates of 90 percent and winter occupancy rates of 70 percent. Therefore, a reasonable estimate of available temporary housing units varies between 620 and 1,860, depending on the season. The use of 1,200 of these units by a construction workforce could result in the displacement of approximately 10 percent of the tourists wishing to stay in Santa Barbara County during the summer season, while no displacement of tourists would occur during the winter months. If 600 of these workers had chosen to purchase or live in permanent housing units, the remainder of the workforce could be housed in available temporary units with little or no impact on tourism. The 600 purchased units would, however, represent approximately 25 percent of the available permanent housing in the county and would have a noticeable effect on both housing prices and availability.

TABLE 40

CONSTRUCTION LABOR FORCE REQUIREMENTS IN SANTA BARBARA COUNTY

Year	Quarter	LNG Terminal	Pipeline	OCS Oil Exploration*	Vandenberg Space Shuttle Development	Total
1979	1	243		500	217	960
	2	315		500	217	1,032
	3	448		500	217	1,165
	4	579		500	217	1,296
1980	1	726		500	1,124	2,350
	2	1,101		500	1,124	2,725
	3	1,493		500	1,124	3,117
	4	1,683		500	1,124	3,307
1981	1	1,658		700	811	3,169
	2	1,395	250	700	811	3,156
	3	963	250	700	811	2,724
	4	713	250	700	811	2,474
1982	1	451	250	900	127	1,728
	2	25		900	127	1,052
	3	203		900	127	1,230
	4	230		900	127	1,257
1983	1	195		800		995
	2			800		800
	3			800		800
	4			800		800

* Preliminary estimate subject to revision.

Source: Western LNG Terminal Associates; Fluor, Inc.; U.S. Department of the Interior, Pacific OCS Office; Henningson, Durham & Richardson, consultants to Vandenberg Air Force Base.

Construction of the proposed facilities would generate some secondary employment in the county, chiefly from the purchase of building materials such as sand and gravel. Gross construction wages would total an estimated $135 million. On an average annual basis, this would represent a 1.8-percent increase in the personal income of Santa Barbara County.

Building permit and plan check fees paid to the County of Santa Barbara for the proposed construction would total approximately $1.4 million.

Commercial fishermen would have to avoid the immediate vicinity during construction of the trestle and loading dock facilities. The impact of this would probably be minor.

Operation and maintenance of the LNG terminal would employ a maximum of 50 persons. This would increase the current county labor force by less than 0.05 percent. Even if all employees of the plant were recruited from outside the county, their socioeconomic impact on the community would be negligible.

The terminal itself would have more impact during its operational phase. The applicant's projection of property taxes to be paid on the proposed facility is provided in table 41.

By substantially changing the unspoiled nature of the area and introducing significant vehicle traffic, the terminal would probably have a detrimental effect on property values of the adjacent Hollister Ranch subdivision and possible Bixby Ranch subdivisions. The exclusive nature of these parcels makes market comparison impossible. Therefore, the staff has no realistic method to determine the decrease in property value that might be caused by the terminal.

The applicant has stated that electric power requirements for the terminal would be met by onsite generation, the purchase of offsite power, or a combination of both. If the maximum average terminal requirement of 40,000 kilowatts per hour were bought from Southern California Edison Company (SCE), it would represent an increase of nearly 50 percent in the average power load for the Santa Barbara service district. At this time, SCE is unable to define the facilities which would be required to provide such service.

TABLE 41

PROJECTED ANNUAL PROPERTY TAXES ON COMPLETED FACILITY
(excludes land)

	Proposed	Prospective Expansion
Total Installed Cost of Project 1/ (1977 Dollars)	$ 589 mil.	$ 657 mil.
Assessed Valuation (20%)	$ 117.8 mil.	$ 131.4 mil.
Property Tax Rate per $100 of Assessed Valuation (1977-78 fiscal year)	$ 8.6993	$ 8.6993
Annual Property Tax Revenue to: ($ millions)		
General County of Santa Barbara	$ 2.906	$ 3.242
County Fire Protection District	.527	.587
Schools	6.17	6.879
Hospitals	.403	.447
Other	.246	.273
TOTAL	$10.251	$11.428

1/ Preliminary estimate only.

Because of the loss of bottom habitat around the offshore facilities, abalone divers would be expected to harvest a smaller crop. The applicant has estimated this loss at 36,000 pounds annually. Most of the abalone harvested in this area are red abalone. Based on the April 1977 average price of $1.25 per pound paid to fishermen, the potential loss to local divers could reach $45,000 for each year of operation. If the value added to the abalone product through processing and retailing is conservatively estimated at four times this amount, the total loss to the abalone industry could reach $180,000 per year.

9. Land Use, Recreation, and Aesthetics

a) Land Use

The proposed LNG terminal would have a significant impact on land use in the Point Conception area in both the construction and operation phases. Nearly the entire 209-acre site, as well as an additional 75 acres of adjacent property, would be utilized during construction of the terminal. In addition, an unspecified amount of land would be disrupted by the construction and maintenance of an access road and electric transmission lines to the proposed site.

Construction traffic would have a major impact on local road use. At the peak of construction, approximately 3,100 additional vehicle trips per day might be experienced on the access route chosen by the applicant. Contrasted with a present maximum of 50 vehicle trips per day on the existing Hollister Ranch Road, it is clear that local residents would be significantly affected. A Hollister Ranch access route might also have a significant localized impact on users of Highway 101. During peak traffic hours, 1,050 construction vehicles might be turning in one direction. Added to the current peak-hour traffic figure of 2,550 cars, the combined total peak-hour traffic of 3,600 cars is close to peak-hour capacity for the highway. Other effects of increased construction traffic on the Hollister Ranch property include: (1) noise and increased hazards for residents who walk or ride horses over the current road, (2) danger to cattle from increased traffic flow, and (3) the creation of a barrier (equivalent to a small highway) between inland residences and the ocean beaches.

During the operational phase, the presence of an industrial facility would be the greatest impact on land use. In keeping with the present zoning and the county comprehensive plan, most of the surrounding land area consists of open space, agriculture, and 100-acre minimum residential parcels. The proposed LNG terminal would be in direct conflict with the exclusive residential development and open space characteristics of both the Hollister and Bixby Ranches.

Finally, it should be noted that SCE retains ownership of more than 700 acres of land adjacent to the proposed terminal site. The California Liquefied Natural Gas Terminal Act of 1977 permits "associated industries that make substantial use of byproducts of LNG processing . . ." to be constructed near an LNG facility. Any new facility would be subject to the requirements of the Santa Barbara County Planning Board and the California Coastal Management Program; however, the range of possible uses other than industrial is limited by the California act. After access improvements are made to construct the LNG facility, the remaining SCE land would become a highly desirable industrial site. Technical Report 13, published by the California Public Utilities Commission, discusses four different types of industrial processes in many different industries that could utilize waste cold.

Construction of the proposed 112 miles of 34-inch diameter pipeline would temporarily disturb a 100-foot wide right-of-way. A permanent 50-foot wide right-of-way would be maintained. If the terminal were expanded to the legal limit, it would require 45 miles of a second "looped" 34-inch diameter pipeline. This segment would require a temporary construction right-of-way 125 feet wide. A 75-foot wide permanent right-of-way would be required in this area.

More than 66 percent of the proposed pipeline would be constructed in open fields primarily used for grazing. Although construction might temporarily disrupt grazing activities in these areas, no long-term impact would be expected on these lands. Pasture within the construction right-of-way would be lost for at least one season.

Approximately 17.5 percent of the proposed pipeline would be constructed in agricultural lands. Field crops within the construction right-of-way would be lost for at least one growing season. Construction in orchards and vineyards, however, could have a significant impact on individual landowners. The applicant proposes to construct the same 100-foot wide construction right-of-way in these areas, estimating that approximately 13 acres of vineyards would be disturbed. Vines could be replanted in the permanent right-of-way.

More than 16 percent of the proposed pipeline would be constructed in mineral extraction areas. The largest of these is the former Elk Hills Naval Petroleum Reserve. Minimal impact would result from construction in these areas.

The total land requirement during construction would be approximately 1,455 acres. This includes construction right-of-way and any additional facility areas required. Following construction, approximately 685 acres would be committed to permanent right-of-way and related facilities. If the terminal were expanded, the additional looping would raise the total land requirement during construction to approximately 1,600 acres, with 820 acres permanently committed to right-of-way and related facilities.

b) Recreation

Construction and operation of the proposed terminal would have no direct impact on any established recreational areas. Depending on the access routes chosen, users of either Gaviota or Jalama Beach Parks might be affected by increased construction traffic.

Beach and offshore recreation would be significantly impacted by this project. Construction of the trestle would impact recreational boating and fishing in the surrounding area. The presence of an industrial facility would detract from the scenic enjoyment of beach users for long distances along the coast. Some part of the tanks would probably be visible at Gaviota State Park and beyond. Tanker traffic in the Santa Barbara Channel and the Point Conception area would also disrupt recreational boating, fishing, and diving in the area. Surfing activities on nearby beaches might be curtailed by disruption of recreational boating or the presence of industrial facilities in the area.

Construction of the proposed pipeline would have a minimal impact on users of the Los Padres National Forest. Some minor disturbances such as the presence of heavy equipment, noise from blasting, and fugitive dust might affect users in scattered areas. The permanent right-of-way would most likely be perceived as an additional firebreak through the forest and might actually increase visitor access.

c) Aesthetics

One of the major impacts to the Point Conception area would be the degradation of the scenic quality of this area. This section of coastline is renowned for its scenic beauty, mainly because there is little development in the area. As the applicant states, "The proposed project would alter the untouched rural character of the coastal terrace in the vicinity of the proposed facilities."

This scenic degradation would have a major impact on many areas. The residents of Hollister and Bixby Ranches would experience a decrease in scenic quality from their home sites which overlook Point Conception, as well as from the beaches on the property. Correspondingly, property values might drop, at least for properties which overlook the terminal site.

However, aesthetic impact would occur to more people on the beaches and offshore than on the Hollister and Bixby properties. Both the terminal and the tankers would contribute to the industrialized presence in these areas. With a tank height of 245 feet above mean sea level, the applicant has estimated that at least some part of the facility would be visible from as far away as 25 miles offshore and 18 miles onshore. Since this encompasses such a large land and sea area, it can be assumed that a significant number of bathers, boaters, fishermen, etc. would be affected.

Construction of the proposed pipeline would have a short-term aesthetic impact along scenic roads and corridors. During the various stages of construction, both the presence of heavy equipment and the cleared 100-foot right-of-way would detract from the scenic beauty of these areas. After revegetation, however, there would be relatively little scenic impact.

There would be minimal aesthetic impact along the proposed pipeline route during operation. Since most of the land would be returned to its preconstruction use, the permanent right-of-way would create little visual impact. One exception would be in the mountains along ridgetops. If blasting were required to level ridgetops, the new topography might have an unnatural or artificial look, resulting in a negative aesthetic impact.

10. Archaeological and Historic Resources

Significant adverse impact may result from the construction of all the facilities proposed except for the offshore trestle. Direct adverse impact would likely result from any terrain modifications at the locations of cultural resources. These would include land clearing, grading, cut-and-fill operations, placing foundations, trenching and backfilling for pipelines, and heavy equipment travel. Shallow components and surface scatters could be destroyed completely or lose significant horizontal parts, while deeply stratified and buried sites could lose materials and contexts, seriously impairing the value of the remainder of the deposits. Maintenance roads would increase the accessibility of remote areas to relic collectors and others who would loot vulnerable sites or vandalize pictographs and petroglyphs.

Industrial development in the Point Conception area would have an adverse impact on the ideological values of local Native Americans. The siting of the terminal at the Edison property would decrease any spiritual value associated with the plant site proper and surrounding mountains. Construction of facilities on the sites of ancient villages would have similar impact. Ancient cemeteries sacred to living Chumash would be disturbed during construction or archaeological excavation.

The applicant has proposed a rearrangement of the proposed terminal that would avoid prehistoric properties. In this revised plan, the plant would be placed over an area of isolated artifact finds but not directly on known archaeological sites. The 75-acre workyard, which would provide room for parking, materials storage, and a concrete batching plant would be placed in an area free of cultural deposits.

Improvement of the Hollister Ranch Road to provide access to the proposed terminal may impact five known historic and prehistoric sites. Construction of an access road parallel to the Southern Pacific Railroad right-of-way would adversely impact at least five prehistoric villages between Goleta and Santa Anita Canyon, six sites between Santa Anita Canyon and Barranca Honda, and two sites west of Barranca Honda. The impact from construction of the terminal's powerline is uncertain due to the lack of an archaeological survey to date, but at least one recorded prehistoric site could be affected. The CPUC consultant believes the impact from the railroad parallel access road would be greater than from the proposed terminal. The applicant's consultant states that impact from the proposed improved Hollister Ranch Road and the proposed powerline route would be minor to moderate.

Impact from pipeline construction is uncertain at present. The surveyed route is only a hypothetical alignment. The final right-of-way will be determined after a 2-mile wide corridor has been surveyed to determine the best alignment. The route, as presently described by the applicant, would have direct adverse impact on at least 20 known cultural areas along approximately 1.5 kilometers of historic and prehistoric property. Approximately 200 acres would be required in addition to the right-of-way for pipe storage, equipment storage, work areas, and metering facilities. The impact from these requirements is uncertain.

11. Air and Noise Quality

The analysis of the impact on air and noise quality addressed both the proposed project, having a baseload capacity of 0.9 billion cubic feet per day (Bcfd), and the maximum potential development permitted under existing California law, 1.3 Bcfd baseload capacity. Most of the impacts from construction and some of those from operation would be similar for both the proposed project and the maximum development. The main difference in construction impacts would be those from the 45-mile long pipeline looping required for the maximum development. During operation, the primary differences would be the additional emissions associated with the increased LNG tanker traffic--129 annual arrivals for the proposed project versus 193 for the maximum development--and the additional offsite emissions resulting from generating the plant's electric utility requirements. Unless specifically noted, the following impacts would apply to both project developments.

a) Air Quality

i. Construction Impact

During construction of the LNG plant, marine terminal, and pipeline, the main sources of air pollutants would be the exhausts from the gasoline- and diesel-powered construction equipment and fugitive dust from general construction activities. Average daily emissions of particulate matter (PM), sulfur dioxide (SO_2), nitrogen oxides (NO_x), hydrocarbons (HC), and carbon monoxide (CO) during construction of the plant and terminal, based on an 8-hour workday and 5-day workweek, are listed in table 42. The maximum daily emissions, estimated for a 16-hour, two shift workday, would be double the average values. During unfavorable meteorological conditions, construction emissions would cause a localized increase in ambient pollutant levels. Regionally, construction would cause a slight increase over current emissions in southern Santa Barbara County, as shown in table 42.

TABLE 42

AIR POLLUTANT EMISSIONS DURING CONSTRUCTION OF LNG PLANT AND MARINE TERMINAL 1/

	PM	SO_2	NO_x	HC	CO
Emissions (lb/day)	24.8	47.0	637.3	75.1	632.3
Percent Increase	0.5	1.7	1.6	0.1	--

Construction of the 112.4-mile long pipeline for the proposed project would be completed within 12 months, while the additional 45-mile long pipeline looping necessary for the maximum development would require 4 to 5 months to complete. Therefore, any impact on local or regional air quality would

1/ Emission factors and fuel usage estimates appear in appendix J of volume I of this EIS.

be only temporary. Land clearing wastes from the right-of-way may be disposed of by controlled open burning in some locations, after appropriate burning permits have been obtained. The smoke from open burning could cause a temporary nuisance for nearby residents.

Fugitive dust from vehicular traffic on unpaved roads, materials stockpiling, and grading, trenching and backfilling operations would be an additional source of PM emissions during plant and pipeline construction. The extent of dust generation would depend on the level of construction activity and soil composition and dryness. Because of their relatively large diameter, dust particles tend to settle out of the atmosphere in the vicinity of the construction site. However, if proper dust suppression techniques were not maintained, dry and windy weather could create a nuisance for any nearby residents.

ii. Operation Emissions

The main sources of air pollution directly related to the operation of both the proposed 0.9 Bcfd project and the maximum 1.3 Bcfd development are listed in table 43. The primary source of plant emissions would be the intermittent use of the gas-fired vaporizers and the trim heater. All plant equipment, except emergency diesel generators and pumps, would use unodorized plant gas for fuel. The emissions of all pollutants except NO_x would normally be low.

The three gas-fired vaporizers would be used 5,400-unit hours per year for the proposed project and 7,400-unit hours per year for the maximum development, providing up to 300 Bcfd load-leveling capacity in each case. During winter months, the gas-fired trim heaters would raise the gas temperature to 50°F, as required for delivery.

Minor sources of plant emissions would include bunker and diesel fuel storage tanks and the emergency diesels. The 100,000-barrel (bbl) bunker storage tank would have a breathing loss of 0.23 pounds per hour (lb/hr.) and a maximum working loss of 0.92 lb/hr. A gas-fired bunker tank heater used to maintain a storage temperature of 120°F would emit less than 0.1 lb/hr. of NO_x and negligible amounts of the other pollutants. A 10,000-bbl diesel fuel storage tank would supply fuel for the emergency pumps and generators. The tank would be filled once a year and have an average loss of 0.4 lb/hr. The four emergency diesels, ranging in size from 165 to 1,160 horsepower, would be used only 15 minutes per week for testing.

TABLE 43

AIR POLLUTANT EMISSIONS - OPERATIONAL PHASE

Source	Maximum Firing Rate	Emissions at Maximum Firing Rate (lb/hr.)[1]					Average Operation
		PM	SO_2	NO_x	HC	CO	
Plant Emissions - 0.9 Bcfd Project:							
Gas-Fired Vaporizers (3 units)	188 x 10^6 Btu/hr.	0.9	Neg	18.8	0.5	2.9	5400 Unit-hr/yr.
Trim Heater	3.2 x 10^6 Btu/hr.	Neg	Neg	0.6	Neg	Neg	5100 hr/yr.
Bunker Fuel Storage	0.76 x 10^6 Btu/hr.	Neg	Neg	0.1	1.2	Neg	760 x 10^3 bbl/yr.
Gas-Turbine Generator	35 mw	7.8	Neg	225.1	2.1	9.1	Standby Only
Plant Emissions - 1.3 Bcfd Project:							
Gas-Fired Vaporizers (3 units)	233 x 10^6 Btu/hr.	1.1	Neg	23.3	0.6	3.6	7400 Unit-hr/yr.
Trim Heater	6.2 x 10^6 Btu/hr.	0.1	Neg	1.1	Neg	0.1	5100 hr/yr.
Bunker Fuel Storage	0.76 x 10^6 Btu/hr.	Neg	Neg	0.1	1.2	Neg	960 x 10^3 bbl/yr.
Gas-Turbine Generator	46 mw	10.6	Neg	272.8	2.8	12.3	Standby Only
LNG Tanker (120-130,000 m^3)[2]							
Approaching	1.19 MT/hr. (oil)[3]	3.3	26.2	12.6	1.0	0.1	0.5 hours/trip
Berthing	1.19 MT/hr. (oil) 0.61 MT/hr. (gas)	6.6	26.2	18.2	1.2	1.1	0.4 hours/trip
Unloading	0.3 MT/hr. (oil) 1.22 MT/hr (gas)	6.3	6.6	11.4	1.2	1.5	15.0 hours/trip
Hoteling	0.3 MT/hr. (oil) 0.38 MT/hr. (gas)	2.5	6.6	5.3	0.6	0.4	7.5 hours/trip
Deberthing	1.19 MT/hr. (oil) 0.61 MT/hr. (gas)	6.6	26.2	18.2	1.2	1.1	0.2 hours/trip
Departing	1.19 MT/hr. (oil) 0.44 MT/hr. (gas)	5.7	26.2	16.9	1.1	0.8	0.4 hours/trip
Tug Assistance	30 gal/tug-hr.	2.2	3.5	51.5	1.2	7.7	3 tugs at 5 hours/trip

1/ Emission factors are presented in Appendix J, Vol. 1.

2/ Fuel consumption estimates from Western's new source review application to EPA, March 1978.

3/ MT/hr. - Metric tons per hour (1 metric tons = 2204.6 pounds).

Electric utility requirements for both the proposed project and the maximum development would be purchased from the local utility, Southern California Edison Company (SCE). Standby gas-turbines would be available to supply the plant's maximum peak requirement--35 megawatts for the proposed project and 46 megawatts for the maximum development--if the offsite power supply were interrupted.

Emissions from the LNG tankers' boilers during docking maneuvers and while docked at the marine terminal would be the major source of project emissions. It is estimated that 129 annual ship arrivals would be required for the proposed project and 193 for the maximum development. However, these numbers could vary slightly, depending on the capacity of ships actually in service.

During the estimated 24-hour in-port time, about 15 hours would be devoted to offloading cargo. The ships' boilers would operate at about 22 percent capacity to provide the necessary power to run the ships' cargo pumps. About 7.5 hours would be spent hoteling, with the boilers operating at about 9 percent to maintain the ships' auxiliary functions. Table 43 lists maximum hourly emission rates, typical of the 120,000- to 130,000-cubic meter tankers expected at Point Conception, for offloading cargo, hoteling, and docking maneuvers. During these operations, cargo boil-off gas would be burned at the maximum extent in order to reduce impacts on ambient air quality. As a safety requirement, it would still be necessary to operate a fuel-oil fired pilot(s) to maintain fuel flow to the ship's boilers if the gas supply is cut off. The tankers would use 0.5 percent sulfur fuel oil in the vicinity of the marine terminal and 2 percent sulfur fuel oil at sea.

LNG tankers would also contribute to regional air quality during a portion of the inbound and outbound transit and while maneuvering and docking at the marine terminal. The actual fraction of the tanker transit which should be assigned to the regional emission inventory cannot be uniquely defined since existing meteorological conditions would determine where emissions would actually affect the air basin. Because the prevailing winds are westerly, it is likely that tanker emissions at sea would frequently be directed into the air basin. In estimating the tanker emissions for the service speed condition in table 44, it was conservatively assumed that 2 hours of both the inbound and outbound transit could affect the region. Therefore, at an average service speed of 18 knots, about 40 miles of each transit would be included in the emission inventory.

TABLE 44

ANNUAL PROJECT EMISSIONS
(Tons/yr)

Source	Proposed Project (0.9 Bcfd)					Maximum Development (1.3 Bcfd)				
	PM	SO_2	NO_x	HC	CO	PM	SO_2	NO_x	HC	CO
I. Plant:										
Gas-fired Vaporizer	0.8	neg	16.9	0.4	2.6	1.4	neg	28.7	0.7	4.4
Trim Heater	0.1	neg	1.5	neg	0.1	0.3	neg	2.8	neg	0.3
Bunker Fuel Storage	neg	neg	0.3	1.0	neg	neg	neg	0.3	1.1	neg
Diesel Fuel Storage	neg	neg	neg	1.6	neg	neg	neg	neg	1.7	neg
Total	0.9	neg	18.7	3.0	2.7	1.7	neg	31.8	3.5	4.7
II. Marine Terminal:										
LNG Tankers 1/	7.9	12.1	15.2	1.6	1.7	11.9	18.1	22.7	2.4	2.6
Tug Assistance	0.7	1.1	16.6	0.4	2.5	1.1	1.7	24.8	0.6	3.7
Total	8.6	13.2	31.8	2.0	4.2	13.0	19.8	47.5	3.0	6.3
III. LNG Tankers in Transit:	13.6	57.0	22.5	1.1	2.3	20.3	85.3	33.7	1.6	3.4
IV. Offsite Utility	53.5	486.1	288.9	22.9	29.0	74.5	677.4	402.5	31.9	40.4
V. Staff Transportation	0.3	0.1	1.9	1.1	16.9	0.3	0.1	1.9	1.1	16.9
				Emission Savings (1000 Tons/yr)						
VI. Replacement Fuel:										
Distillate Oil (.25% S)	0.1-1.7	46.2	0-8.6	0.8	3.6	0.2-2.5	66.7	0-12.4	1.2	5.3
Residual Oil (.5% S)	7.2-8.8	96.0	34.8-52.8	0.7	3.2	10.4-12.8	138.7	50.2-76.3	1.0	4.7

1/ Emissions for all operations listed in Table 43.

Traffic from commuting employees would generate additional vehicular emissions in the region. Estimates of these emissions in table 41 are based on an average one-way trip of 25 miles for the 50-person staff.

iii. Local Impact

The impact of plant operations on local air quality was analyzed for the primary sources of project emissions--the gas-fired vaporizers and the LNG tankers while docked at the marine terminal. The analysis of the gas-fired vaporizers is based on the maximum emissions and stack parameters for the 1.3-Bcfd maximum development. The impact from the tankers at berth is based on emission and stack data representative of the 120,000- to 130,000-cubic meter class tankers.

Estimates of ambient pollutant concentrations from point sources are normally based on a gausian-type dispersion model, such as the computational techniques compiled by Turner (Workbook of Atmospheric Dispersion Estimates, EPA, 1970). The gausian class of models is considered the state-of-the-art technique for estimating ground-level pollutant concentrations in simple terrain. Unfortunately, the topography in the vicinity of the Point Conception plant site prevents the direct application of the gausian model. Located immediately north of the plant site are the irregularly shaped Santa Ynez Mountains with peaks up to 1,800 feet. The geometry of this region would complicate the behavior of plumes from the vaporizers and LNG tankers during southerly winds. The 40- to 80-foot high sea cliffs present a further obstacle for plumes from an LNG tanker at berth. While a modest data base of both observation and theoretical information has been gathered on plume behavior in complex terrain, there exists no proven modeling technique.

Most of the current approaches for predicting plume behavior in complex terrain rely on gausian plume dispersion and represent the influence of terrain by simply adjusting the height of the receptor, i.e., the distance between the plume centerline and the terrain surface. However, dispersion coefficients applicable to flat terrain fail to characterize the influence of terrain roughness on turbulence. Field investigations have found that complex terrain enhances turbulence over that found in relatively flat surfaces and amplifies horizontal plume spreading, especially under stable atmospheric conditions. The theory of plume impingement--a plume centerline striking an elevated receptor yields high pollutant concentrations--has not been supported by field observations. Rather, in most circumstances, plumes appear to be deflected before impingement. These phenomena and the turbulent influences of complex terrain cannot be reliably predicted by the gausian model.

A comprehensive review of various techniques for modeling complex terrain and their application at Point Conception was made by Thomas Reid Associates. 1/ Three complex terrain models using various height adjustment techniques were applied to the LNG tankers and the onsite gas-turbine generators in the original proposal to illustrate the range of possible predictions. Estimates of ground-level concentrations for the gas-turbines varied by a factor of 34. Concentrations for the LNG tanker showed much less variance. The "proportional" terrain adjustment model, selected to evaluate the LNG tanker, yielded a maximum SO_2 concentration of about 3,000 $\mu g/m^3$ for a tanker using 2-percent sulfur fuel oil at berth.

Projected maximum ambient concentrations of TSP, NO_2, and SO_2 for the gas-fired vaporizers and the LNG tanker at the marine terminal are listed in table 45. Maximum 1-hour concentrations for stability classes A through F were calculated from EPA's PTMAX program, with the highest concentration for stable, neutral, and unstable conditions shown in the table. Estimates are also presented for fumigation, a condition of high short-period concentrations which can occur when a plume, originally emitted into a stable atmosphere, is rapidly mixed downward by an unstable atmosphere.

Table 45 presents estimates of pollutant concentrations for receptors on elevated terrain. To compensate for the difference in height, the impact of LNG tanker emissions on receptors at the sea cliffs and coastal terrace was estimated by subtracting the receptor height from the tanker plume height. This correction cannot be applied to receptors in the Santa Ynez Mountains, where the terrain rises above the initial plume heights of the tankers and vaporizers. For these

---

1/ Arthur D. Little, Inc., "Meteorology/Air Quality Technical Report No. 4 For the Draft Environmental Impact Report, Point Conception LNG Project," January 1978.

TABLE 45

MAXIMUM AMBIENT POLLUTANT INCREASES
(concentrations in $\mu g/m^3$)

Source	Receptor Height (ft)	Distance to Max (km)	Stability Class	Windspeed (m/sec)	1-hour Max. TSP	1-hour Max. SO_2	NO_x	3-Hour Max SO_2	24-hour Max. TSP	24-hour Max. SO_2	Annual TSP	Annual SO_2	Annual NO_x
Gas-fired Vaporizers	60	0.30	A	1.0	5	neg	114	neg	2	neg			
		0.85	D	2.0	4	neg	88	neg	2	neg			
		1.97	E	2.0	2	neg	44	neg	1	neg			
		1.00	Fumigation	2.5	8	neg	162	neg	-	-			
		0.60	All	All	-	-	-	-	-	-	neg	neg	2
	160	0.76	D	1.5	13	neg	266	neg	5	neg			
	210	0.80	E	2.5	10	neg	217	neg	1	neg			
			F	2.5	19	neg	400	neg	2	neg			
LNG Tanker	Sea Cliff (80)	1.65	C	2.0	6	25	17	14	3	4			
		1.65	D	3.0	9	35	24	24	5	8			
		2.50	E	2.0	9	34	24	16	5	7			
		4.20	Fumigation	2.5	14	55	38	24	-	-			
	Coastal Terrace (120)	2.00	C	2.0	5	20	14	8	1	2			
		2.00	D	2.5	10	40	28	27	6	9			
		2.55	F	2.0	18	70	49	46	10	15			
		2.00	All	All	-	-	-	-	-	-	0.3	0.4	0.5
	240	2.60	E	2.5	11	42	29	21	3	5			
			F	2.5	21	84	58	45	7	11			
National Ambient Air Quality Standards													
	Primary				-	-	-	-	260	365	75	80	100
	Secondary				-	-	-	1300	150	-	60	-	100
California Ambient Air Quality Standards					-	1300	470	-	100	131	60	-	-

Note:

1. Stack parameters are listed in Appendix J, Vol. 1.
2. Receptor height is feet above sea level.
3. Maximum 1-hour concentrations for stability classes A through F were computed by EPA's PTMAX program.
4. Fumigation and annual concentrations were calculated according to <u>Guidelines For Air Quality Maintenance Planning and Analysis Volume 10 (Revised)</u>, EPA, October 1977.
5. Multiplying factors of 0.9 and 0.4 were used to calculate 3-hour and 24-hour concentrations from the 1-hour maximums listed in the PTMAX output. 3-hour maximum concentrations for fumigation are based on 1-hour fumigation followed by 2 hours at D stability.

locations, concentrations were estimated by EPA's "Valley" model, a gausian-type model which addresses the effects of terrain by allowing the plume centerline to approach within 10 meters of the surface. The model is designed to calculate a worst-case 24-hour average by assuming (1) a uniform horizontal distribution of pollutants over a 22.5-degree sector and (2) constant wind direction within the sector for 6 hours during a 24-hour period. The 24-hour average in table 45 is based on the direct application of this model. The 3-hour concentrations were calculated for winds within the sector for the entire period. An estimate of 1-hour concentrations departs from the uniform horizontal distribution in the "valley" model and substitutes the standard gausian distribution about the crosswind axis. Estimates for all three time periods were made for stability classes E and F at a windspeed of 2.5 meters per second. Stability class E is considered a realistic assumption for characterizing plume behavior in complex terrain. Calculations for F stability are offered as conservative estimates. While stable atmospheric conditions and even lower windspeed could exist at the plant or marine terminal, such a high level of stability is unlikely to persist as the plumes approach complex terrain.

As shown in table 45, the gas-fired vaporizers would increase annual NO_2 levels a maximum of 2 $\mu g/m^3$ at distances close to the source. When the assumed background of 20 $\mu g/m^3$ is considered, this source would be within the national ambient standard. Maximum 1-hour concentrations are within the California NO_2 standard.

The maximum 1-hour concentrations for the LNG tankers shown in table 45 represent berthing and deberthing operations. Although these operations would require less than 1 hour, emissions and stack parameters for these conditions were found to yield the highest concentrations. Three-hour and 24-hour concentrations were based on 1 hour of berthing followed by 2 and 23 hours, respectively, of hoteling. Because of the low exhaust velocity, the hoteling mode was found to yield the highest ambient concentrations while the ship is berthed. Estimates of annual concentrations are based on the stack conditions for hoteling and average emission rates reflecting all operating modes shown in table 42. When the assumed SO_2 background concentration of 20 $\mu g/m^3$ and TSP background of 30 to 40 $\mu g/m^3$ are considered, LNG tanker emissions would comply with all appropriate national and California ambient standards.

iv. Regional Impact

Regionally, the proposed project would increase PM and NO_x slightly; SO_2 emissions in the basin would increase by about 25 percent for the proposed project and 30 percent for the maximum development (table 46). SO_2 emissions could be expected to contribute to sulfate levels in the more easterly parts of the air basin.

NO_x emissions in the basin would increase only slightly--about 1.5 percent for the proposed project and 2.2 percent for the maximum development. However, in a region that currently exceeds the national standards of PO_x, any increase of an oxidant precursor, in this case NO_x, would be contrary to the goals of attaining the standard. PO_x formation is a regional problem, and models used to quantify the impact of a single source have limited success. The application of a trajectory-type model (previously noted in section B.11) would show the scavenging effect on oxidants from the high level of NO_x and very low fraction of reactive hydrocarbons which would exist at this source.

On a regional basis, the sensitivity of PO_x formation from inputs of precursor pollutants can be judged by the ratio of nonmethane hydrocarbons to nitrogen oxides ($NMHC/NO_x$). Where this ratio is low, such as in urban or suburban areas, PO_x formation is most sensitive to changes in the level of NMHC. The available data for southern Santa Barbara County suggest that the $NMHC/NO_x$ ratio is about 1:1. Therefore, the small increase in NO_x emissions from this project would not be expected to have a significant impact on regional PO_x levels.

v. Indirect Impact

The plant's annual electric utility requirements of 244×10^3 megawatt hours (MWH) for the proposed project and 340×10^3 MWH for the maximum development would be supplied by SCE. Since SCE's electric generating stations are interconnected, the additional load required by the project would be distributed throughout the system. As a result, the additional emissions from generating power for the LNG plant cannot be assigned to a specific generating plant. The emissions associated with the electric utility requirements identified in table 44 were estimated from 1977 power generation and fuel consumption data for SCE's generating stations. As detailed in appendix J in volume I of this EIS, an average emission factor was developed for the gas- and oil-fired

TABLE 46

AIR POLLUTION EMISSION INCREMENT
(Percent of Existing Emissions)

Source	PM	SO_2	NO_x	HC	CO
Project Operation - Increase In South Santa Barbara County 1/					
1) Proposed Project (0.9 Bcfd)	3.89	24.84	1.45	0.38	-
2) Maximum Development (1.3 Bcfd)	5.86	28.71	2.22	0.45	-
Electric Utility Emissions (Offsite) - Increase in SCAQMD 2/					
1) Proposed Project	0.04	0.23	0.04	NEG	NEG
2) Maximum Development	0.05	0.32	0.06	NEG	NEG
Increase in Ventura County 3/					
1) Proposed Project	0.06	0.60	0.21	0.02	NEG
2) Maximum Development	0.09	0.83	0.30	0.02	NEG
Emission Savings - Potential Increase In California 4/					
1) Proposed Project					
Distillate Oil Replacement	0.02 - 0.32	8.56	0 - 0.63	0.04	0.04
Residual Oil Replacement	1.35 - 1.99	17.79	2.54 - 3.85	0.03	0.04
2) Maximum Development					
Distillate Oil Replacement	0.04 - 0.47	12.36	0 - 0.90	0.06	0.06
Residual Oil Replacement	1.95 - 2.39	25.71	3.66 - 5.56	0.05	0.05

1/ Arthur D. Little, Inc., "Meteorology/Air Quality Technical Report No. 4 For The Draft Environmental Impact Report, Point Conception LNG Project," January 1978, Table 8.

2/ Southern California Air Pollution Control District, "Fuel Use and Emissions From Stationary Combustion Sources," July 1976.

3/ Ventura County Air Pollution Control District, "1975 Emissions Inventory Update."

4/ EPA, "1973 National Emissions Report," EPA 450/2-76-007, May 1976.

steam electric and gas-turbine generating plants in the system, with an assumed transmission efficiency of 90 percent. Although the impact of these emissions on ambient air quality would be distributed over four air quality control regions occupied by SCE generating stations, the major portion of these emissions would occur in Ventura County and the South Coast Air Quality Management District (SCAQMD), composed of Orange County and portions of Los Angeles, Riverside, and San Bernardino Counties. In 1977, about 22 percent of SCE's steam electric and gas-turbine power was generated in Ventura County and about 78 percent in the SCAQMD. As shown in table 46, the additional emissions would cause only slight increases of current regional emissions, with SO_2 having the greatest increase. However, in the parts of the SCAQMD where the national ambient standards for all pollutants except SO_2 are exceeded, any emission increase could impede progress toward attainment of the standards. SO_2 emissions would also contribute to particulate sulfate and SO_2 levels which currently exceed the California ambient standards. The small SO_2 increment in Ventura County would have little impact, since there are presently no clearly identifiable SO_2 problems in the region.

In evaluating the project's indirect impact on air quality, the benefits from the availability of natural gas must also be considered. Since the project is designed to offset declining natural gas reserves, denial of the project would eventually require the substitution of other fuels or development of alternate sources of gas to meet the anticipated demand. Table 44 presents estimates of the additional pollutants if the entire gas volumes associated with the proposed project and the maximum development are replaced with the equivalent energy in fuel oil. It is assumed that gas curtailments would first be applied to the industrial sector, and therefore the increased pollutants from fuel oil usage over those pollutants normally attributed to gas combustion were based on emission factors for industrial process equipment (appendix J of volume I of this EIS). The high estimate of air quality benefits is based on full replacement with 0.5 percent sulfur residual oil; the low estimate is based on substituting 0.25 percent sulfur distillate oil.

The actual location of the potential emission increases cannot be evaluated without specific data on end-users and alternate fuel availability. However, it can be assumed that the emission increases would be distributed over PG&E's and

SoCal's distribution systems and therefore cause impacts over most of California. Table 46 lists the potential increase in emissions for the entire state. Increases in PM and NO_x would be relatively minor, ranging from 0 to 2.5 percent for PM and 0 to 5.5 percent for NO_x, depending on the type and quality of fuel oil replacement. SO_2 emissions could increase significantly, from 8 to 26 percent, depending on the alternate fuel replacement. Alternate sources of gas or competing gas transportation systems could yield similar savings in emissions.

vi. Compliance With Regulations

EPA defines a major source in a nonattainment area as having an allowable emission rate of 100 or more tons/yr (1000 tons/yr for CO). Major sources are subject to an ambient air quality analysis and are required to obtain offsetting emission reductions of those pollutants which currently exceed the national ambient standards. The emission reductions, obtained from existing sources in the area of the proposed source, must exceed emissions from the proposed source. According to EPA, a major source is determined from the sum of plant process emissions and tanker emissions while at berth. Both the proposed project and ultimate development would emit less than 100 tons/yr from these sources and therefore EPA's emission offset requirements would not apply.

Under the Santa Barbara County New Source Review (NSR) rule, the air pollution control officer shall deny any new source which emits more than 5 lb/hr of any single pollutant (50 lb/hr for CO) unless emissions from the project will not: (1) cause a violation of, or interfere with the attainment or maintenance of any national primary or state ambient air quality standard; or (2) prevent reasonable progress toward the achievement of any national secondary ambient air quality standard. This NSR rule is more stringent than EPA's requirements in that the Best Available Control Technology (BACT) is required for pollutants greater than 5 lb/hr and emission offsets are required for pollutants greater than 10 lb/hr. Project emissions requiring offsets include facilities on land, tankers at berth and while in transit in California coastal waters, and secondary emissions such as offsite electric power generation.

The California Air Resource Board (CARB) has performed a preliminary analysis of the proposed project at the request of the CPUC. In their letter of July 6, 1978, they stated that BACT would be required for the project's emissions of SO_2, NO_x, PM, and nonmethane hydrocarbons. Additionally, the applicant would be required to obtain emission offsets of SO_2, PM, and NO_x at a ratio of at least 1.2:1 for the total maximum hourly emission rate and at a ratio of at least 2:1 for total annual average emissions of these pollutants. The offsets should be obtained in the applicable zone of the South Central Coast Air Basin--Southern Santa Barbara County and all of Ventura County. In order for the applicant to receive credit for the emission reductions associated with gas availability (i.e., not replacing curtailed gas volumes with less clean fuels), the CARB has indicated that additional documentation beyond existing supply/demand projections will be required. Otherwise, alternative emission offset packages should be prepared.

vii. Alternative Vaporization and Electric Power Generation

The use of onsite electric generation has been recommended by several commentors as a method to eliminate the visual impact of the electric transmission line required to supply the plant's electric utility needs. Also, gas-fired baseload vaporization has been recommended as an alternative to the proposed seawater vaporizers in order to mitigate impacts associated with the seawater exchange system. Both alternatives would consume a portion of the project's gas volumes and increase NO_x emissions at the plant site.

Table 47 compares the proposed project with 1) gas-fired baseload vaporizers, 2) onsite gas-turbine electric generation, and 3) gas-fired vaporization with onsite electric generation. Also presented is a system (alternative 4) in which waste heat is recovered from the gas-turbines and used to provide a portion of the plant's vaporization. This alternative is based on the system currently employed by Columbia LNG Corp. at their Cove Point, Maryland, import terminal. At this facility, two 100 million cfd intermediate fluid exchange vaporizers operate off the waste heat from two 8.5 MW gas turbines. Alternative 4 in table 44 is based on waste heat recovered from 34 MW gas turbines providing 400 million cfd vaporization and gas-fired vaporizers providing the remaining 900 million cfd.

TABLE 47

ALTERNATIVE VAPORIZATION AND ELECTRIC UTILITY SYSTEMS
(1.3 Bcfd Project)

Vaporization (baseload) Power Generation	Proposed Project Seawater Offsite	Alternative 1 Gas-Fired Offsite	Alternative 2 Seawater Gas-Turbine	Alternative 3 Gas-Fired Gas-Turbine	Alternative 4 Gas-Fired Gas-Turbine With Recovery
Plant Fuel Requirements (10^6 cf/yr)					
Trim Heater	28	0	28	0	0
Vaporizers	499	7,972	479	7,972	5,519
Gas-Turbines	0	0	3,400	3,046	2,976
Total (Percent of Throughput)	507 (0.1%)	7,972 (1.7%)	3,907 (0.8%)	11,018 (2.3%)	8,495 (1.8%)
Plant Utility Requirements (10^3 mwh)	340	305	340	305	298
Plant Emissions (Ton/yr) - NO_x	30	449	540	906	757
Offsite Utility Emissions (Ton/yr)					
NO_x	403	361	0	0	0
PM	75	67	0	0	0
SO_2	677	607	0	0	0

Seawater Pumps-- Utility = 7mw @ 1.3 Bcfd
= 5mw @ 1.0 Bcfd

Gas-Fired Vaporizer (0.1 Bcfd unit)-- Utility = 0.2 mw
Fuel = 70 x 10^3 cf/hr

Gas-Turbine Generator-- Fuel = 10 x 10^3 cf/mwh
NO_x = 3 lb/mwh

Emission Factors in Appendix J-2, Vol. 1.

Plant's Nonvaporization Utility = 32.2 mw

Offsite Utility-- Assume 90% transmission efficiency

All of the alternative systems would increase plant emissions of NO_x to more than 250 tons/yr and therefore require EPA's PSD review. Onsite gas turbines, originally proposed by the applicant, were analyzed in the previously referenced A.D. Little study and found to cause violations of the California 1-hour NO_2 standard. While three gas-fired vaporizers used for load leveling would be within the standard, 13 baseload gas-fired vaporizers would increase the ambient levels shown in table 45 by 13/3 and exceed the 1-hour standard. As a result, all of the alternative systems in table 47 would cause unacceptable air quality impacts.

As shown in table 47, the alternatives using onsite gas-turbine electric generation would eliminate the SO_2 and PM emissions associated with offsite electric utility generation. However, the gas needed to fuel the turbines would be lost to the transmission system and replacement with distillate or residual fuel-oils would negate any air quality savings. Similar penalties would result from the gas used to fuel the gas-fired vaporizers.

b) Noise Quality

Both the construction and operation of the proposed project would impact the local noise environment. Although techniques are available for projecting construction and operational noise levels at nearby residences or other noise-sensitive areas, few criteria exist for determining the acceptability of exposure to environmental noise. Under the Noise Control Act of 1972, states and local governments were assigned the primary responsibility for establishing ambient noise standards, with the assistance and guidance of the Federal Government. In response to this act, EPA published the "Levels Document," which evaluates the effects of various levels of environmental noise. 1/ EPA emphasizes that the "identified levels" discussed in the document should not be interpreted as a Federal ambient noise standard, since neither cost nor technical feasibility is considered. Rather,

---

1/ "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974.

they provide information for state and local governments in developing their own ambient noise standards. At this time, relatively few states or local jurisdictions have promulgated ambient noise standards. At present, there are no state or local standards in California.

In the absence of local ambient noise standards for the project area, EPA's "identified levels," summarized in table 48 have been used to evaluate predicted noise levels. It should be noted that the guidelines consider only the total environmental noise and do not address the effects of noise increments. In remote or pristine areas having a quiet environment, an increase in noise levels could represent an unacceptable impact, even if the total noise were within the guidelines.

Pipeline construction activities would proceed at an average rate of about a half mile per day. Therefore, the impact on the noise environment at any specific location along the pipeline route would be only temporary. Estimates of noise levels in the vicinity of pipeline construction have been made by A.D. Little Inc., based on a typical 2-mile long construction spread. 1/ Noise levels 2 miles to the side of the spread in unpopulated regions would be barely perceptible for about a week. At 1 mile, noise levels would be perceptible for about 10 days. In areas where the existing ambient noise is higher, such as small towns along the route, construction noise would be perceptible for a number of days but would not represent a significant increase. Construction in these areas would have a negligible impact at distances greater than 2,000 feet from the spread. Nighttime noise levels would not be affected, since construction would be limited to daytime hours.

Construction of the LNG plant and marine terminal would occur over about 49 months. During this time, noise levels would vary with the type of activity and the equipment actually in use. An estimate of noise levels for four phases of plant construction has been made in the A.D. Little, Inc. study. Construction noise levels were projected at the noise survey sites identified in figure 28 and at several other distances

---

1/ Arthur D. Little, Inc., "Noise Assessment, Technical Report No. 6 For the Draft Environmental Impact Report, Point Conception LNG Project," December 1977.

TABLE 48

EFFECTS OF AMBIENT NOISE LEVELS

Effect	Level	Area
Hearing Loss	$L_{eq}(24) \leq 70$ dBA	All areas
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dBA	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq}(24) \leq 55$ dBA	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dBA	Indoor residential areas
	$L_{eq}(24) \leq 45$ dBA	Other indoor areas with human activities such as schools, etc.

Source: EPA, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974, page 3.

Note : The $L_{eq}(24)$ represents the A-weighted sound energy averaged over a 24-hour period while the L_{dn} represents the $L_{eq}(24)$ with a 10 dBA weighting applied to nighttime sound levels (2200 to 0700 hours).

from the center of the plant site. Table 49 lists the estimated noise levels during plant construction at sites 2 and 4, representative of the nearest potential noise sensitive areas, and at the nearest existing residences on the Hollister Ranch, about 6,000 feet from the plant center. Potential residents near sites 2 and 4 would experience the greatest impact, with L_{eq} (24) levels increasing from 9 to 15 dBA and L_{dn} levels increasing from 7 to 14 dBA, depending on the construction phase. A 10-dBA increase roughly corresponds to a doubling of perceived sound. L_{eq} (24) and L_{dn} levels at the nearest existing residence would increase from 5 to 9 dBA and 0 to 4 dBA, respectively. The estimated maximum L_{eq} (24) of 52 dBA and L_{dn} of 53 dBA would be within the "identified levels" listed in table 48.

Operation of the proposed pipeline would have little impact on ambient noise levels. There would be no compressor stations, a major source of gas transmission noise, and all measurement and pressure regulating equipment would be buried. These facilities would not exceed background levels at distances beyond 100 feet.

The proposed LNG plant and marine terminal would be the major noise source during the project's operation. A preliminary estimate of noise levels for the major noise-producing equipment has been made by the applicant. In general, the noise estimates represent levels expected from untreated equipment and do not reflect the acoustic treatment required of some sources. The projected noise levels from plant operations at the nearest potential noise-sensitive areas, sites 2 and 4, and at the nearest existing residences are listed in table 49. A 3- to 6-dBA increase is estimated for sites 2 and 4; however, the resultant L_{eq} (24) and L_{dn} would be within the "identified levels." The nearest existing residences would experience no change in environmental noise.

12. Analysis of Public Safety

When analyzing the risks to the public from the proposed LNG terminal at Point Conception, all events which could cause casualties among the general public must be considered. Normally, this analysis focuses on the marine transportation of LNG as the element in the system having the greatest potential for large releases of LNG. The safety features proposed for the process and storage facilities are such that the

TABLE 49

NOISE IMPACTS-POINT CONCEPTION LNG PLANT 1/

(Noise Levels in dBA)

LOCATION: Site no. 2 (North property line) 2/

Activity	Existing Noise Leq (24)	Existing Noise Ldn	Activity Noise	Predicted Total Leq (24)	Predicted Total Ldn	Noise Increase Leq (24)	Noise Increase Ldn
Construction							
Clearing	42	47	61	57	56	+15	+9
Foundations			57	53	55	+11	+8
Erection			56/61 3/	57	57	+15	+10
Dikes/Foundations			57	52	52	+10	+5
Operation			43 4/	46	51	+4	+4

LOCATION: Site no. 4 (Northwest corner of property) 2/

Activity	Existing Noise Leq (24)	Existing Noise Ldn	Activity Noise	Predicted Total Leq (24)	Predicted Total Ldn	Noise Increase Leq (24)	Noise Increase Ldn
Construction							
Clearing	45	46	63	59	58	+14	+12
Foundations			59	55	54	+10	+8
Erection			58/63 3/	59	59	+14	+13
Dikes/Foundations			59	54	53	+9	+7
Operation			45 4/	48	52	+3	+6

LOCATION: Nearest residences (Approx. 6,000 ft. from plant center) 2/

Activity	Existing Noise Leq (24)	Existing Noise Ldn	Activity Noise	Predicted Total Leq (24)	Predicted Total Ldn	Noise Increase Leq (24)	Noise Increase Ldn
Construction							
Clearing	43	48	54	51	53	+8	+3
Foundations			50	49	51	+6	+1
Erection			49/54 3/	52	53	+9	+4
Dikes/Foundations			50	48	50	+5	0
Operation			33 4/	43	48	0	0

1/ Noise estimates from Arthur D. Little, "Noise Assessment, Technical Report No. 6, For the Draft Environmental Report, Point Conception LNG Project," California Public Utilities Commission, December 1977. The operational noise impacts in this table refer to estimates for the 1.3 billion cfd since the 0.9 billion cfd project analysis included noise from on-site power generation, which is no longer proposed for this case.

2/ Noise survey sites and nearby residences are identified in Figure 28.

3/ Day/evening

4/ Leq (24)

consequences from an LNG release in these areas would be restricted to the nearby vicinity of the plant. The proposed terminal site is located approximately 20 miles south of Vandenberg Air Force Base. Missile launches from Vandenberg could present a hazard to the LNG terminal; however, since there are no flight paths closer than 3.6 miles from the site, the probability of a missile causing damage to the LNG facility is very low. However, an LNG tanker casualty resulting in a spill of LNG on water could form a potentially flammable vapor cloud which could drift into populated areas. 1/ If ignited at the spill site, an intense pool fire could generate hazardous radiation levels and cause fatalities among the nearby population. In evaluating the safety of the proposed project, the probabilities and consequences of these events are quantified and then judged as to their acceptability.

The inherent properties of LNG--flammability, volatility, and extreme cold (-260°F)--necessitate increased safety precautions in transportation and transfer operations for these potential hazards:

(1) As a cryogenic liquid, LNG will rapidly cool materials upon contact, causing extreme thermal stresses on normal containment materials and, in the case of contact with humans, immediately freeze (burn) human skin.

(2) LNG is a liquefied flammable gas which readily vaporizes when exposed to external heat sources (anything at temperatures above -260°F), including water, soil, air, etc., producing approximately 620 to 630 cubic feet of natural gas vapor at ambient temperature for every cubic foot of liquid. Unconfined, the vapor mixed with air is not explosive. In a mixture of 5 to 15 percent vapor and air, it is flammable. Within enclosed spaces, in such concentrations, and in the presence of an ignition source, it can explode. The primary danger present in a large-scale LNG spill is a very intense fire at the spill site. A more remote hazard is that the vapor plume could

---

1/ A casualty is defined as an accident involving a ship and should not be construed as a human fatality or injury.

drift downwind, possibly into enclosed spaces, and explode or catch fire. Once the air-vapor mixture has been ignited, the fire would probably propagate back to the fuel source.

(3) Methane is colorless, odorless, and tasteless and is classified as a simple asphyxiant, possessing only a slight inhalation hazard. However, methane or revaporized LNG, inhaled in significant quantities and over sufficient time (i.e., exposure to a low oxygen concentration), could result in extreme health hazards including death. Extremely cold methane gas could also cause health hazards, including "freeze burns" and death.

Although there is little actual experience with the extent of hazards to the public from the type of LNG import terminal proposed for Point Conception, California, there are data concerning LNG spills, analytical techniques for calculating vapor dispersion, and past experience involving the transportation and storage of LNG and other liquefied flammable gases. These data and techniques can be used to analyze the potential hazards associated with LNG transportation and terminal operations. The transportation of LNG by sea has become a feasible commercial operation. The first experimental voyage was undertaken in 1959 when the 5,123-cubic meter capacity Methane Pioneer transported LNG from Lake Charles, Louisiana, to Canvey Island, England. Foreign LNG carriers with capacities up to 125,000 cubic meters are currently available for service, and vessels with up to a 165,000-cubic meter capacity are now being designed.

In the following analysis of public safety (see attachment A of the EIS), the operation of LNG vessels in and around the Santa Barbara Channel has received the primary emphasis. The rationale is that shipping accidents are the most likely mechanism for large-scale LNG spills. A land-based storage tank spill would be limited to the confines of the surrounding dike, thereby limiting the vapor cloud and radiation hazards associated with such an unlikely event. For example, for a storage tank failure, the more severe thermal radiation levels (72,000 Btu/hour/ft^2) have been found to remain within the LNG plant boundary and estimated vapor cloud distances are less than those calculated for an LNG shipping accident and major spill at the berth. Additional research work is also being conducted by the staff in refining its analytical methods for determining such risks and potential hazards. Small LNG spills, such as flange or piping breaks, would also create hazardous situations, but they would be much less hazardous than those created by a large-scale spill. Large-scale spills could be caused by material or construction defects, seismic forces, or sabotage. Mitigating or preventing the first two have been discussed in "Mitigating Measures." Although the threat of sabotage exists, there are a number of measures which the applicant may take to reduce the probability: employee screening, a perimeter intrusion detection and alarm system, vehicle barriers around the perimeter of the plant, perimeter lighting, plant entry control, and escorts for all visitors. Underground tanks may provide increased security, in that they would present a smaller target for potential saboteurs than aboveground tanks. Even if these tanks were sabotaged, causing a massive failure, the spill and possible fire would be contained in an area even smaller than the diked area proposed for the aboveground tanks. There is no method of totally eliminating the threat of sabotage; however, with a properly implemented security system, this threat can be minimized, and with properly designed safety features, consequences can be confined within the terminal boundaries. The staff is also currently studying the ability of dikes to contain LNG spilled from a storage tank as a result of a hole in the tank below the liquid level (spigot flow). Preliminary figures indicate that if the distance to the dike wall is equal to or greater than the maximum liquid level in the tanks, there is no danger of liquid being spilled over the dike in this manner. The staff is also studying the ability of a dike wall to contain the splashing of a large wave of LNG resulting from a massive, instantaneous failure of an LNG tank.

The marine transportation around the Point Conception area would pose a threat to the public if an accident resulted in an LNG spill onto the water. In such a case, the escaping LNG could form a potentially flammable vapor cloud which could endanger the populace within the dispersion limits of the cloud. The direction and extent of travel of the vapor cloud would depend on the magnitude of the LNG spill, the prevailing meteorological conditions, and the number of nearby ignition sources. The California Terminal Act of 1977 sets population density criteria for areas surrounding an LNG facility up to a distance of 4 miles from the perimeter of the site. These criteria identify allowable number of people potentially exposed in the event of an LNG accident. It is the staff's opinion that these criteria cannot be used by themselves to accept or reject any potential site. While failure to meet these criteria would serve as a notice that a potential safety conflict could arise at a particular site, a detailed risk analysis (such as the staff has presented in attachment A of this EIS) would be necessary prior to accepting or rejecting the site.

In conducting the study of LNG spill probabilities and accident fatalities, it was necessary to determine a basis for the volumetric size of a large-scale spill. Of considerable importance was a determination of what type of shipping accident could result in a sudden release of large volumes of LNG. This type of damage could occur as a result of collisions (ship to ship), rammings (ship to object), and groundings.

Groundings are considered to be the most likely causes of large-scale LNG release. This study considers the maximum credible event to be the instantaneous spill of the contents of one cargo tank. Physical constraints on maximum vessel speeds and maximum depth of collision penetration make the possibility of a sudden LNG release of more than one cargo tank unlikely. This does not imply that the total destruction of a loaded LNG vessel and consequent loss of its entire contents is not possible, but such a catastrophic, noncredible event would require extraordinary circumstances which the staff considers extremely remote.

It should be noted that there are considerable differences in estimates of the maximum downwind distance from a spill site to the LFL predicted by several researchers in the field. For example, for a 25,000-cubic meter spill, the computed distances to the LFL under stable atmospheric conditions are 300,000 feet, over 200,000 feet, or 37,000 feet as predicted by Professor James A. Fay from MIT, Dr. David Burgess from the Bureau of Mines, and the API, respectively. The staff's predictions for a 5-mph wind and neutral stability is 4,265 feet for a 30,000-cubic meter spill. A detailed explanation of each author's model is beyond the scope of this analysis, but the wide variance of plume travel predictions is primarily due to the different assumptions used in each author's models. Some of the primary differences are:

(1) the issue of positive buoyancy--i.e., some models incorporate positive buoyancy of the cloud into the dispersion model, while others do not;

(2) the use of a point source dispersion model versus the use of a line source dispersion model versus the use of an area source dispersion model;

(3) the use of a neutral (D class) atmospheric stability class versus a stable (F or G class) atmospheric stability class;

(4) the use of a gravity spread model to account for the spread of LNG over water, as well as the spread of LNG vapor from negative to neutral buoyancy;

(5) the use of different windspeeds;

(6) the use of peak-to-average ratios other than unity, as suggested in the Bureau of Mines study, to predict downwind concentrations.

While widely varying estimates have been made, the salient point is that the probability of ignition of the cloud approaches unity at a finite distance downwind, regardless of the unignited vapor travel distance calculated by the various models.

In the absence of tanker casualty data for the Santa Barbara Channel, the staff analysis applied a mean tanker casualty rate developed from an average of seven U.S. ports--1.20×10^{-3} casualties per trip. When this mean casualty rate is multiplied by the number of proposed tanker trips (193 per year) the LNG tanker fleet would have an annual probability of casualty 0.232 while in the Santa Barbara Channel. This casualty rate includes all types of collisions, rammings, and groundings, regardless of the magnitude of damage. The annual probability of a spill would be much less than 0.232 and has been estimated to be 5.66×10^{-4}. In this case, the primary cause would be grounding.

The probability of immediate ignition following a collision and spill is conservatively estimated to be 90 percent. It was assumed that a vapor cloud not ignited at the spill site would not encounter any ignition sources over water. Over populated areas, the probability of vapor cloud ignition is modified on the assumption that each residence contains one ignition source and that each source has only a 1 percent chance of igniting the cloud. These parameters are chosen to provide an extremely conservative estimate of risk.

The risk consequence analysis was based upon the impact of pool and plume fires and the associated thermal radiation from each. The level of thermal radiation required to cause fatal burns is assumed to be 5,300 Btu/hr.-ft^2. This is the level at which blistering occurs after 5 seconds of exposure. It was further assumed that 20 percent of the people within the area exposed to this level of radiation were fatalities. This is based on surveys that have indicated that the fraction of people outdoors and not otherwise effectively shielded from radiation is 20 percent during the day. The fraction is much smaller at night.

The staff's calculations for a pool fire from a one-tank spill of 30,000 cubic meters yields an area of hazardous radiation extending 3,830 feet radially. The maximum range of flammable vapors for a one-tank spill without ignition is about 4,265 feet. The configuration of the Santa Barbara Channel and the proposed approach to the terminal is such that the nearest populated areas are farther than 10,826 feet from the LNG tanker route. Therefore, the risk to the general public from either a flammable vapor cloud or hazardous radiation from an LNG pool fire would be negligible.

The staff recognized the considerable controversy over the maximum range of flammable vapors from an LNG spill on water. Therefore, in the interest of conservatism, additional risk estimates were made in attachment A based on vapor cloud distances considerably greater than 4,265 feet, e.g., staff performed risk calculations based on vapor cloud distances up to 27.1 kilometers.

The additional calculations yielded an individual risk of 7.83×10^{-7} fatalities per exposed person per year for the residents of the Cojo Ranch area. These risks are comparable to the risks from natural events such as tornadoes, hurricanes, and lightning.

The staff's safety study is extremely conservative and should not be construed as an exact science. In the event of an LNG spill, the actual number of people endangered and the extent to which they would be physically affected is highly variable and would depend on (1) the location of the spill and the population of the areas adjacent to this location, (2) the presence of an ignition source within the dispersion limits of the vapor cloud and whether the cloud became ignited,

(3) the flammability of the structures and material encompassed by the vapor cloud or exposed to radiation from a large LNG pool source, and (4) the time required to notify the public and take appropriate mitigating actions. If the vapor cloud were not ignited, people close to the spill could have difficulty breathing, depending on how long they were subject to high concentrations of natural gas. In addition, extremely cold methane gas could also cause "freeze burns" or even death.

D. MEASURES TO ENHANCE THE ENVIRONMENT OR TO AVOID OR MITIGATE ADVERSE ENVIRONMENTAL EFFECTS

1. LNG Terminal

a) Regulatory Agencies

Avoidance or mitigation of any adverse effects to the environment, the regional economy, and the safety of the public and terminal personnel is essential in projects involving LNG. Approval from Federal, state, and local agencies concerning various aspects of Western's proposed Point Conception LNG terminal is required, and their regulations must be followed. These agencies, their jurisdictions, and the statutes and codes defining their authority over the construction and operation of the proposed LNG terminal are listed in appendix P. Standards applicable to the construction and operation of the proposed LNG terminal facilities are listed in appendix Q.

LNG spills or fires would pose the greatest potential hazards in the operation of the proposed LNG terminal. Safety measures necessary to avoid such hazards demand the utmost consideration in the design and operation of the proposed terminal and marine facilities. The safety measures proposed by Western are described in the following pages.

b) Design and Construction

The final design of the LNG storage tanks has not yet been selected; however, Western has provided some information on specific design features and construction procedures which would be required and has indicated that conformance with American Petroleum Institute (API) Standard 620, Appendix Q, "Recommended Rules for Design and Construction of Large Welded Low-Pressure Storage Tanks for LNG" and National Fire Protection Association (NFPA) No. 59A, "Storage and Handling of Liquefied Natural Gas" would be maintained.

The proposed LNG tanks would have metal, double-wall, cylindrical shells and concrete ringwall foundations. A load-bearing sand with heating coils to prevent frost heave would be used to fill the areas beneath the LNG tanks inside the ringwall.

The outer tank would be constructed of carbon steel and would be vapor tight. The outer tank shell would be approximately 84.5 feet high and 240 feet in diameter. The overall tank height, including the shell height and dome roof, would be approximately 150 feet. The outer tank would be secured to the ringwall by anchor bolts imbedded into concrete, which would make the LNG tanks resistant to wind forces at the site.

The inner tank, constructed of 9-percent nickel steel, would be able to withstand the cryogenic temperatures and hydrostatic pressures exerted by the stored LNG. Nine-percent nickel steel is suitable for use at temperatures as low as -320°F; the LNG would be stored at approximately -260°F. A concrete-bearing ring independent of the concrete ringwall foundation would support the inner tank. Anchor straps welded to the tank and imbedded in the concrete ringwall foundation would restrain the inner tank from excessive movement caused by earthquakes. Figure 4, an elevation view of the proposed LNG tanks, shows the concrete-bearing ring.

All vertical seams of the inner tank would be 100 percent x-rayed. All other shell seams would be x-rayed over 30 percent of their length, which exceeds API 620 Standards. All welds not fully radiographed or vacuum-box tested would be examined by the dye penetrant method or solution film test, or both. After the welds were tested, the tanks would be tested hydrostatically and pneumatically. During the hydrostatic testing, tank settlement would be monitored. When the hydrostatic test water reached 1.25 times the maximum LNG weight, the inner tank anchor straps would be secured.

All insulation materials used in the tanks would be noncombustible. Perlite would be used to fill the annular space between the inner and outer tanks, mineral wool would be placed on the suspended insulation deck above the inner tank, and load-bearing foamglass blocks would be used for insulation between the inner and outer tank bottoms.

Liquid levels in the LNG tanks would be monitored by two float-type level gauges. In addition, a traversing temperature probe would indicate temperature variations throughout the depth of the tank. In this way, the probe could detect stratification of LNG within the tank as well as liquid level.

The storage tanks would each be provided with a standpipe about 9 feet in diameter and 75 feet tall, which would be supported by the inner tank bottom. The standpipe would be utilized to channel incoming LNG to the bottom of the tank.

The LNG would be introduced at the top of the standpipe, flash at storage tank pressure, flow to the bottom of the pipe, then out of the bottom outlets and mix with the tank contents. Although this would be the normal method of loading the storage tanks, a nozzle would be provided to allow LNG to be injected on top of the stored liquid if the incoming LNG were heavier than the LNG already in the tank or if stratification were detected, necessitating mixing the tank contents.

The pressure control system on the LNG tanks would be based on an absolute pressure scale. Maximum allowable design pressure in the tanks would be 2 pounds per square inch above atmospheric pressure. Normal operating pressure would be about 15.64 psia (0.94 psig), minimum operating pressure would be 15.05 psia (0.35 psig), and maximum operating pressure would be 16.23 psia (1.53 psig). Protection against overpressurization would be provided by a manually operated "discretionary" vent valve mounted on the vapor system between the LNG storage tanks. If overpressurization continued, direct-acting pressure-relief valves on the tank roof set to operate at 2.0 psig would vent LNG vapor directly to the atmosphere.

In the event of underpressurization (i.e., if the internal tank pressure became less than the design minimum pressure), a redundant, self-contained pressure regulator would supply gas automatically from the outlet of the vaporizers to restore pressure. If underpressurization continued, direct-acting vacuum-relief valves on top of the tank would automatically admit ambient temperature air into the tanks until pressure were restored.

All liquid lines flowing into the tanks could be shut down by high liquid level and high pressure emergency controls. The vapor makeup lines could be shut down by the high pressure controls. All liquid withdrawal lines could be shut down by low-level signals from the liquid level and low-pressure emergency controls.

All piping into the LNG tanks would enter through the outer tank dome roof. The piping would be connected to the outer tank roof by gas-tight expansion joints. Inside the tank, piping would be supported from either the inner tank shell or the base. The vapor return pipeline would terminate above the suspended insulation deck, and chimneys through that deck would assure equalized vapor pressure above and below the deck.

Pipe towers would be constructed adjacent to each LNG storage tank independent of the storage tank structure. The towers would support the top and bottom LNG fill lines, the LNG withdrawal line, the vapor return line, and the gas make-up and boil-off vapor venting line. Design of the pipe towers would be such that the static and dynamic forces from liquid surges in the pipeline could not be transferred to the storage tanks. The storage tanks, pipe towers, and other structures would be designed to withstand instantaneous wind gusts of 98 miles per hour.

For purposes of earthquake design, the facilities would be divided into three categories. (An explanation of the categories and the facilities proposed for each may be found in appendix R.) Briefly, Category 1 includes all facilities necessary for safety, Category 2 facilities are necessary for continued operation, and Category 3 is everything else. Structures and equipment in categories 1 and 2 would be required to perform their functions after being subjected to the Contingency Level Earthquake (CLE) and the Reliability Level Earthquake (RLE), respectively. 1/ These earthquakes are defined in terms of elastic response spectra based on design ground accelerations of 0.50g and 0.25g, respectively. Category 3 structures and equipment would be designed to conform to the Uniform Building Code requirements for earthquake zone 3.

There is an additional elastic response spectrum being used for these facilities. It is based on a design ground acceleration of 0.4g. This spectrum is proposed for the LNG tanks even though they are assigned to Category 2 by the applicant and would otherwise have been subject to the 0.25g spectrum. The earthen containment dikes around each tank would be in Category 1, consonant with their safety function.

The environmental staff has retained the services of the National Bureau of Standards to assess (1) the validity of assumptions and completeness of the applicant's seismic safety

---

1/ These are terms used by the applicants. The method by which the design ground acceleration for the CLE was obtained is outlined in Dames and Moore, Technical Appendix A, Supplement, 1978. In essence, the acceleration is based on a probabilistic analysis of the seismicity of the project area and the selection of a 10,000-year mean recurrence rate. The RLE was chosen as resulting in one-half the design acceleration of the CLE. Its recurrence rate is about 100 years.

design for the proposed LNG storage tanks and containment systems and (2) the conservatism of the applicant's design in comparison with the seismic design requirements of the Nuclear Regulatory Commission for nuclear power plants. Upon completion of this study, the staff may have additional recommendations on seismic design.

Seawater would be transported to the vaporizers through a 9-foot diameter pipe from the seawater intake located 2,400 feet offshore at a depth of 30 feet. Sodium hypochlorite would be injected into the seawater at various points along the pipeline to prevent biofouling. A velocity cap would be placed over the intake to minimize fish entrainment. The seawater supply line would terminate onshore in the seawater supply basin, from where the water would be pumped to the vaporizers. Additional sodium hypochlorite would be injected into the water downstream of the pumps to help prevent biofouling in the vaporizers. Traveling screens would be provided in the supply basin to guide any entrained fish into the fish bypass, and then to a holding chamber. A fish elevator would then lift the fish into a seawater sluiceway which would feed into a 4-foot diameter pipe which would discharge the fish 2,200 feet offshore at a depth of 20 feet. A 28,000-gpm sluice water pump would be provided to supply the seawater to transfer the fish from the sluiceway to the ocean.

After passing through the vaporizers, the seawater would be detoxified by the addition of sulfur dioxide, then discharged through a 7-foot diameter pipeline to a point located approximately 4,300 feet offshore at a water depth of 50 feet.

Bunker-C fuel oil would be stored in a 100,000-barrel single-wall metal tank designed in accordance with API Standard 650. The oil would be brought to the site by tanker and stored at a temperature of 120°F.

c) Dikes and Drainage

Spill containment at the proposed LNG terminal would be accomplished by a diking system around the process equipment. Each LNG storage tank would be constructed in the center of a 25-foot deep square earthen basin with sloping sides 440 feet long. The basins would be sized to hold the entire contents of one storage tank and leave a freeboard of 4 feet above the liquid. This could serve as a vapor fence, requiring LNG vapor to absorb additional heat to rise out of the containment area, thereby decreasing the downwind distance to its lower flammable limit (LFL). Plant drawings indicate that an impounding sump would be provided within each diked area to contain small spills or rainwater; however, no details have been provided on their capacities. In the event of a catastrophic failure of a full storage tank, the impounding sump and dike freeboard would help prevent any LNG from potentially splashing out of the diked area. However, more study is needed on the hydrodynamic nature of a sudden large-scale LNG spill, the potential liquid splashing, and ability to contain it.

The seawater vaporizers and the secondary LNG pumps would also be enclosed in independent diked areas. The Bunker-C fuel oil tank and the diesel fuel tank would be enclosed within one diked area. Containment for the LNG transfer line at the railroad crossing, beach areas, and plant area is planned, but designs have not yet been prepared. The applicant has not indicated that spill containment would be provided for the transfer line over water.

Grading to control stormwater runoff would be carried out at the completion of facility construction. The details have not yet been worked out, but all storm runoff would be treated, held for a period of time, and then discharged to the ocean.

d) Fire Detection and Extinguishing

The LNG spill and fire detection and extinguishing systems at the proposed plant would consist of a combustible gas detection system, flame detectors, low temperature detectors, a fire-control water system, high expansion foam generators, and fixed and portable dry chemical extinguishers.

Combustible gas detectors would be located at the unloading platform, the seawater and gas-fired vaporizers, the secondary pumps, and the air inlets of all ventilated buildings at the plant. Ventilation systems would automatically shut down if the gas concentration at the air inlet reached 25 percent of the LFL. At all other gas detector locations, ambient air would be monitored continuously to check for gas leaks. Activation of a gas detector would cause visual and audible alarms in the central control room.

Low temperature detectors would be located in all containment areas, the secondary pump area, the vaporizer area, and the insulation spaces of the LNG storage tanks. When activated, visual and audible alarms would be set off in the central control room.

Ultraviolet (UV) flame detectors would be installed at the LNG unloading platform, in the storage tank areas, in the secondary pump areas, and in the vaporizer area. The UV detectors would send visual and audible alarms to the central control room, where operating personnel would further assess the hazard. Temperature rise sensors or UV detectors would be used in conjunction with the flame detectors throughout the process area and at the LNG storage tanks.

The fire-control water system would cool structures exposed to intense heat and would be used to fight non-LNG fires. The system would supply water throughout the terminal, except the unloading dock, which would have its own fire-control water pumping system. Monitor nozzles, fixed spray nozzels, hoselines, and hydrants would be provided on the system. A water deluge system would be provided on each LNG storage tank to provide cooling in the event of a fire at the adjacent tank. The system, when not in use, would be pressurized with fresh water from the freshwater tank, but during use all fire-control water pumps would utilize seawater as their only source. Fresh water would also be used to flush out the system after it had been used. There would be one electric motor-driven pump backed up by one diesel engine-driven pump located in the seawater intake system to supply fire-control water. Fire-control water pumps at the pier would supply seawater for fire protection at the dock. The seawater would cool structures on the pier or on the berthed LNG tanker.

The dry chemical system would be partially automatic and partially manual. At the vaporizers and the LNG transfer (secondary) pumps, if two or more UV detectors were activited, the dry chemical system would discharge automatically through prepositioned nozzles. Automatic dry chemical units with manual overrides would also be located at the unloading dock to control a fire resulting from an unloading arm rupture. Fixed dry chemical units at the tank vents on the LNG storage tanks would be designed to extinguish a fire at maximum burning rates expected immediately after vapor venting. All automatic units could be either automatically or manually controlled. Portable dry chemical extinguishers would be located at various locations throughout the plant to combat small fires.

High expansion foam systems would also be provided in the transfer pump and vaporizer areas. They would automatically activate after a dry chemical system discharged or when a low temperature detector were activated. The foam would decrease the downwind vapor concentration from an LNG spill, reduce radiation in the event of a fire, reduce reignition possibilities, and also provide a measure of control over an LNG fire.

Two firetrucks would be provided at the terminal to supplement the dry chemical systems, the water systems, and the high expansion foam systems. The trucks would also be capable of fighting small fires within the plant or fires with limited access. The trucks would be able to travel to any area of the plant on the roadway system and would provide an additional measure of safety.

Plant personnel would receive fire-fighting training consisting of classroom and field exercises. There would also be instruction on the physical properties of LNG, design of the installed safety systems, and the theories of handling LNG spills and fires.

The applicant has stated that it would acquaint the Santa Barbara County Fire Department with the facility's fire detection and suppression equipment. Available equipment from the department would include one 750-gpm pumper and one rescue unit from the Buellton station and one 750-gpm pumper from the Lompoc station.

A radio system would be provided at the terminal for communications within the plant boundaries. The system would consist of a base station in the control room, a satellite station in the security building, 6 mobile units in plant vehicles, and about 15 handheld portable units. In the event of an emergency, the base and satellite stations would be able to be switched to contact police, fire, ambulance, and medical personnel away from the site.

e) Safety Valves

All control valves would be spring-loaded to fail (on loss of air pressure or electricity) in the safe positions. All valves, except those in the LNG transfer line between the dock and the storage tanks, would close within 10 seconds. The LNG transfer line valves must have a programmed closure to minimize fluid hammer and would close within 20 seconds. Flow through all pumps and compressors would cease almost immediately after shutdown.

f) Operation and Preventive Maintenance

Since regasification would continue 365 days per year, certain critical items of the regasification system such as the secondary LNG pumps and the instrument air compressor would have spare units. The proposed peaking vaporizers would provide backup capability to maintain baseload output from the plant during minor malfunctions of the seawater vaporizers. Equipment for transferring LNG to shore would be maintained and serviced between scheduled periods of operation.

A periodic preventive maintenance program would be in effect for all equipment. Each piece of equipment would be monitored, and performance evaluations would be made to determine if it were showing signs of wear. Proper implementation of such a program would reduce hazardous malfunctions in the process system by allowing maintenance and repair to be properly scheduled.

A number of features are incorporated into the design of the Point Conception LNG terminal to minimize energy consumption (as well as operating costs) during the various modes of operation. The first energy-saving feature is that the secondary pumps would be used to pressurize the LNG to pipeline pressure before vaporization. Each secondary pump is rated at 1,000 horsepower, only a fraction of the power that would be needed to compress the LNG to pipeline pressure after vaporization, since it requires a great deal more energy to raise the pressure of a vapor than of a liquid.

The second energy-saving device to be installed would be the vapor absorber. In the absorber, boil-off from the storage tank would be absorbed into the LNG prior to the secondary pump stage. To do this, compressors would raise the pressure of the normal boil-off, as well as vapor generated during tanker unloading, to about 80 psia and pump it to the vapor absorber. The alternative would be to raise the vapor to pipeline pressure (about 1,400 to 1,500 psia) and inject it into the sendout system. This is much less energy-efficient and much more expensive.

Utilizing seawater as the primary heat source for LNG vaporization would be another energy-saving feature. The only energy this would require is that used to operate the water pumps. Gas-fired vaporizers, which would also be available, would be used for load-leveling or emergencies. Although they require less electrical power, the gas they consume is equivalent to perhaps 10 or 12 times more energy than the seawater vaporizers use.

Other features of the plant which should be studied as possible energy savers are using the seawater discharge for electrical generation and using the low temperature of the LNG as a heat sink (absorber). Some other possible uses of the cryogenic temperatures are air separation, food processing, desalination, and power plant cooling. The two primary factors in utilizing the two features are the locations of the industries which would make use of the energy potential and the actual amount of energy (or energy sink) available. At Point Conception, there does not appear to be any demand for the available "cold power." However, the availability could encourage the development of some industry which could use it.

g) Waste Treatment and Disposal

A prefabricated packaged waste treating unit would be installed to process oily water and the sanitary wastes generated by plant personnel. Sanitary sewage and oily water from the tugboats and dock facilities would be transported by truck to the waste treatment unit. There are presently no plans for handling sanitary wastes from the LNG ships at the Point Conception terminal. The effluent from the treatment plant, approximately 7,200 gallons per day, would be chlorinated and tested for biological oxygen demand, suspended solids, acidity, and chlorine concentrations. The effluent would then be pumped to a holding pond before being added to the plant seawater discharge.

h) Undersea Tunnel and Underground Storage Tanks

There are numerous combinations of equipment types and designs which could be used at the proposed LNG terminal. There is no universally accepted optimum design which is most economical, most reliable, or which best mitigates adverse environmental impact. Depending on the operating conditions in the site area and the actual operating requirements of the LNG terminal, the options for types, designs and manufacturers of equipment are flexible. Economic, engineering, and environmental factors all influence selection of the design and equipment.

For California LNG sites in general, two design variations have received attention as potential ways to mitigate environmental and safety concerns. Briefly, the City of Oxnard, California, in the Pacific Indonesia LNG case before the Commission in Docket No. CP74-160 et al. had requested that the Federal Government require that Western construct the "sunken silo" type LNG tank and an "optimized" subsea tunnel for unloading the LNG in lieu of the proposed aboveground LNG tanks and marine trestle. The Department of Energy's Economic Regulatory Administration in its "Opinion and Order on Importation of Liquefied Natural Gas From Indonesia" issued December 30, 1977, ordered that "the applicant [will] construct underground storage tanks and underwater LNG transfer piping, unless it demonstrates to DOE that there are significant advantages to aboveground construction...."

While these two design variations do not necessarily represent new design concepts for the worldwide LNG industry, there are nonetheless unique aspects in using either of these designs at Point Conception which require detailed evaluation.

i. Underwater LNG Transfer Piping

There are basically two types of underwater tunnels for LNG unloading lines. The only one actually constructed is at the Cove Point LNG terminal on Chesapeake Bay in Maryland. This compartmentalized tunnel has three sections, two of which have an inert atmosphere and contain the LNG unloading and other lines. The central section is a manway for access by operators and maintenance personnel. The second type of tunnel--the "optimized" tunnel receiving attention for the Oxnard LNG terminal--is apparently suggested as an economical alternative to the more expensive Cove Point-type tunnel. 1/

The "optimized tunnel" offered by Oxnard's consultants would consist of multiple (at least two) 6-foot diameter concrete pipelines which would act as tunnels and would house the various LNG unloading lines, the vapor return line to the ship, and the service piping and electrical lines. It is presumed that a single tunnel would be needed for each LNG unloading line and a second tunnel would be needed to house the vapor return and other service pipelines. This "optimized tunnel" would still require construction of the proposed pile-supported marine berthing platforms. It would not allow personnel access once it was constructed. If a leak or other problem requiring inspection or maintenance occurred, it is probable that complete shutdown of the line would be required. In the absence of specially developed procedures to enter the concrete tunnel and make repairs underwater, a relatively minor problem could render the unloading line and "optimized" tunnel useless.

1/ Western provided estimates to the City of Oxnard that a "Cove Point-Type" tunnel would cost $130 to $180 million more than the proposed trestle. S.E.S. (Oxnard's consultants) believes this estimate excessive.

A Cove Point-type tunnel would require that a trench about 30 to 40 feet wide at the bottom, over 50 to 60 feet wide at the top, and over 20 feet deep be cut in the ocean bottom to permit placement of the tunnel sections. The ocean offshore of the Point Conception site is considerably rougher than in the Chesapeake Bay. In addition, the Chesapeake Bay has soft bottom conditions for trenching operations, while the bottom conditions at Point Conception are predominantly bedrock exposed at the surface or overlain by sand layers a few feet thick.

Tunnel construction in general would be dramatically more difficult than that of a trestle. To varying degrees, either tunnel would require blasting and removal/disposal of rock along the trench. Environmental disturbance during construction would be much greater. Inspections, maintenance, and any necessary repairs on the "optimized" tunnel would be much more difficult, if not impossible. Designing a means for the tunnels to traverse the 100-foot high cliffs at the site would produce additional difficulties and environmental impact. The costs of either tunnel would likely be significantly greater than the proposed trestle. Finally, the "optimized" tunnel represents a completely untested design that would require detailed analysis to determine its technical feasibility and its practicality.

Since the disadvantages outweigh the only apparent advantage of the tunnel concept--a small aesthetic improvement if the trestle were not present--the staff has given no further serious consideration to either tunnel concept.

ii. Underground Storage Tanks

Below-ground LNG tanks are another major mitigative design variation available for the Point Conception LNG terminal. There are two basic types of underground tanks: a cylindrical reinforced concrete tank with an insulation liner and a sealing membrane 1/ and the "sunken silo" tank, a conventional double-wall steel LNG storage tank set in a large concrete-lined silo in the ground. In this design, there would be no soil in contact with the LNG tank. The dike walls would provide all support to external soil forces. 2/

1/ This is similar to the underground LNG tanks presently used in Japan.

2/ The City of Oxnard has advocated use of this tank design at Oxnard.

Of these two types of underground tanks, the staff considers the feasibility of the cylindrical reinforced concrete tank to be the more questionable for the following reasons: the advisability of using a membrane-type steel liner in a tank as the cryogenic barrier; the potential for frost-heaving--i.e., lifting of the tank from forces created by the ground freezing; the necessity for additional study of the tank's ability to withstand the thermal expansion forces which would occur during warmup of the tanks, as well as additional study to determine the seismic stability of this type of tank design. Economic analysis for this type of tank design is not available and would be needed. One significant fact is that there is no successful operating history for this type of tank in the U.S., and more in-depth study would be needed prior to its acceptance as a suitable means for LNG storage in the U.S.

The "sunken silo" LNG storage tank would not involve any new concepts for LNG storage or any indeterminate design problems other than the additional construction to prepare the silo excavation and the design for the sunken concrete dike/liner. The sunken silo tank design would essentially result in the same type of tank proposed at Point Conception with a dike similar to that originally proposed at Oxnard. However, the tank would be set into a silo about 80 feet below grade elevation. The staff therefore considers the sunken silo tank the better of the two designs for the Point Conception facilities.

The subsurface soils at the site consist primarily of silty and sandy clays of low plasticity, underlain by highly weathered shale of varied thickness which overlap shale bedrock. These terrace deposits of Pleistocene age cover most of the site and are generally less than 60 feet thick over the Sisquoc shale surface. In the general area of the proposed tanks, the shale probably exists at a depth of about 40 to 50 feet.

In the soil borings taken for the applicant by Dames and Moore, groundwater was generally found at depths of 25 to 45 feet in the area where the proposed tanks would be located. 1/ However, the Dames and Moore investigation notes that the transmissivity of the terrace deposits is probably quite low because of their fine-grained nature. It is likely that this groundwater accumulation is also seasonal and that it would not be encountered in sufficient quantity to pose any significant dewatering problems in construction of the underground tanks.

1/ Dames and Moore, "Preliminary Soils Investigation," Volume III. 1977. Plates A1A to A1G.

Although dewatering would apparently not be a major problem, the excavation for the storage tank would be a major undertaking and require serious consideration. Excavation below the 40- to 50-foot level would probably encounter the Sisquoc shales, making the excavation more difficult. It is possible that some portions of the excavation could require blasting. The staff's first discussion in the DEIS of the "sunken silo" underground tank concept contemplated separate excavations about 300 feet in diameter for each of the tanks. The walls of these excavations would have been very steeply sloped, and construction of retaining structures such as "tie-backs" would have been necessary to support and stabilize the walls during tank construction. This retaining method would have resulted in a lesser amount of earthmoving than other excavation methods, but might be inadvisable due to the shrink-swell potential and low strength of the subsurface soils at the site.

Recommendation 44 of the staff's DEIS requested a feasibility study of "sunken silo" type underground storage tanks, and Western prepared such a report. 1/ Whereas the tank and silo wall considered by Western in this report is similar to that envisioned by the staff, the excavation procedures are dramatically different. Figure 41 shows that the excavation for the inground tank concept studied by the applicant is about 350 feet in diameter at the bottom and about 510 feet in diameter at the top. In addition, instead of excavating individually for each of the tanks, the applicant's plan envisions a common excavation large enough for both tanks. The tanks would be spaced 430 feet on centers in this arrangement.

Dimensions of the 84-foot deep basin for the two tanks would be about 938 feet long and 510 feet wide on the top and about 770 feet long and 340 feet wide on the bottom. In addition, the applicant identified the need for a construction access ramp into the bottom of this excavation that would have a maximum slope of 6 percent. Therefore, a 1,400-foot long ramp would be needed to descend to the 84-foot depth of the underground tank excavation.

1/ Preliminary Evaluation of Inground LNG Storage Tanks For Point Conception LNG Terminal Facility, Fluor Engineers and Constructors (May 12, 1978).

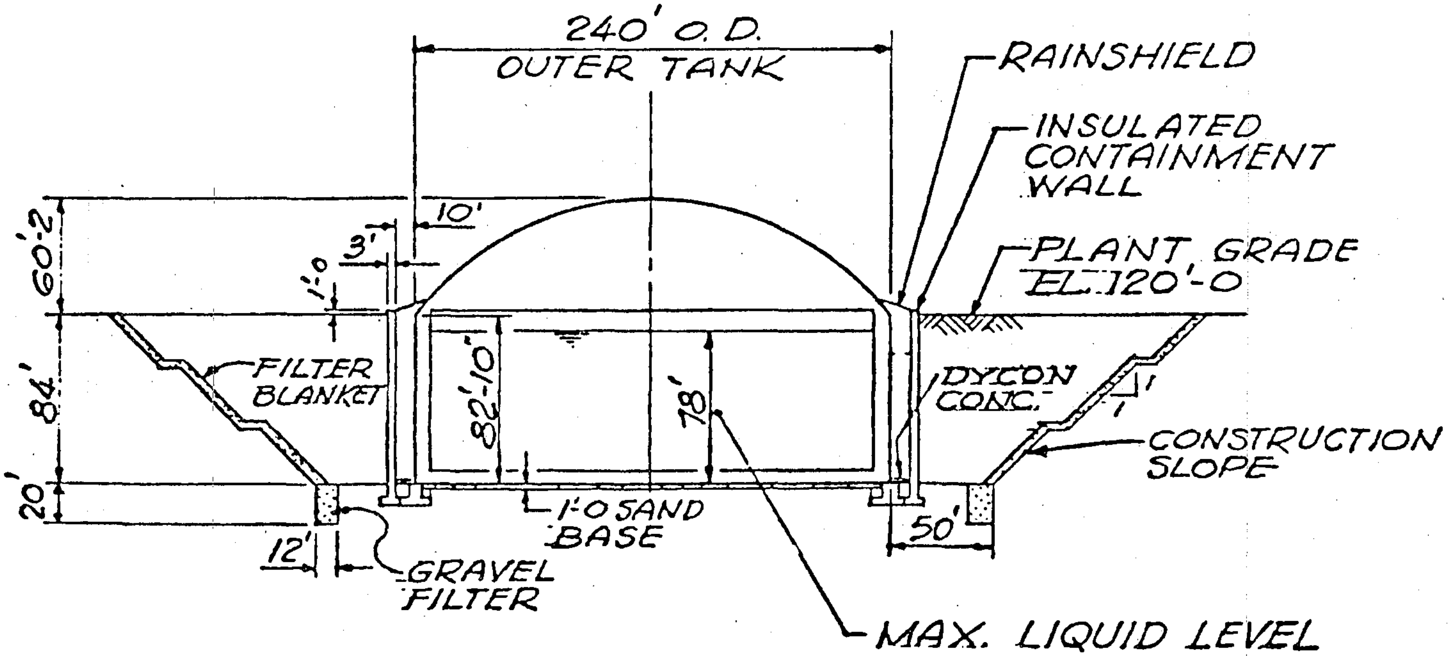


Figure 41

Preliminary Concept:
Sunken-Silo-Inground Tank Containment System

Source: Western LNG Terminal Company, May 1978.

The applicant estimates that 1.7 million cubic yards of excavation would be required to accommodate the basin for construction of the two tanks. About 75 acres of open land would be needed to stockpile this excavated material during the tank construction. 1/ In this preliminary study, it is proposed that about 1.36 million cubic yards of this material would be backfilled around the completed storage tank's concrete silo walls. This process of excavating the basin, stockpiling the soil, and then backfilling the basin after completion of the concrete containment walls would represent a tremendously intensive use of both labor and machinery.

The positions offered by the major intervenors in their comments to the staff's DEIS are very much in favor of requiring inground tanks. The major reason stated by those commentors for advocating inground storage tanks is to reduce the aesthetic impact of the LNG facility in the event that it is approved at Point Conception. Indeed, this was also the major reason for staff's recommendation, in the DEIS, that the feasibility of such tanks be studied. The engineering and safety arguments for the inground tanks are much less compelling, although the "sunken silo" type tank would appear to pose fewer questions in terms of engineering feasibility than the Japanese-type inground tank. Since the sunken silo tank would consist of the conventional double-walled steel tank, the major problem areas would be the design of the silo's concrete containment wall and the necessity to ensure that groundwater would not enter the silo. The "sunken silo" type inground tanks would be feasible from an engineering standpoint; however, the tanks, the containment wall, and tank foundations would need careful scrutiny to assure their integrity, especially under seismic unloading conditions.

Additional benefits resulting from the use of inground tanks would be reduced fire radiation and vapor dispersion hazard distances in the event of an LNG spill and possibly some improvement in security of the tanks. It is doubtful, however, that the increased safety and security would be justification for placing the tanks inground in the absence of the compelling need to reduce the aesthetic impact at Point Conception.

1/ 1.7 million cubic yards of overburden would cover 75 acres of land to a depth of about 14 feet.

One major deviation from the applicant's preliminary study of inground tanks, which could easily be accomplished, would involve either not backfilling or only partially backfilling the excavation for the LNG storage tanks. If the backfilling were not done, the need for the concrete retaining wall encircling the tanks would be eliminated and the excavated material could be used to create artificial ridges for screening around the site. These landforms have been previously advocated by the staff as a method to screen the LNG facilities from view along the coastal terrace. The ridges could be revegetated with both grasses and shrubbery to be more compatible with the surrounding terrain and to reduce erosion.

If the basin for the tanks were not backfilled, it would be necessary to provide for removal of rainwater and accumulations of groundwater, as well as precautions to stabilize the side slopes of the basin. This is a relatively easy task. Access to the tanks for inspection would be improved and the artificial lighting and the forced air circulation system could be eliminated. In addition, if the locations of the ridges around the facility were planned in advance, the excavated materials from the tank basins could immediately be placed in its permanent location, thereby eliminating double handling of this material and the need to stockpile it on 75 acres of open space land as identified by the applicant. Early creation of the ridges would facilitate revegetation early in the construction process and would also aid in screening the facility throughout the construction period.

Overall, the benefits accruing from not backfilling the excavations far outweigh the difficulties which may result. The staff has included a recommendation in section I of this EIS which supports "below grade" storage tanks and the use of ridges to screen the facility.

i) Miscellaneous

Western has stated that, to the greatest extent possible, construction excavation would be accomplished during the dry seasons to minimize the possibility of erosion. No dust control procedures have been outlined, however. Although no specific noise abatement procedures have been described, the applicant has stated that all applicable regulations would be followed.

The LNG terminal would be built near four archaeological village sites, one of which is presently affected by wave erosion. These sites will be avoided by moving the plant boundaries and rearranging the layout. The applicant will also stake or fence off these areas to protect them from inadvertant damage. Although prehistoric burial grounds may be associated with these sites, Western LNG will not actively search for them; however, if burials are discovered during construction, an archaeologist will consult with appropriate agencies and advise Western on appropriate procedures for salvage and reburial.

To minimize visual and acoustical impact of the proposed facility and to provide windscreening, the applicant would plant trees and shrubs in areas surrounding the plant. Trees would be placed at the maximum distance from the LNG tank enclosures which would provide optimal subtended angle screening. The proposed screening would be most effective from low-lying areas near the plant; however, since the most prominent plant structures would be LNG storage tanks, the visual screening would not be particularly effective. The tanks, vent stack, and marine facilities would be visible for more than 15 miles from east and west of the proposed site and from many areas where the foothills of the Santa Inez Mountains would provide an overview of the area. The use of underground tanks would substantially reduce the visibility of the plant.

2. Marine Trestle and Berth

a) Design and Construction

The marine trestle would provide roadway access to the unloading berths and pipe support for the LNG unloading line, vapor return line, potable water line, bunker fuel line, diesel fuel line. The 4,600-foot long trestle would extend out to a water depth of 52 to 56 feet (MLLW). The trestle would have a total width of about 32 feet. The LNG transfer line which would be supported by the trestle structures would be constructed of stainless steel with its insulation covered by a moisture-proof barrier. Expansion joints would compensate for movement of the pipeline caused by thermal forces. Wherever possible, all welded construction would be used in place of flanges to minimize the possibility of leaks.

Western has proposed that the LNG transfer line from the shore to the storage tanks would cross under the Southern Pacific Railroad tracks. Figure 42 shows a general representation of the proposed tunnel crossing.

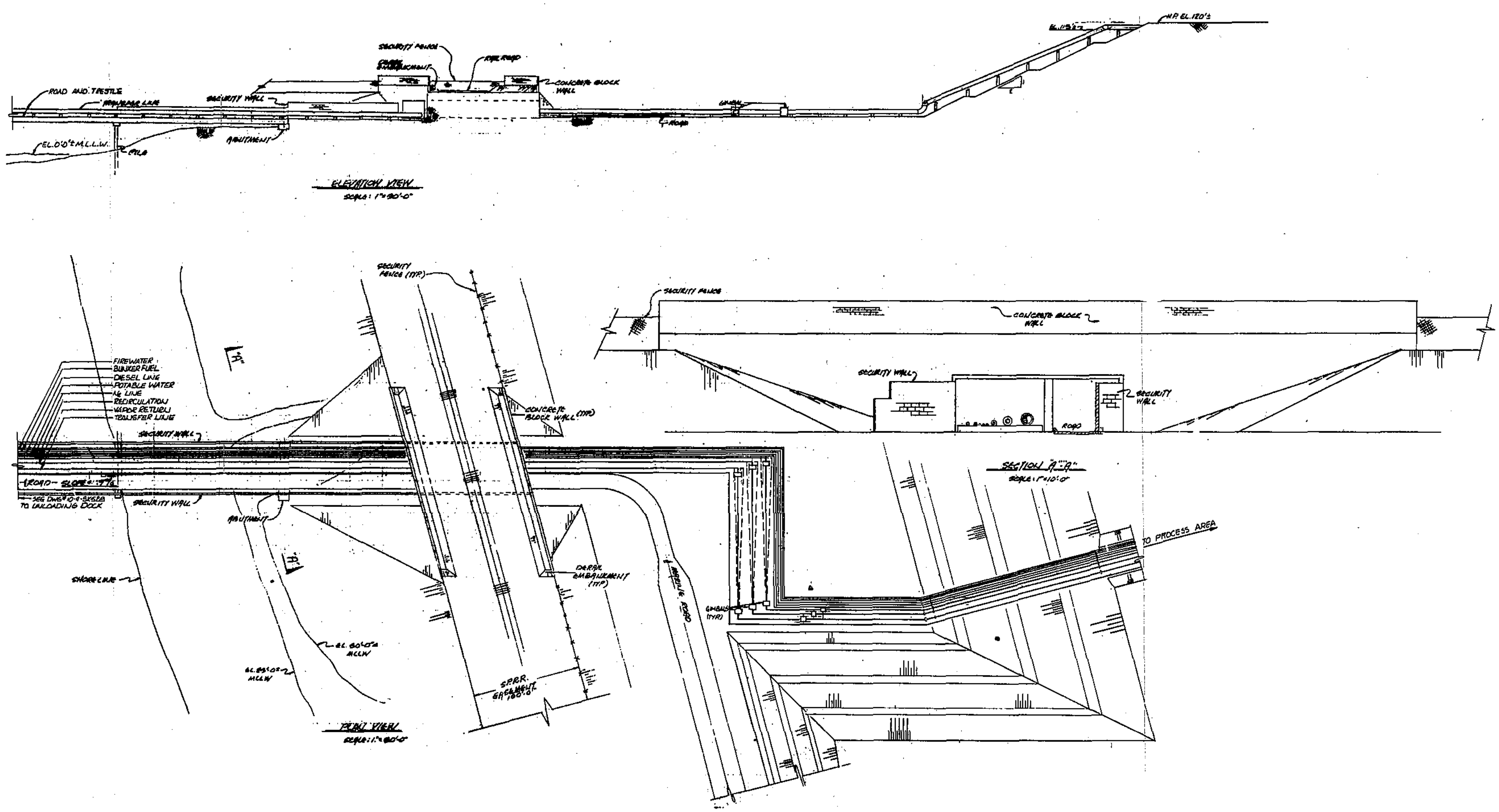


FIGURE 42: Conceptual Design of Trestle Crossing Under Railroad Tracks

To the side of the trestle's concrete roadway, a pipe rack would support all the cryogenic, vapor, and service piping for the tanker berth. The trestle structure would consist of precast, prestressed concrete girders which would span pile bents consisting of precast, prestressed concrete cylinder piles with concrete pile caps across the tops of the piles.

The marine terminal would be designed to operate in winds of approximately 29 miles per hour and waves with a significant height of about 6 feet. With higher wind speeds and more significant wave heights, the LNG tanker would cease cargo unloading. The berthing and unloading equipment would be designed to allow the ship to drift up to 10 feet away from the dock, 5 feet above or below normal load draft, and up to 15 feet fore or aft.

The unloading platform would consist of four 16-inch diameter LNG unloading arms, a 16-inch diameter vapor return arm, a Bunker-C fuel oil loading arm, an LNG drain drum and pump, a nitrogen surge drum, and a control tower. Emergency shutoff valves would be provided to isolate the unloading berth from the onshore facility. The control tower would provide an unobstructed view of the unloading operations. The unloading arms could be controlled from the tower.

The tanker berth would be equipped with flexible breasting dolphins to withstand the berthing forces from an LNG tanker. The dolphins would consist of large-diameter, high-strength steel pipe piles which would have a corrosion-resistant coating plus cathodic protection to resist corrosion. Mooring dolphins would be provided to restrain the LNG tanker. The mooring and breasting dolphins would be equipped with powered capstans and quick-release hooks to allow the ship to leave the berth quickly in an emergency.

b) Safety Measures

The unloading platform and service platform area would be equipped with combustible gas detectors, ultraviolet flame detectors, and low temperature detectors. If one of the detectors were activated, an alarm would be sent to the control tower and the central control facility. The detection units would act as a backup safety system to the plant operators in charge of unloading operations.

Fire extinguishing and equipment cooling capability would also be located at the unloading and service platforms. Fixed dry chemical systems at the dock would be capable of either manual or automatic operation. If automatic systems were used, they would have a manual override which could be used to delay the discharge of the unit and allow any operating personnel on the deck to move away before the dry chemical systems were discharged. A water firefighting system consisting of hydrants located at the dock would be used primarily for cooling process equipment on the dock or on the ship in the event of a nearby fire. Water would be supplied to the system by a seawater pump at the docks.

Liquid nitrogen would be produced onsite in an LNG cold aided air separation plant and stored at the dock in an 11,000 gallon tank. The nitrogen would be used to purge the unloading arms as well as for purging and inerting purposes aboard ship. The nitrogen would also be used to back up the plant instrument air system.

c) Tanker Operations

Two fleets of LNG tankers would bring LNG to the proposed terminal. One fleet would consist of two 130,000-cubic meter tankers transporting the Alaskan LNG to the site. The other fleet would be made up of nine ships of approximately 125,000-cubic meter capacity. The principal characteristics and safety features of the LNG tankers are described in "Mitigating Measures" of Volume I of this environmental impact statement. The LNG tanker voyage from southern Alaska would be approximately 2,037 nautical miles and would normally take about 4½ days. The tankers would pass along the California coast and turn into the southbound lane of the Santa Barbara Channel. Once the tankers were south of the terminal and clear of all traffic, they would proceed directly to the terminal. The voyage from Indonesia would be approximately 8,100 nautical miles and require about 19 days. The approach to the terminal would be from a southeasterly direction. The tanker would pass in the vicinity of an oil platform (Herman) and several submerged wellheads. Lighted radar reflector buoys would mark the locations of the submerged wellheads to the southeast of the proposed LNG ship berth. A navigational light would be located on the unloading platform to make the platform more visible during periods of low visibility. A radar set would be provided at the terminal toassit approaching LNG ships in identifying all contacts in the area. A set of range markers would be installed at the terminal to aid the LNG ships approaching the terminal in determining the correct approach course. The markers would be lighted and have radar reflectors. Any other navigation aids required by the Coast Guard would also be installed.

The LNG tankers would not enter the Santa Barbara Channel until communications had been established with the terminal. After turning from the channel toward the terminal, the tanker would contact the pilot and tugs. Once on board the tanker, the pilot would communicate with the tugs, and the control tower would monitor the communications. When leaving, departure communications would be the reverse of arrival communications, with contact being maintained until the LNG tanker was 10 miles away from the terminal.

The U.S. Coast Guard has not yet outlined any procedures or regulations governing the operation of LNG tankers in the vicinity of Point Conception, but would do so if the proposed project was approved.

The first time a tanker called at the terminal, it would dock only during daylight hours. Afterward, when the master and crew became familiar with the area and operations, nighttime docking would be permitted. This would also be the procedure if it were the ship master's first trip to the terminal. Initially, berthing would not be permitted when visibility was under 1 mile, but this policy would be reviewed when the crews gained operating experience.

Three tugs would be available to dock the LNG tankers. Two line-handling boats would be available during the berthing of the tankers but would not be needed for departure, since the lines would be handled from the dock. The tugs and/or the line-handling boats would also be used to rig an oil boom around the tanker before bunkering operations began. The boom would help contain any oil spilled during bunkering. The ship would be capable of leaving the berth on 30-minute notice in an emergency.

LNG tankers would use low sulfur fuel oil, 0.5 percent by weight, while in the vicinity of the marine terminal in order to reduce SO_2 emissions. Cargo boil-off gas would be used to the maximum extent in the ship's boilers to reduce the need for fuel oil. These measures would reduce SO_2 emissions at the marine terminal from about 700 to 20 tons per year.

3. Pipeline--Point Conception to Gosford

Compressor stations would not be required along the proposed route, thereby avoiding the possibility of atmospheric contamination and noise pollution. Since most of the pipeline would be buried, surface impact should occur mainly during construction. Revegetation of the right-of-way and continued cultivation would be possible.

An archaeologist would follow construction along the proposed pipeline to preserve any artifacts discovered, although the archaeological sites themselves might be destroyed. Further archaeological field surveys would be conducted as part of the final pipeline alignment studies. Buried sites are quite possible in Tepusquet Canyon, Ytias Creek, and the Santa Inez River Valley. More on this subject may be found in the "Conclusions and Recommendations" section of this EIS.

The applicant has not yet announced any plans to survey the pipeline route to locate any rare and endangered animal species. Construction during the breeding season could have an adverse impact on rare and endangered species, particularly the San Joaquin kit fox and blunt-nosed leopard lizard. (See "Conclusions and Recommendations.")

Special design features at submerged river and stream crossings would include heavy-wall, concrete-coated pipe to provide negative buoyancy and protection from abrasion should pipe become exposed. Depth of burial would be 5 to 14 feet below the bottom of waterways. The applicant has not stated any plans to prevent siltation of all natural springs and artificial water catchment basins. Recommendations on this subject may be found in the "Conclusions and Recommendations" section of this EIS.

The design of the pipeline would conform to OSHA and U.S. Department of Transportation (DOT) requirements. Mainline block valves would be provided at least every 20 miles in Class 1 locations and every 15 miles in Class 2 locations. These valves would be capable of manual as well as automatic operation.

Where damage to the pipeline is possible, Western would locate and mark transmission facilities and schedule protective surveillance in the immediate area. Pipeline crossing signs giving the location of the pipeline would be posted on each side of all river and road crossings.

Soil subsidence and seismic forces would be given special design consideration. Areas where landslides or erosion pose threats to the pipeline would be avoided if possible. Erosion control methods and appropriate revegetation would be employed along the right-of-way. To minimize the probability of erosion in areas of ridge-cutting, excavation for the pipeline would be accomplished during dry seasons. Hill slopes would be designed to provide for runoff, and sediment check dams would be installed at the bases of slopes and in drainage channels below spoil areas.

Accidents during pipeline operation would be prevented by:

1. Maintaining the pipelines and equipment.
2. Maintaining the right-of-way.
3. Updating local records describing the location of the pipelines and making that information available to construction firms, ranchers, and other pipeline operators.
4. Maintaining surveillance of third party activities along the pipeline where there is a risk of accidental damage to the pipeline.

The applicant's specific operating and maintenance plan would include:

1. Instructions for employees defining operating procedures during normal operations and repairs.
2. Specific repair procedures.
3. Patrol schedules.
4. Maintenance programs, including specific programs for facilities presenting the greatest hazard to public safety.
5. Programs relating to any specific extraordinary construction required.
6. Periodic inspection to insure that operating pressures are appropriate and that pressure-limiting facilities are in good operating condition.

Western's emergency plan would include:

1. Specific procedures to be followed in emergency situations at specific installations.
2. Measures for acquainting operating and maintenance employees with the procedures.
3. Measures to inform any appropriate public officials, including fire and police officials, of the procedures.

In addition, the applicant has indicated that it would establish a program which would assist the public in reporting emergencies; however, no details have as yet been provided.

The safety program would comply with appropriate OSHA standards and would include employee training and routine maintenance. All vehicles would contain first-aid equipment.

Practically the only noise sources along the pipeline route would be valves and headers at metering stations. Noise from these sources would be reduced by placing these components partially underground.

Dust would be minimized by dampening the construction area with water sprays. Disturbance to traffic and waterflow would be minimized by boring under paved highways and open-cutting only lightly used unpaved roads.

E. UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACT

This section explores those adverse effects of the construction and operations of the proposed Point Conception LNG receiving terminal and pipelines which could not be avoided in the event of project implementation. Two categories are identified for these effects: short-term, which are usually evidenced during the construction phases, and long-term, which generally exist over the operational life of the project and can sometimes continue after project abandonment.

The first impacts occurring at the proposed LNG terminal and access road would result from preconstruction site preparation. After final surveying and alignment is concluded, clearing and grading operations would commence which will have immediate and long-term impacts on the ecology of the affected area. Terrain modifications would occur from cut-and-fill leveling operations. Within the boundaries of the terminal site, grading is expected to involve at least 2 million cubic yards of material. The three arroyos which now drain the southern part of the site would be filled.

Construction of the access road involves some irreversible topographic changes as a result of grading and cut-and-fill operations. A limited amount of soil will be lost to vegetation productivity as a result of paving and maintenance operations. Some increase in erosion is expected during construction, and a short-term increase in water turbidity is likely to occur where eroded material can be carried to streams or to the ocean. This impact will be much greater if an entirely new access road is constructed. Construction activities would destroy most surface vegetation, which is largely herbaceous plants with some sage scrub. Over most of the plant site, regrowth of the natural vegetation will be prohibited for a long-term period by surface structures and the introduction of revegetating grasses. By reducing the amount of surface vegetative cover and exposing underlying soils, there would be an increase in the sediment load to the Canada del Cojo. This would result in a short-term increase of the amount of sediment transported to the littoral zone. Alteration of the site topography would result in long-term change of surface drainage patterns and create new locally wet or dry areas. Earth-moving operations would also cause a combining of underlying soils of low fertility with better structured topsoils. This mixing would result in a soil fertility for the disturbed site area which is lower than for surrounding undisturbed areas.

The rare and endangered plant *Scrophularia atrata* may be locally eliminated where clearing would occur in coastal sagebrush vegetation. Because of its limited range, this could be of significant detriment to the species' viability.

The removal of vegetative cover at the terminal site would also lead to a displacement of fauna from the immediate site during the operational life of the project. This would represent a long-term reduction in the wildlife carrying capacity of the area, although the significance of such a reduction would be relatively minor. The intermittent noise and movement involved in construction activities would discourage disturbance-sensitive wildlife species from locating in the physically undisturbed areas surrounding the terminal site. This impact would be short-term and exist only during project construction phases. Terminal operations would emit a constant low to moderate sound level throughout the life of the project. Many wildlife forms become accustomed to such a continuous long-term noise level and would probably return to the project area after construction. However, the area's habitat would become unsuitable to species which are particularly sensitive to the activities resulting from man's presence.

Construction of the plant and marine terminal would cause a localized increase in ambient air pollution levels. Fugitive dust and exhaust emissions from the operation of construction equipment would affect the area's aesthetics. Increased traffic volumes on the site access road would represent a disruptive element to the residents of Hollister Ranch and persons using the Gaviota State Beach Park access road.

The construction of shoreline facilities would cause disturbances to the marine environment. Turbidity would be increased near dredging operations for the seawater intake and outfall structures. The disposal of dredge spoil at an ocean location (if selected) would also cause short-term increases in turbidity in the disposal area. The most significant short-term impact of ocean spoil disposal would be the loss of benthic fauna covered by dredge spoil.

Long-term impacts of ocean disposal would include a permanent change from the existing natural benthic habitat to an artificial one. This would also be accompanied by a change in associated species composition. This may be a positive or negative impact, depending on the recolonization of the area.

Emplacement of the marine trestle would also cause bottom disturbances and increased turbidity levels. This disturbance would be short-term, occurring only during the construction phase. Construction activities may affect local abalone, reducing populations in the area for several years.

Terminal operations would have numerous long-term impacts. Many commercial and recreational boaters, as well as persons residing in the Hollister Ranch area, would be subjected to the visual intrusion of the proposed facilities. This would represent a significant long-term degradation of the area's aesthetic values.

Present uses of the proposed site and offshore area would be preempted or restricred for the project's operational life. The project would conflict with the exclusive residential development proposed for the area by the Hollister and Bixby Ranches as well as with the perceived open-space character of the area. Other area uses which would be disrupted include recreational boating, surfing, beach activities, and cattle grazing. The LNG facility would introduce major industrial development into an undeveloped area. The pressure for further industrial development along the south coast region would increase, with potential for major environmental impact being incurred if additional industrialization efforts were successful.

LNG tanker operations would introduce large-scale vessel traffic in the Point Conception area. This activity would cause occasional disruptions to the movements of pleasure boats and other commercial craft. Such interference, in addition to the partial barrier presented by the trestle would largely preclude casual boating activities from the offshore tanker mooring area for the project's operational life.

The cooled water discharge of the regasification facilities would cause minor ecological changes in the outfall area. Plant and animal species would either adapt to the temperature depression to which they were exposed, leave the area, or die.

The flow of seawater through the vaporization system would cause traumatic disruption to those organisms drawn into it. The entrainment of large organisms in the intake screening process and their travel through the fish return system is likely to stun, if not injure, those individuals which pass through it. This would leave those organisms susceptible to predation or disease. Nearly complete mortality of plankton, eggs, and larvae which pass through the screening process and into the vaporizers is anticipated due to mechanical abrasion, thermal shock, and treatment with an anti-fouling biocide.

With the storage and handling of LNG there always exists a risk to public safety in the event of an unintended LNG release. A fire could be fueled by the vapors resulting from a spill from LNG storage tank rupture or LNG transfer line break. Such a risk to personal safety could be considered as an adverse impact.

The operation of the proposed facilities would increase emissions of SO_2, NO_x, and particulates in the Point Conception area.

The Point Conception project will likely result in some adverse impact to cultural resources. The potential adverse impact includes removal of all or portions of archaeological deposits and disturbance of places sacred to Native Americans. The consequences of these impacts would include the loss of information about human history and the desecration of places sacred to Native Americans. Any modifications of the soil of the Point Conception archaeological sites may result in an impact. Once the physical relationships between the contents of archaeological sites are destroyed as a result of site disturbance, there is no way to retrieve the information which is lost.

Relocating the proposed terminal site approximately 1,500 feet eastward to mitigate cultural resource impacts will probably result in the destruction of ancient burial grounds as well as possible other evidence of human activity which was not observed through surface reconnaissance. In other areas such as Tepusquet Canyon, even realignment of the pipeline route may not be able to completely bypass cultural resources. Cultural resources which could not be easily found during archaeological surveys, such as trails, buried sites, and some types of sacred places, may also be damaged or destroyed.

An additional potential unavoidable adverse impact would result from salvage excavation. Under even the most favorable research conditions, archaeologists are not able to collect all of the information present in an archaeological site. Frequently, data recovery programs are conducted under less than optimal conditions. As a result, large-scale salvage programs sometimes retrieve only a small portion of the information known to exist within archaeological sites. Should such programs be carried out as a consequence of the LNG project, the result would be undesirable loss of information.

The proposed construction of the pipeline from the LNG terminal to Gosford would display many of the adverse impacts which are expected from the construction of the terminal. Clearing and leveling of the pipeline right-of-way would alter topography and destroy vegetation and animal habitat for the length of the route.

Long-term topographical alterations would be significant along ridge crests. The route would be particularly visible in these areas due to the conspicuous nature of a linear right-of-way through high relief ridges. Additionally, the process of cutting would push spoil dirt downhill and bury or partially cover existing vegetation. The ability of the affected vegetation to survive depends on the type of plant and depth of spoil coverage. Erosion potential is great in these ridge cutting areas due to the high relief of the exposed soil area. These vegetation and erosion effects should be short-term if the first vegetation efforts are successful following construction completion. However, chronic erosion may arise in steeply sloping ridge areas and would result in long-term scarring of surface features.

The removal of natural vegetation along the proposed pipeline routes would reduce habitat available to wildlife. Noise and equipment movements during construction activities would drive animal species from physically undisturbed areas bordering the pipeline route. These disturbances would be largely short-term as wildlife return to border areas immediately following construction and to right-of-way areas as revegetation occurs. However, periodic inspection of the pipelines by surface vehicles would represent a long-term periodic disturbance that may render the area of the right-of-way unsuitable to some disturbance-sensitive species. In addition, certain species of wildlife which require dense cover may experience a long-term reduction along the right-of-way.

Soil fertility would be reduced within the right-of-way due to a mixing of low fertility subsurface soils with original topsoils. This overall reduction in fertility would be evidenced by modified vegetative growth characteristics which would exist for a long-term period and render the route visible for many years. An additional significant long-term impact would occur through wooded areas where the growth of trees would be prohibited for the operational life of the pipelines.

Short-term impacts to biota in streams and rivers would occur primarily as a result of increased turbidity levels in areas downstream of pipeline crossings and in release of soil-bound chemicals from excavated spoils. Such effects may lead to the mortality of various aquatic organisms depending on the severity and length of detrimental effects.

The restricting of any permanent structures above the right-of-way would represent a long-term economic impact because commercial development is thus restricted. Short-term impacts would occur from reduced crop productivity where routing is through cultivated areas.

Short-term inconveniences would be experienced by persons engaged in activities near pipeline construction. Noise and dust would temporarily discourage recreational use near construction areas. Where dirt and gravel roads are encountered, temporary detours and vehicle traffic disruption would occur from open-cutting procedures.

Operation of these high-pressure gas transmission lines would present a long-term risk to the safety of those persons near the right-of-way at any time. There exists the constant potential for a pipeline rupture and subsequent fire which could render property bordering the right-of-way less attractive to some individuals who may locate there.

F. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The local short-term use of the environment to construct and operate the proposed LNG terminal and pipeline facilities need not significantly affect the long-term productivity of the project areas. 1/ Local productivity would be somewhat reduced during the lifetime of the proposed project, primarily as a result of changes made in or restrictions placed upon present land uses and the environmental impact associated with pipeline and LNG plant construction. However, after termination of the project, the pipeline rights-of-way and the plant site could be returned to their present use with little or no permanent reduction in productivity.

The construction and operation of the proposed LNG plant and related marine terminal would commit approximately 209 acres of open space/grazing land and the adjacent offshore areas to industrial use for a minimum of 20 years. Additional land areas would be committed for construction of an access road and transmission pipeline. The presence of these facilities and the access road could attract further industrial development, permanently altering land use patterns in the general project area. Such industrial development would probably permanently reduce long-term agricultural and scenic productivity.

The proposed LNG tanks would have a significant visual impact on nearby residences within the Hollister Ranch Development, where a major selling point is the scenic view of the coastal plain and ocean. Therefore, it is expected that residential development of surrounding areas would be adversely affected by the presence of the LNG facilities.

The land occupied by the project facilities would be preempted from other productive use for the short term. Mineral production, residential development, and certain types of recreation would be curtailed on the pipeline right-of-way and

---

1/ For purposes of evaluating the effects of the proposed action on potential future land uses and long-term productivity, "short-term" use is considered to occur over the project's lifetime of approximately 20 years. Long-term productivity would then be a measure of the project area's productive capacity after termination of the project.

the LNG terminal site for the life of the project. Wildlife would avoid the right-of-way area during construction, and some species might be eliminated from the right-of-way for the life of the project.

Balanced against these short-term uses of the environment would be a short-term gain from a relatively clean-burning, useful fuel in the general market area of the project gas.

In conclusion, it must be realized that the maintenance and enhancement of long-term land use depends largely upon the applicant's ability and willingness to remove the plant facilities and restore the site to near original condition when the project terminates.

G. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Resources which would be irreversibly or irretrievably committed in the development of the proposed project are:

(1) Construction materials which could not be recovered and recycled with prevailing technology;

(2) Construction and operating labor;

(3) Electricity, natural gas, and other energy resources used during construction and operation;

(4) The quantities of natural gas delivered from Alaska and imported from Indonesia;

(5) Land and marine areas permanently excluded from other uses by the construction of project-related facilities;

(6) Areas of spiritual significance to California Indian groups and sites of archaeological significance disrupted or destroyed by construction activities;

(7) Unique biological areas disturbed by pipeline construction which could not be restored to their natural condition.

Upon termination of the proposed project, the LNG facilities could be dismantled and the plant site returned to its original use. However, the presence of the LNG plant and the construction of an access road could spur industrial development; thus, the potential exists that the project site and the adjacent areas might be irreversibly committed to industrial use.

H. ALTERNATIVES TO THE PROPOSED ACTION

This section discusses the alternatives to implementing the proposed project. These alternatives include:

1) Alternative Pipeline Routes
2) Alternative West Coast LNG Sites
3) Alternative Access Roads
4) Alternative Dredge Spoil Disposal Sites

Alternatives 1, 2, 3, 4 and 5 are discussed in the following pages. To avoid the reproduction of the lengthy analysis of technology which would be required to properly address the subjects in Alternatives 6, 7, and 8, the staff references Energy Alternatives: A Comparative Analysis. This document was prepared by the Council on Environmental Quality with the support of the Department of the Interior and is readily available to the public. In particular, Part II--Chapters 14 through 16 of the document--describe the procedures for evaluating and comparing energy alternatives. Technical location, source, fuel-switchning, and policy considerations are treated. In addition, appendix S further discusses energy conservation.

The staff believes that to meet projected demands for natural gas, this nation must fully explore all possible sources of energy supplies, coupled with programs of energy conservation. No one source of energy will be sufficient to meet all projected demands.

1. Alternative Pipeline Routes

The staff has examined several alternative pipeline systems for delivering gas received at Point Conception to the existing gas transmission facilities in California. While many alternative routes have been considered (including those presented by the applicant), only those with significant potential for reducing the environmental impact of constructing the pipeline were examined in detail. Among the criteria used to determine the relative impact of various pipeline routes were:

- Magnitude and cost of the facilities.

- Avoiding environmentally sensitive areas.

- Maximizing the use of existing rights-of-way.

- Avoiding hazards to the facilities.

Several alternative alignments for the applicant's proposed pipeline (alternatives A, B, and C) and one wholly different pipeline route (alternative D) have emerged as possible systems for minimizing the environmental impact of the project. These are illustrated in figure 43 and compared in table 50. The route descriptions provided in this section are drawn from features shown on the most recent USGS 7 1/2-minute topographic maps.

a) Alternative A

Alternative A, which would differ from the proposed route between the terminal site and MP 11, would maximize common rights-of-way to reduce environmental impact in the Santa Ynez Mountains. This alternative route would begin at the northeast corner of the terminal site and follow the roadway up Canada del Cementerio to the head of Los Amoles Creek, where the road ends. The route would then follow ridges northeast to Highway 1, cross El Jaro Creek 0.5 mile southeast of Rancho San Julian, and follow ridges north to the proposed route near MP 11 at the head of Ytias Creek.

The first 4 miles of this route would follow Southern California Edison's (SCE) existing powerline easement and an unpaved roadway. Should the easement be used to construct powerlines for the terminal facilities as proposed, construction of the gas pipeline along the same corridor could significantly reduce the total impact of the project in this area. The roadway might be partially utilized for pipeline right-of-way, and would reduce new construction of access roads. This alternative, about 1.33 miles shorter than the proposed segment, would parallel 4 miles of existing roadway instead of only 1.8 miles paralleled by the applicant's route. It would also avoid the archaeological sites which have been confirmed in the Ytias Creek basin, and would pass through less oak woodland by avoiding the oak groves found along the Creek Basin.

The principal disadvantage of this alternative is that it would pass through part of the Hollister Ranch properties, imposing temporary adverse impact on property owners. At least one house has been constructed along Cementerio Road, apparently on or adjacent to the powerline easement. This residence would have to be avoided by a distance sufficient to eliminate any potential for property damage from pipeline construction and to minimize inconvenience to the property owner. A further disadvantage of the route is that it would cross terrain 200 feet higher than the proposed segment and could possibly encounter steeper slopes.

Alternative A would be superior to the proposed route segment because it is shorter and would reduce the number of rights-of-way in the project area. Neither the amount of construction to build the powerline along this section of the easement nor

TABLE 50

COMPARISON OF PROPOSED AND ALTERNATIVE PIPELINE ROUTES

	Proposed Segment	Alternative A	Proposed Segment	Alternative B	Proposed Segment	Alternative C	Total Proposed Route	Alternative Route D
Length (miles) 1/	10.4	9.1	27.5	33	16.3	16.3	110	110
Existing ROW								
miles	1.8	4.0	1.25	24	2.0	14.0	9	88
percent	17	44	5	73	12	86	8	80
National Forest crossed (miles)	-	-	13	3	-	-	13	7
Relief (feet) 2/	1,280	1,480	2,150(MP 39-55) 1,940(MP 55-65)	1,100 1,780	2,200	2,200	3,040	2,680
Perennial Streams	1	1	0	0	0	0	2	21

1/ As measured on USGS 7 1/2-minute topographic maps. These distances are usually 1-3 percent shorter than pipeline milepost distances, so all mileages cited in this table for segments of the proposed pipeline are measured, not MP distances.

2/ Difference between highest and lowest points along the route segment.

Figure 43: Location of Proposed and Alternative Pipeline Routes

GOSFORD
ALTERNATIVE C
QUIGLEY ROUTE
QUIGLEY STATION
OXNARD-QUIGLEY ROUTE
VENTURA
OXNARD ALTERNATIVE
LNG SITE
LOS PADRES NATIONAL FOREST
PACIFIC
CHANNEL

the amount of new access roadway--if any--which would be necessary along the first 10 miles of the proposed pipeline route have been determined, but it is evident that adoption of alternative A would minimize the level of construction disturbance in this sensitive coastal area. However, should a powerline route other than the one proposed by the applicant finally be utilized--such as the alternative upgrading of the 16-kv powerline along the coast--many of the advantages of alternative A would be eliminated. In that event, the following considerations would apply: 1) there is a land use difference between the two routes in that future development of Bixby Ranch could be planned around an already established pipeline corridor, while alternative A would cross over established parcels; 2) there is no significant difference in terrain between the two routes. Slopes are somewhat steeper along alternative A, but not to the extent that its suitability for pipelining would be significantly affected. Therefore, in the case where an alternate powerline route were chosen, alternate pipeline route A and the first 11 miles of the proposed route would be very similar in their environmental impact, but alternative A would be preferable on the grounds that it is shorter.

b) Alternative B

Alternative B would depart from the proposed route at the confluence of Colson and Tepusquet Canyons, MP 38.5, and follow Tepusquet Canyon to its end near Cigarette Spring. From there, it would follow a ridge nath to Buckhorn Canyon and follow this canyon along Tepusquet Road to Highway 166. It would follow the highway along the wide Cuyama Valley for about 16 miles to Carrizo Canyon Road, where it would leave the highway and curve northeast up and along the backs of a series of ridges between Red Rock and Carrizo Canyons, cross the shallow Saltos Canyon on Chimneas Ranch Road, and continue north to the proposed route at MP 65.5.

Although this alternative is about 5.5 miles longer (table 50) than the proposed route, 73 percent of it would be constructed along existing rights-of-way, compared with only 5 percent of the corresponding segment of the proposed route. About 6 miles of the alternative route would be within the Los Padres National Forest boundary in Cuyama Valley, but one-half to two-thirds of the valley land is actually privately owned, so alternative B would traverse about 3 miles of national forest land instead of nearly 13 miles for the proposed route.

While the proposed route would traverse rugged ridge-canyon topography between MP 39 and MP 45, reaching a maximim elevation of 3,000 feet, the alternative route would be largely confined to flat, slowly rising valleys. It would reach a maximum elevation of 2,000 feet. Both pipeline routes would cross similar terrain after leaving Cuyama Valley, except that the proposed route would reach elevations 200 feet higher than would Alternative B. These elevation differences decrease the relative length of the alternative by about 0.5 mile, so Alternative B would actually be only 5 miles longer than the proposed route segment.

To maintain the desired delivery pressure at Gosford, additional capacity for peak case IV gas volumes (beyond the proposed 45 miles of 34-inch looping) would be required as a consequence of adding 5 miles to the mainline length. For a system similar to the one the applicant has proposed, 6 to 7 miles of additional 34-inch pipeline loop would be required, for a total of 52 miles of case IV looping. However, there are numerous alternatives to increasing the mileage of loop. Foremost among these would be the use of 36-inch instead of 34-inch pipeline loop, which is more expensive per unit length, but would reduce the mileage of construction required. Another option would be to sacrifice some measure of the flexibility inherent in the designed delivery method, where gas would arrive at the Gosford pressure limiting station at 750 psig and be delivered into the PG&E system at about 700 psig, or as low as 650 psig. Adoption of alternate B would cause the gas to arrive at the pressure limiting station at a pressure about 4 percent lower, or approximately 720 psig. The optimum method of obtaining the necessary capacity would depend on conditions within the applicant's system at the time of case IV expansion, but it is evident that adoption of alternate B would not necessarily result in additional looping construction.

The following elements of pipeline construction would be reduced for the alternative route relative to the proposed route segment because of more favorable topography and because it would parallel existing highways for most of its length:

- Access road construction

- Blasting

- Shaving off ridge tops to provide a workpad

- Construction right-of-way width

- Right-of-way clearing

- Right-of-way restoration and maintenance

- Time of construction per mile of pipeline

These reductions would all diminish the relative cost per mile and environmental impact of Alternative B.

Alternative B would have several disadvantages, however. In following Highway 166, the route would cross the Cuyama River about 12 times instead of only once. This is not a major problem, since the river dries to a trickle during summer and is very turbid when it flows. Precautions to prevent scour and washout of the pipeline at river crossings would be necessary. Archaeological sites might be encountered in Cuyama Valley and upper Tepusquet Canyons, where such sites are typically found. This problem might be reduced by following the highway where cutting and filling has already occurred. Finally, right-of-way acquisition could be more costly for the alternative, since more of it is on private land. This potential problem would be greatly mitigated if part of the existing highway right-of-way could be used.

The FERC and Los Padres National Forest staffs agree that alternative B would have significantly less adverse environmental impact than the proposed route segment. The cost of constructing the two segments is probably similar, even though the alternative is 5 miles longer. The staff therefore recommends that the pipeline be constructed along Alternative B between MP 38.5 and MP 65.5. (See Section I, "Conclusions and Recommendations.")

c) Alternative C

This alternative would be located between MP 80 and MP 102. Alternative C is not a specifically proposed alternative route; rather, it is an exemplary one designed to take advantage of the many existing pipeline and roadway rights-of-way that crisscross the San Joaquin Valley. Although a set of existing rights-of-way has been selected for discussion, there are other rights-of-way which could be followed along the same general route.

The alternative route would begin at MP 80 and go east across Crocker Flat to Highway 33 in Midway Valley. It would follow roads for part of this distance. At Highway 33, near oil tanks about 0.5 mile south of Midway Pumping Station, the route would meet an east-west pipeline and parallel it past the pumping station to the Standard Oil tank farm at Dustin Acres, there intersecting the proposed route near MP 95. The alternative route would then follow pipeline rights-of-way to Highway 119 and parallel the highway to MP 102, where it would rejoin the proposed route.

Eighty-six percent (14 miles) of this alternative route segment would parallel existing rights-of-way, while only 14 percent (1.7 miles) of the proposed route would do so. Otherwise, the two routes are very similar, since they are the same length and parallel one another closely.

Most of this part of California's Central Valley is practically void of natural habitat because of intensive agriculture and mineral extraction. For this reason, it is generally preferable to construct along existing right-of-way, thereby avoiding the few remaining tracts of habitat, any endangered species, and minimizing erosion and restoration problems. A further benefit of adhering to existing right-of-way in an area with many existing pipelines, such as Elk Hills, is that it simplifies future construction by reducing the number of separate pipeline crossings.

For these reasons, the FERC environmental staff believes that alternative C, or a similar route also using existing rights-of-way, may be environmentally superior to the proposed route between MP 80 and MP 102. While there is insufficient reason to define this route on an FERC certificate, the staff recommends that the applicant retain alternative C as an option during the process of obtaining permits from agencies with jurisdiction over the land involved, and as an option for any realignments required as a result of endangered species or archaeological surveys. (See section I of this EIS--"Conclusions and Recommendations.")

d) Alternative D

Alternative D would use a wholly different system for delivering the project gas to market. It requires construction of a pipeline from Point Conception to Quigley and would there deliver all the gas into existing pipelines serving southern California. A compensatory amount of gas from other sources would be diverted to northern California by exchange and displacement. Certain volumes of the imported gas could be taken off-line into existing facilities at Goleta and in the Santa Clara Valley (e.g. La Vista Pressure Limiting Station) to facilitate distribution.

This alternative would use more existing rights-of-way than the proposed route, it would avoid crossing the coastal mountain ranges, and it would avoid the San Andreas fault.

From the terminal site, this alternative would follow the coastline to near Goleta, utilizing existing railroad, pipeline, highway, or powerline rights-of-way as convenient, and avoiding the state beach parks. West of Bell Canyon, the pipeline would utilize Highway 101 and railroad rights-of-way, continuing west across Santa Barbara by adhering to the highway and railroad rights-of-way, by following Foothill Road, or by following one of the existing gas pipelines which cross the city. The route would then cross orchard lands to Foothill Road near Serena Park, follow the road to Rincon Creek and follow Chismahoo Road onto Laguna Ridge in the Los Padres National Forest. The route would follow Laguna and Coyote Creek ridges to Highway 150 near Lake Casitas, follow 150 east to Sulphur Springs, and oil roads to Timber Canyon. From there it would descend to the Santa Clara Valley. The route would follow existing road, railroad, or pipeline rights-of-way up the valley and across the Santa Susana Mountains via Potrero Canyon to Quigley.

This alternative would be approximately the same length as the proposed route, but nearly 90 percent of it would parallel existing right-of-way, compared with 23 percent of the proposed route. Alternative D has the advantage of generally following existing transportation and utility corridors and would have less impact on undisturbed ecosystems. It would provide pipeline facilities for receiving gas which may be produced in nearby offshore oil and gas leases, thereby reducing the potential adverse impact of developing these leases, or it might serve as part of a common coastal pipeline corridor for other oil and gas lines, such as the proposed oil pipeline between Corral Canyon and Los Angeles currently under study by the Santa Barbara County Planning Department. Except for the Laguna and Santa Paula Ridge areas, Alternative D avoids difficult terrain and environmentally sensitive areas comparable to the Santa Ynez and Sierra Madre Mountains. It would cross only 5 miles of national forest land.

However, this alternative would have several drawbacks. It would cross about 30 perennial streams (table 50), causing temporary adverse impact on stream environments. It would also very likely have significant adverse impact on archaeological sites, which are abundant along the Santa Barbara County coast, particularly near streams. Even though this route would use existing rights-of-way, trenching would affect deeper layers of archaeological material than previous construction on the surface. Construction would cause considerable inconvenience to people in the Santa Barbara, Goleta, and Meiners Oaks areas and to travelers using the coastal roadways. Pipeline construction through urban areas is relatively expensive because of more costly right-of-way acquisition, time-consuming construction, and the need to blacktop the backfilled trench. Alternative D would be more costly than the proposed pipeline.

Any looping or additional pipeline beyond Quigley which would be necessary to implement this alternative would seriously detract from its advantages. At this time, additional costs associated with diverting gas in the existing pipeline system to northern California are not known.

Alternative D would be attractive in combination with one of the alternative terminal sites closer to Santa Barbara. For example, a pipeline using Alternative D from Naples to Quigley would be about 29 miles shorter than a pipeline from Naples to Gosford (see Section H.2f). Alternative D would not be economically or environmentally advantageous as a route for delivering Point Conception gas and will be retained only as a possible pipeline route for alternative terminal sites on the eastern part of Santa Barbara County's coast.

2. Alternative LNG Sites

The development of natural gas liquefaction facilities and associated marine LNG transportation facilities near the Pacific Ocean requires that receiving terminals for the storage and regasification of LNG be developed on the west coast of the United States. In view of the concerns for human safety, project success, and environmental protection applicable to the proposed west coast LNG terminal, the staff has undertaken an extensive siting study for potential LNG terminal sites. With the assistance of an outside consultant, Intersea Research Corporation, the staff previously conducted a regional and subregional analysis of the United States west coast, evaluating locations on a site-specific level. 1/ The specific sites that are analyzed here were chosen on the basis of material obtained from the applicant, the California Public Utilities Commission (CPUC), the California Coastal Commission (CCC), and the studies of outside consultants.

a) Onshore and Offshore System Configurations 2/

Onshore systems are defined as those with all LNG storage and regasification facilities located on the mainland, connected

---

1/ Intersea Research Corporation was contracted by the FPC to conduct a study of Alternative Sites for Alaskan Related LNG Facilities on the West Coast of the Contiguous United States, which was submitted to the FPC in final form in September 1975. Additional information pertaining to this study is contained in forthcoming sections of this report.

2/ Parts of this discussion are primarily an edited version of previous staff analysis presented in a contract study by Resource Planning Associates, Inc., Alternative Site Study-Gulf Coast LNG Conversion Facility, June 23, 1977.

to an associated marine terminal by an LNG-carrying cryogenic pipeline. Thus, if one possible configuration requires locating the receiving terminal offshore and all other facilities onshore, it is still defined as an onshore system.

Offshore facilities are defined as those configurations in which the storage and regasification facilities and the marine transfer terminal are either sited on natural or artificial islands or in areas presently covered by water. This category would include semisubmersible structures, floating barges, fixed and mobile platforms (all attached to the ocean floor), as well as subsea structures. (See table 51 for the categorization used.)

Initial analysis indicates that well over 100 onshore LNG storage facilities and only two offshore LNG facilities (i.e., the Canvey Island terminal at the United Kingdom and the Das Island terminal in the Arabian Gulf) exist throughout the world. Both offshore facilities are located on natural islands and are primarily land based. Although many of the proposals for less conventional offshore LNG facilities are technically feasible, none of these proposals has yet passed the preliminary design stage.

Based on the Western LNG Company application and the current state of the art, three basic configuration requirements were established:

1. The facility configuration must be technically feasible at present and not require any further research and development to solve engineering problems.

2. The facility configuration must be capable of receiving and regasifying that volume of LNG proposed in the Western application (i.e., regasifying 0.9 to 1.3 billion cfd or unloading on the average one 125,000-cubic meter LNG tanker every 1.5 to 2 days).

3. The facility configuration at an alternative site must be capable of being operational within the same general time frame proposed in the Western application, with the realization that choosing an alternative site over the proposed site could require some additional time to process through the regulatory hearings.

Only onshore facilities and offshore facilities on natural islands are able to meet all three requirements.

Several preliminary designs for offshore facility configurations appear technically feasible and capable of being built to the required size within the required time. However, because these facilities require that components derived from existing

TABLE 51

POSSIBLE CONFIGURATIONS FOR LNG TANKER BERTH AND STORAGE AND REGASIFICATION FACILITIES

Type	Description	Example
Onshore		
Completely Land Based	Onshore LNG tanker berth is connected to onshore storage tanks and regasification facility by short cryogenic pipeline.	Everett, Massachusetts
Primarily Land Based	LNG tanker berth located in water of adequate depth near shore is connected to onshore storage tanks and regasification facility by cryogenic pipeline.	Cove Point, Maryland
Offshore		
Natural Island	LNG tanker berth located in water of adequate depth on or near natural island is connected by short cryogenic pipeline to storage tanks and regasification facility located on natural island. Subsea pipeline is used to transport natural gas to mainland.	Canvey Island, United Kingdom
Artificial Island	LNG tanker berth located in water of adequate depth is connected by short cryogenic pipeline to storage tanks and regasification facility located on artificial island. Subsea pipeline is used to transport natural gas to mainland.	
Floating Facility	LNG tanker berth and storage and regasification facilities located on free-floating structure connected to but not supported by seafloor. Barge and semi submersible structures attached by such means as single-point moorings and mooring tower.	
Fixed and Mobile Structures	LNG tanker berth and storage and regasification facilities located on offshore structures supported by oceanfloor using a fixed tower and concrete caissons.	
Subsea Structures	LNG tanker berth located at surface platform and storage and regasification facilities located on the platform, which is either primarily or completely beneath the surface of the water.	

technology be combined in a new way, a certain amount of additional research and development will be required for most of the proposed offshore configurations before detailed engineering designs can be developed. 1/

Furthermore, the Fairchild report estimates that if offshore facilities other than those located on natural islands were located within the jurisdiction of Federal and state regulatory agencies (i.e., within the U.S. territorial sea, which extends 9 miles off the coast of Texas and 3 miles off the coast of Louisiana, Mississippi, California, and Alabama), development of new state regulations would probably be required before any new technology would be approved. State officials in California have estimated that 18 to 24 months would be required to develop such regulations. 1/ A similar delay would probably occur in the Gulf Coast States. If an offshore facility were located outside the limits of the U.S. territorial sea, new Federal legislation on facility siting could be required which would probably consume a similar amount of time. It has been estimated that, even without these additional time delays, 81 to 96 months would be required from initial application to implement this type of offshore facility. 1/ Therefore, it is not likely that these facilities could be built and operating within the necessary time frame.

The California Coastal Commission (CCC) has been actively studying the feasibility of offshore siting. Their work, to date, is a major contribution in analyzing potential California offshore sites coupled with design specific information. This report, along with others, should provide a good cornerstone for future offshore LNG facilities. In its final report, dated September 15, 1978, the CCC concluded that a floating type LNG terminal in international waters at southeast Ventura Flats in the eastern Santa Barbara Channel would be the most appropriate of all the alternatives evaluated. (See figure 44.) The CCC report does state, however, that if there is general support at all levels of government and limited opposition, it would take about 6 to 8 years to put a floating LNG terminal into operation on Ventura Flats from the time application preparation starts. Its staff report also remarks that this time estimate is optimistic.

Another noteworthy report is a study prepared by DOE Region IX and the San Francisco Operations Office on March 10, 1978. The report, entitled "Siting An LNG Receiving Terminal Offshore: Issues To Be Considered," can be characterized as an issue-raising study and not an issue-

---

1/ Fairchild Industries, Stratos Division, Offshore LNG Receiving Terminal Project, Vol. II, Project Report, March 31, 1977. Also, Henry S. Marcus and John H. Larson, Offshore Liquefied Natural Gas Terminals, 1977.

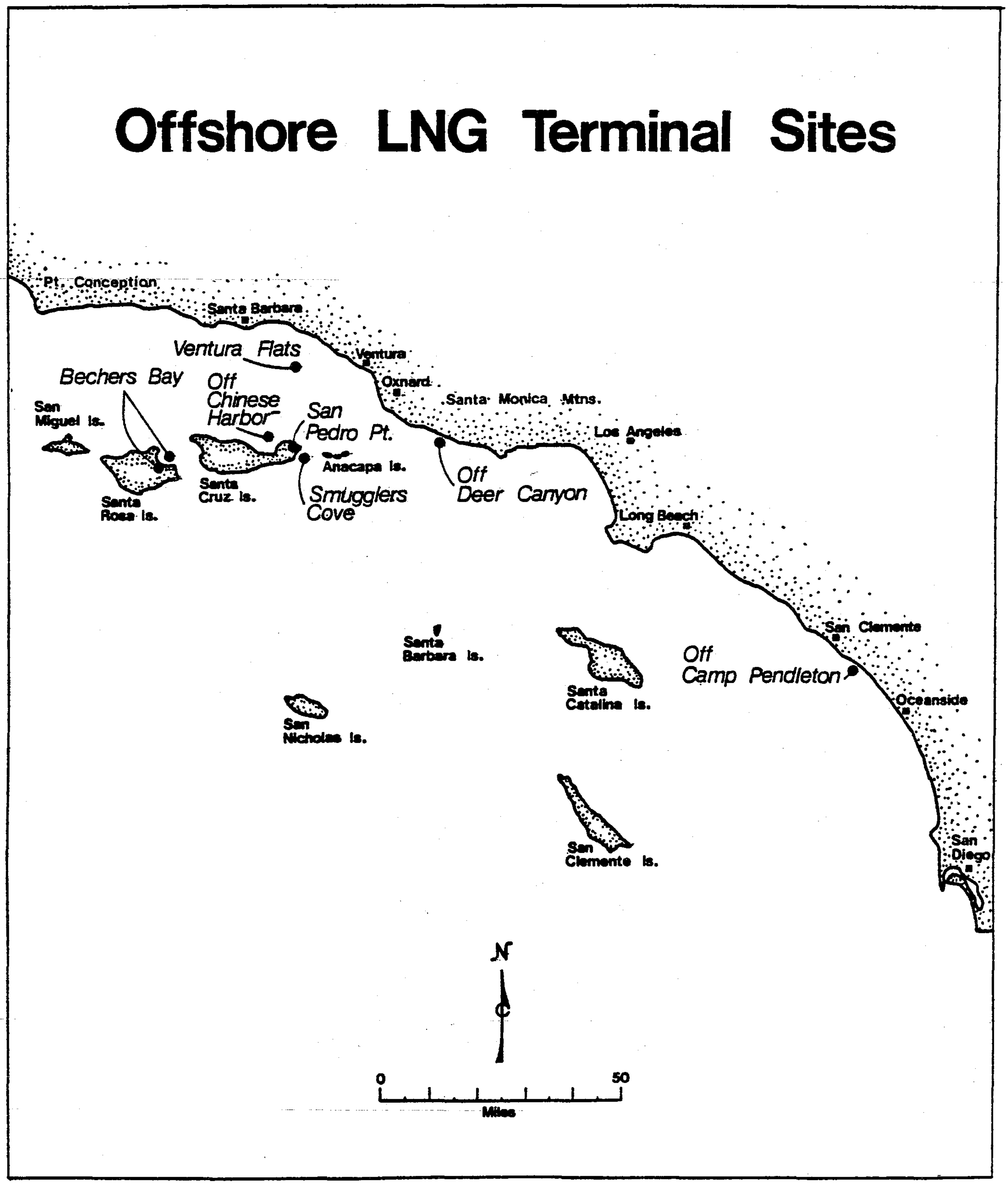

Offshore LNG Terminal Sites
Pt. Conception
Santa Barbara
Ventura Flats
Ventura
Oxnard
Santa Monica Mtns.
Los Angeles
Bechers Bay
Off Chinese Harbor
San Pedro Pt.
San Miguel Is.
Santa Rosa Is.
Santa Cruz Is.
Anacapa Is.
Smugglers Cove
Off Deer Canyon
Long Beach
San Clemente
Off Camp Pendleton
Oceanside
Santa Barbara Is.
Santa Catalina Is.
San Nicholas Is.
San Clemente Is.
San Diego
N
0
50
Miles

Figure 44

resolving one, i.e., this report surfaces and clarifies issues that need to be addressed in siting LNG and other energy supply facilities in the open sea. The conclusions or findings of this study are summarized by category:

DESIGN AND ENGINEERING

Advantages of offshore siting include:

- Technology to be used in floating and fixed base facilities for the gas processing and storage systems is presently available.
- Construction techniques are well within the capabilities of the industry.
- Floating facilities would be free of seismic damage, other than possibly the mooring system.
- Connections of the pipeline to shore are well within the state of the art for fixed based structures.
- In a subsea concept, storage and handling of LNG is relatively insensitive to ocean surface phenomenon.
- Cryogenic power generation may be possible and economically beneficial.

Disadvantages

- Nothing the size of the proposed offshore LNG facility has ever been sited in the open sea.
- Several key operating systems are still in need of further testing and development.
- Component systems have small separation zones as compared to the spacing available on an onshore site.
- More damage is likely from heavy weather since these facilities are in unprotected seas.
- There are depth restrictions (both maximum and minimum) for each concept, as well as restrictions on pipeline depth.
- Mooring systems on floating facilities have not been tested.

SAFETY

Hazards

- A facility located 10 miles offshore could be a navigational hazard.

- Configuration of an offshore facility requires component operating systems to be close together, increasing the possibility of adverse effects from accidents or LNG spills.

- An LNG spill has a greater opportunity to reach water and form vapor clouds.

- Terminals are relatively inaccessible, requiring transportation systems that could increase the probability of accidents such as helicopter crashes or ship collisions.

- Supply ships most likely would have to cross shipping again, increasing the probability of collision with other ships.

- An LNG spill could reach noncryogenic hull material and possibly cause the sinking of the facility.

- Floating facilities could break their moorings and would be extremely difficult to contain or steer.

- The small separation zone between moored tankers and storage tanks on the facility increases the likelihood of secondary adverse affects from accidents.

- Weather conditions would most likely have greater adverse impact on an offshore facility.

- Maintenance must be conducted under circumstances that may be less than ideal and again may increase the probability of accidents.

Risks

- If LNG is spilled at the offshore facility, there is less risk to the general public from fires at the facility. However, there are significant possibilities of vapor clouds forming as a result of the spill of LNG mixing with the ocean waters, thereby partially nullifying the offshore risk advantage to the general public.

- Mooring systems failures on a floating facility could result in the facility floating to shore and spontaneous rupturing of the storage tanks. This also could increase risks to the general public.

- Risk to other shipping and boating would be greater than facilities onshore, since there are no comparable circumstances for onshore facilities.

- Risk to crew and workers would most likely increase due to lack of separation of operating systems, more workers at the facility, and a general hostility of the environment.

ENVIRONMENT

- Ambient air quality is undetermined for the offshore, but no effects are expected on the mainland from operation of an LNG facility offshore.

- Noise effects would be minimal except in the event of massive discharges of LNG.

- Waste disposal is of little consequence.

- Effects on the biota are expected to be beneficial, once the facility is in place. There may be some disturbance as a result of construction.

- Ocean water quality could be affected by waste disposal toxic material discharges and heat exchange.

- Employment potential is dependent on location. Only a small number (under 100) would crew the facility. However, construction could have a substantial impact on employment.

- Dredging of pipelines would have a potentially significant adverse effect on the sea environment.

- Commercial and recreation fishing would be disturbed during construction, but this would ultimately be recovered as a result of the beneficial impact to fishing of the structure once the facility was in place.

- Some impact to normal shipping would occur even if the site were outside shipping lanes.

- Vaporizing medium discharge could have significant effect on the immediate area of the facility.

- The effects of underwater spills of LNG are not known at this time.

LEGAL ISSUES

- Offshore siting would not violate any international treaties or agreements.

- The consensus of legal opinions during the hearings of the Deepwater Ports Act asserted that domestic legislation is needed to site offshore LNG facilities beyond the 3-mile limit.

- No Federal agency has sufficient legal jurisdiction to authorize or regulate operation of an LNG facility in the high seas.

- Alternatives for legislation include:

  o Amend Department of Energy Act
  o Develop new LNG legislation
  o Amend the Deepwater Ports Act

  o Amend the Outer Continental Shelf Lands Act
  o Extend through legislation Federal jurisdiction to 12 miles or beyond

FINANCE

- Conventional financing methods are inappropriate for offshore LNG facility projects.

- Project financing methods are the choice of the financial community; however it believes that there are substantial risks involved resulting from possibilities of:

  o Noncompletion of the project
  o Cessation of operations of all or part of the LNG delivery system
  o Government regulations

Possible measures to mitigate risks include:

- o All events tariff
- o Consumer surcharge
- o Variations in rate base structure
- o Government support financing
- o Foreign ownership

The timing requirement coupled with the need for furthur research and development and the probable regulatory and legislative delays associated with offshore facilities (except those located on natural islands) would rule out these facility configurations from further detailed siting analysis at this time.

b) LNG Terminal Siting Criteria

The following discussion provides detailed descriptions of the physical criteria that were applied to evaluate the abilities of each potential site to accommodate the proposed project. Wherever possible, actual maximum or minimum limits of acceptibility have been assigned in the definitions of the criteria, and both general and specific requirements are included in the definition. In many instances, however, the subjectivity of criteria or the number of offsetting factors involved would not permit such limits. In these instances, the criteria are presented solely on a general, subjective basis.

An ideal site would meet or exceed all the requirements established in the criteria; however, it should be realized that the possibility of locating such a site is remote. Therefore, the terminal site considered most suitable for development would be the one whose physical characteristics correspond most closely to the requirements set forth in the criteria in table 52. The criteria were developed for projects involving the shipment of approximately 1 billion cfd of gas to an onshore unloading terminal. The criteria could vary for projects of different magnitudes and specifications.

c) Evaluation of Potential Sites

To aid the staff in its evaluation of the proposed and alternative sites presented by the applicant, as well as providing additional potential LNG sites, Intersea Research

TABLE 52

SITE IDENTIFICATION CRITERIA

1. Suitable Oceanographic Conditions

Protection from storm conditions (e.g., strong winds, high waves, and flooding resulting from hurricanes) should be present; therefore, no open, exposed coastal areas where operations would be severely limited by wind, wave, and other sea conditions are acceptable.

2. Suitable Bathymetric Conditions

Water depth at the berth and in the approach channel should be no less than 40 feet at mean low water. (This required depth takes into account the maximum ship draft of 36 feet for 125,000-cubic meter tankers plus a 10 percent safety factor.) This depth should be achieved with minimal initial or maintenance dredging or blasting. Greater depth is desirable, particularly in areas subject to heavy tidal action where possible fluctuations in tidal heights could occur for long periods of time.

3. Suitable Navigational Conditions

a. The minimum width of the approach channel should be approximately three times the beam of the ship plus a 10-percent safety factor, or about 450 feet for 125,000-cubic meter LNG vessels. No overhead obstructions (e.g., bridges with clearance of less than 175 feet above mean high water) can be present.

b. The approach channel should be relatively straight and wide, so that extensive turning or maneuvering is not required.

c. The approach channel should not be subject to shoaling or extreme erosion and sedimentation. No obstructions (i.e., no shipwrecks) should be present.

d. Channel length - A long approach channel within a harbor would be undesirable, since it would lengthen transit time of LNG tankers and increase disruption to other shipping.

e. An unobstructed turning basin with a diameter of about twice the tanker length present near the berth to allow the ship to turn before entering the berth. (This diameter would be about 2,000 feet for 125,000-cubic meter tankers.)

f. At least one area suitable for anchoring LNG tankers should be available either at the harbor entrance or in the vicinity of the marine terminal site. The anchorage area should be located at a distance from vessel-maneuvering areas and should be of sufficient size to permit the ship to sway with the wind or current. In addition, the bottom conditions at the anchorage area should be firm to permit secure anchorage.

g. Existing ship traffic should not be so heavy that closing down the approach channel for 2-4 hours every 1.5-2.0 days would impose excessive economic hardship on other shipping activities.

h. Ocean or river currents should not be excessively strong (i.e., currents or 2.5 knots would be undesirable and currents approaching 5 knots would be unacceptable).

i. Areas frequently experiencing limited visibility from excessive periods of fog should be avoided.

j. Formation of sheet ice and floating ice in the approach channel should be minimal so as not to prevent the safe and economical year-round operation of the LNG carriers.

4. Suitable Land Use Conditions

a. A minimum of 100 acres of land should be available for the LNG storage and gasification facilities. Additional land (300 - 1,000 acre site) to serve as a "buffer zone" would be highly desirable, particularly in populated areas, and room for future expansion.

b. Potentially conflicting land uses (e.g., state highways, gunnery/bombing ranges, offshore oil/gas wells and pipelines) should be avoided.

c. A minimum of 400-500 feet of shoreline frontage should be present to allow for the construction of two ship berths located perpendicular to the shoreline.

d. The ship berth and the LNG storage tanks should not be more than 2.5 miles apart to reduce both costs and regasification problems that could arise with a longer cryogenic transfer line. The site should not require construction of underwater cryogenic pipelines.

e. Nature of adjoining area - The site should preferably be located in either a relatively undeveloped area or an industrial area to minimize disruption to local land use. The site should not be located immediately adjacent to a recreational area, such as a state or national park, where its visual impact would be disruptive.

f. Compliance with local zoning requirements and plans - The proposed use of a site should not, if possible, conflict with local zoning requirements or comprehensive plans.

5. Factors Affecting Safety

A. Shipping Accidents

a.	Length of approach channel	The approach channel to the berth should be as short as possible to minimize the risk of accidents.
b.	Channel and berth depth	The approach channel and berth should be at least 40 ft. deep and preferably deeper to minimize the possibility of grounding.
c.	Channel width	The approach channel should be at least 450 ft. wide and preferably wider to minimize the danger of ship accidents
d.	Bottom conditions	The bottom of the approach channel should be relatively stable, and the anchorage should provide good holding power.
e.	Configurations of approach channel	The approach channel to the berth should be relatively wide and straight, requiring only relatively few and gradual turns.
f.	Adequacy of charting	Relatively recent and detailed navigational charts should be available for the area.

g.	Hazards or obstructions	The approach channel should be free from obstructions, (such as bridges, shoal areas, rocks, and ledges), or such hazards should be removable without excessive expense.
h.	Ship traffic volume near berth, turning basin, and anchorage	The LNG tanker berth, turning basins, and anchorages should be located away from areas currently having a large amount of ship traffic to minimize the possibility of collisions or accidents.
i.	Navigation aids	The shoreline in the vicinity of the site should have or be capable of being marked with navigation aids (e.g. lighthouses).

B. Accident at Land Facilities

a.	Ground movement conditions	The site should be located in an area with a low degree of seismic risk and shall not be located on or adjacent to an active fault. The soils and bedrock at the site should not be unstable in the event of seismic activity or present a risk of subsidence.
b.	Exposure to storm tides and floods	The site should be located well above the elevation of water resulting from major storm tides or river floods.
c.	Proximity of airports	The site should not be located near a major airport to prevent danger of airplane collision with a tank.
d.	Cryogenic pipelines	Overhead cryogenic pipelines crossing major public roads and highways pose an unnecessary risk. Cryogenic lines in tunnel-like structures under major public roads, highways, and railroad tracks are acceptable, although not desirable. An overhead cryogenic line crossing a railroad track would require a specialized containment system.

6. Consequences of Accidents [1/]

a.	Exposure of surrounding population to land facility	A minimum number of houses or other actively used land parcels located immediately adjacent to the site (within 1,000 ft.) would be desirable. The present and projected population density within the general area of the site should be low.

1/ These criteria are intended to identify the number of people and facilities potentially exposed in the event of an LNG accident. These criteria cannot and have not been used by themselves to accept or reject any potential site. A detailed risk analysis would be necessary prior to such a conclusion. However, failure to meet these criteria would serve as a notice that a potential safety conflict could arise at a particular site.

b.	Exposure of population around tanker route	The present and projected population density along the tanker route should be low.
c.	Proximity of incompatible facilities	No industrial facilities creating a significant risk of explosions, fires, or accidents should be located in the vicinity of the proposed site.
d.	Availability of fire-fighting equipment	The site should be easily accessible to local fire-fighting equipment and personnel in case accidents occur.

7. Factors Affecting System Outage (because of delayed offloading of LNG carriers)

a.	Exposure to waves	The berth should be protected from long exposed fetches in the direction of prevailing waves.
b.	Exposure to winds	The approach channel and berth should have minimal exposure to strong winds. (Winds greater than 30 mph, 2/ which would hamper ship offloading, should have a low frequency of occurrence.)
c.	Visibility	The berth and approach channel should have good visibility conditions (or high numbers of days with visibility of 2 miles or better). 3/
d.	Electrical storm frequency	The site should have a low frequency of electrical storms. (U.S. Coast Guard does not allow unloading under those conditions.)
e.	Ship transit time	The site should not require enough additional transit time that either an additional LNG tanker or significant additional steaming time would be required.

8. Environmental Impact (including economic cost)

A. Physical Impact

a.	Topographic and soil conditions	The site should not require significant preparation such as cutting and filling, blasting, and removal and disposal of excess overburden. The slope of the site should be minimal to avoid the need for additional booster pumps and appurtenant equipment, but should still permit adequate site drainage. If bedrock is present, it should be at a sufficient depth to avoid interference with preconstruction site preparation. The site should not have highly erodible soils.

2/ Oceanographic Institute of Washington, Alternative Sites for LNG Facilities in the Cook Inlet/Kenai Peninsula, Alaska Area, Seattle, U.S. Department of Commerce, National Technical Information Service, PB-251269, October 1975.

3/ The 2-mile visibility threshold is based on current U.S. Coast Guard operating procedures for the existing LNG receiving terminal at Everett, Massachusetts, that require these conditions before an LNG tanker is allowed to enter the harbor. (See U.S. Coast Guard, Captain of the Port's Office, Boston, Massachusetts, Operating Procedures for Distrigas LNG Receiving Terminal, October 1975.)

b.	Dredging volume and disposal	The site should not require substantial initial or maintenance dredging or blasting. A suitable location for disposal of dredge spoils from the approach channel and berth should be available.
c.	Lost resources	The site should not require construction activities that preempt use of a scarce resource (e.g., mineral deposits or prime agricultural land).
d.	Pipeline construction distance	The site should require relatively little gas pipeline construction to minimize economic cost and ecological disturbance along the pipeline right-of-way during and after construction; in particular, long underwater crossings in deep-water areas should be avoided.

B. Biological Impact--Terrestrial

a.	Ecological value of site	The site should not require construction on valuable vegetation areas such as wetlands or prime wildlife habitat.
b.	Threatened or endangered species	The site should not be part of the habitat of a federally designated threatened or endangered species.
c.	Critical environmental areas	The site should not be located on an environmentally critical area designated during state or regional planning.

C. Biological Impact--Aquatic

a.	Aquatic species vulnerability	The site should not be located so that required water withdrawals or dredging activities would disrupt valuable aquatic habitats.
b.	Seawater exchange system	Where possible, the site should allow use of a seawater exchange system between the LNG facility and power plant. 1/
c.	Critical environmental areas	Construction and operation of the marine terminal should not disturb water areas designated environmentally critical during state or regional planning.

1/ The potential for a seawater exchange system on the west coast was given considerable weight in the final site selection process.

Corporation (Intersea) was previously contracted by the FPC to conduct a study of alternate LNG terminal sites on the west coast of the contiguous United States. Intersea examined a total of 47 potential sites, of which 7 were previously identified by the applicant in its filing to the FPC. Twenty-five other sites identified by the staff, the CPUC, the California Coastal Commission, and others were also evaluated.

A initial list of 72 potential locations along the western coast of the United States was compiled. (See table 53 and figures 45 to 48.) Obvious conditions such as high percentage of facility downtime caused by weather, restrictive water depths, navigation hazards, limited availability of land, or unsuitable topography eliminated 31 of the locations. The remaining 41 sites were studied for factors which might limit the development of an LNG facility. This examination revealed that 37 of the 41 sites are not desirable for development (table 54).

d) Analysis of Retained Sites

The four potential sites acceptable according to the initial rating system include Rattlesnake Canyon, Dos Pueblos Ranch at Los Varas, Naples, and Oxnard. The Point Conception site which was rejected solely for seismic criterion is retained for comparison purposes. The locations of these sites are illustrated in figures 49 to 52.

Each site has been subjected to (1) an in-depth analysis of the pertinent physical characteristics of each site, (2) an assessment of which site more closely correlates with the physical requirements of the project and the established criteria, and (3) a detailed environmental analysis to determine the diversity and sensitivity of ecosystems and populations within the site area and the relative magnitudes of impact that could result from project development at each of the five sites. The following sections present the results of the staff's evaluation of each alternative site. The environmental impact of locating an LNG terminal at Oxnard has been analyzed in detail in the staff's Pacific Indonesia Project: Final Environmental Impact Statement, December 1976. A summary of this material is included below.

TABLE 53

INITIAL SITES SELECTED FOR POTENTIAL LNG FACILITIES ALONG THE WEST COAST OF THE U.S.

(Latitude)

Washington

Strait of Juan de Fuca/Puget Sound - Port Angeles (48°10')
2 Grays Harbor (47°00')

Oregon

Columbia River (46°10')
1 Necanicum River (46°00')
1 Tillamook Head (45°56') to Yaquina Bay (44°37')
1 Yaquina Bay to Umpqua River (43°40') - Newport (44°37')
2 Coos Bay (43°20')
1 Cape Arago (43°18') to Coquille Point (43°05')
1 Port Orford (42°45')
1 Sisters Rocks (42°36') to Cape Sebastian (42°20')
1 Chetco River (42°02')

California

1 Pelican Bay (41°51')
1 Crescent City (41°45')
1 Klamath River (41°32')
1 Trinidad Head (41°05')
2 Humboldt Bay (40°45')
1 Pt. Delgada (Shelter Cove) (40°00')
1 Ten Mile River Beach (39°30')
1 Pt. Arena (39°00')
1 Jenner (38°27')
1 Bodega Bay (38°15')
1 Pt. Reyes (38°00')
San Francisco Bay - Hunters Point (37°44')
1 Pacifica (37°38')
1 Pt. Montara (37°32') to San Gregorio (37°20') including Half Moon Bay (37°30')
1 Pigeon Pt. (37°11')
1 Pt. Ano Nuevo (37°07')
Davenport (37°02')
3 Santa Cruz (36°57')
1 Moss Landing (36°49')
Piedras Blancas/San Simeon Point (35°36')

---

1 Open coast sites where operations would be severely limited by waves.

2 Navigation and water depth restrictions.

3 Marginal land available or/and topographically unsuitable

TABLE 53 (contin

California (continued)

Cayucos (35°30')
Estero Bay (35°26')
Point Buchon (35°13')
Rattlesnake Canyon (35°11')
Port San Luis (35°10')
San Luis Obispo Bay (35°10')
Guadalupe Dunes (two sites)
Oso Flaco Lake (35°02')
Mussel Point (34°56')
Point Sal (34°55') (34°56')
Vandenberg AFB (34°43')
Point Arguello (34°34')
Government Point (34°31')
Point Conception (34°30')
Drake (34°28')
Gaviota (34°27')
Tajiguas (34°27')
Corral Canyon (34°27')
Naples/Dos Pueblos (34°26')
Toro Creek (34° 26')
Rincon Point (34°26')
Oxnard (24°08')
Port Hueneme (34° 08')
Point Mugu (34°06')
Deer Canyon (34°04')
El Segundo (33°55')
L. A. Harbor (33°45')
3 Long Beach Harbor (33°40')
3 Huntington Beach (33°37')
3 Dana Point (33°27')
San Onofre (33°22')
Camp Pendleton (33°19') (2 sites)
Carlsbad (33°08') (2 sites)
2/3 San Diego Bay (32°40')
Border Field (32°35')
4 Channel Islands (Santa Rosa, Santa Cruz)

---

1 Open coast sites where operations would be severely limited by waves.

2 Navigation and water depth restrictions.

3 Marginal land available or/and topographically unsuitable.

4 Water depth too great for transmission pipeline routing to mainland.

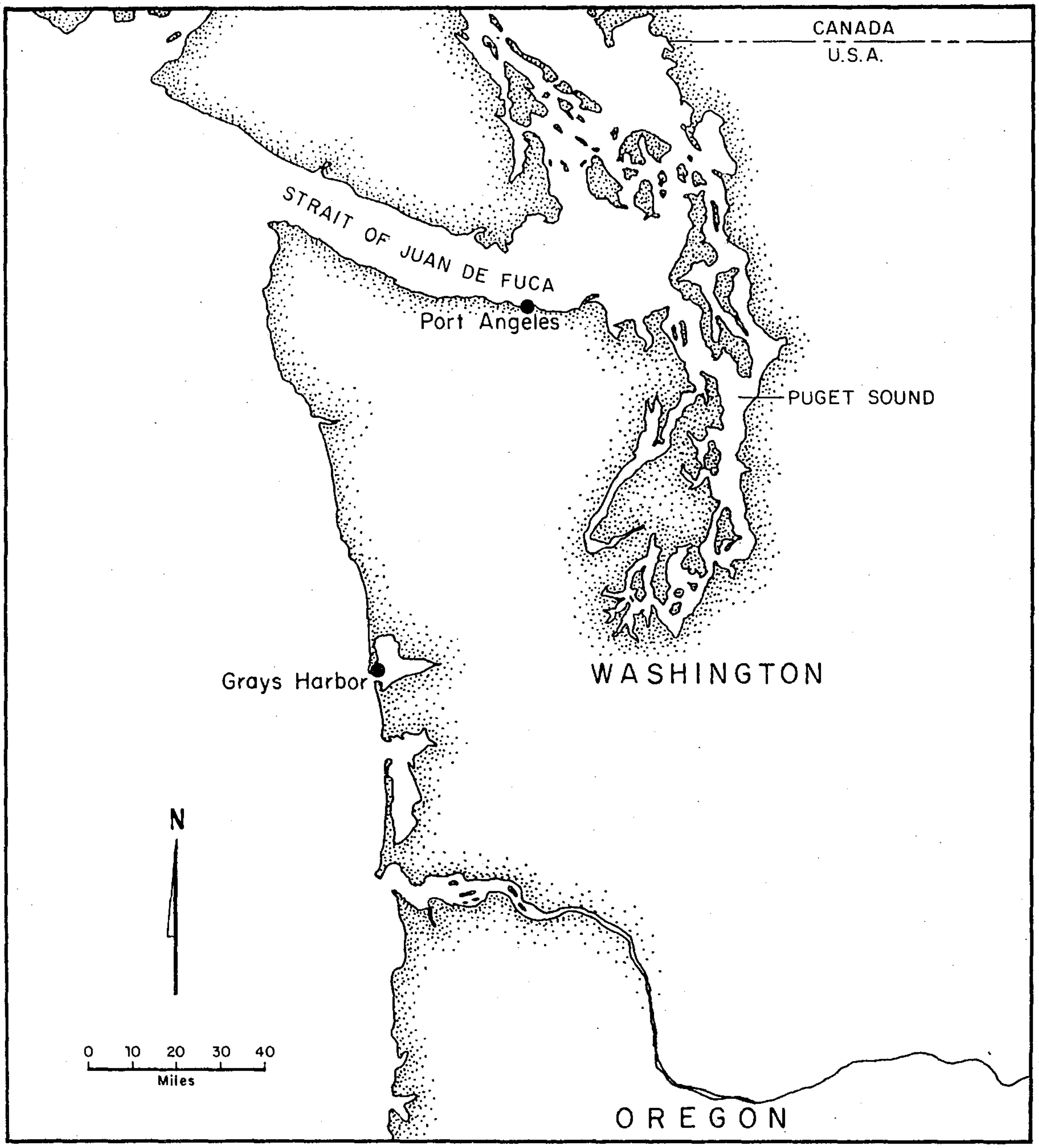


Figure 45: Initial Sites in Washington

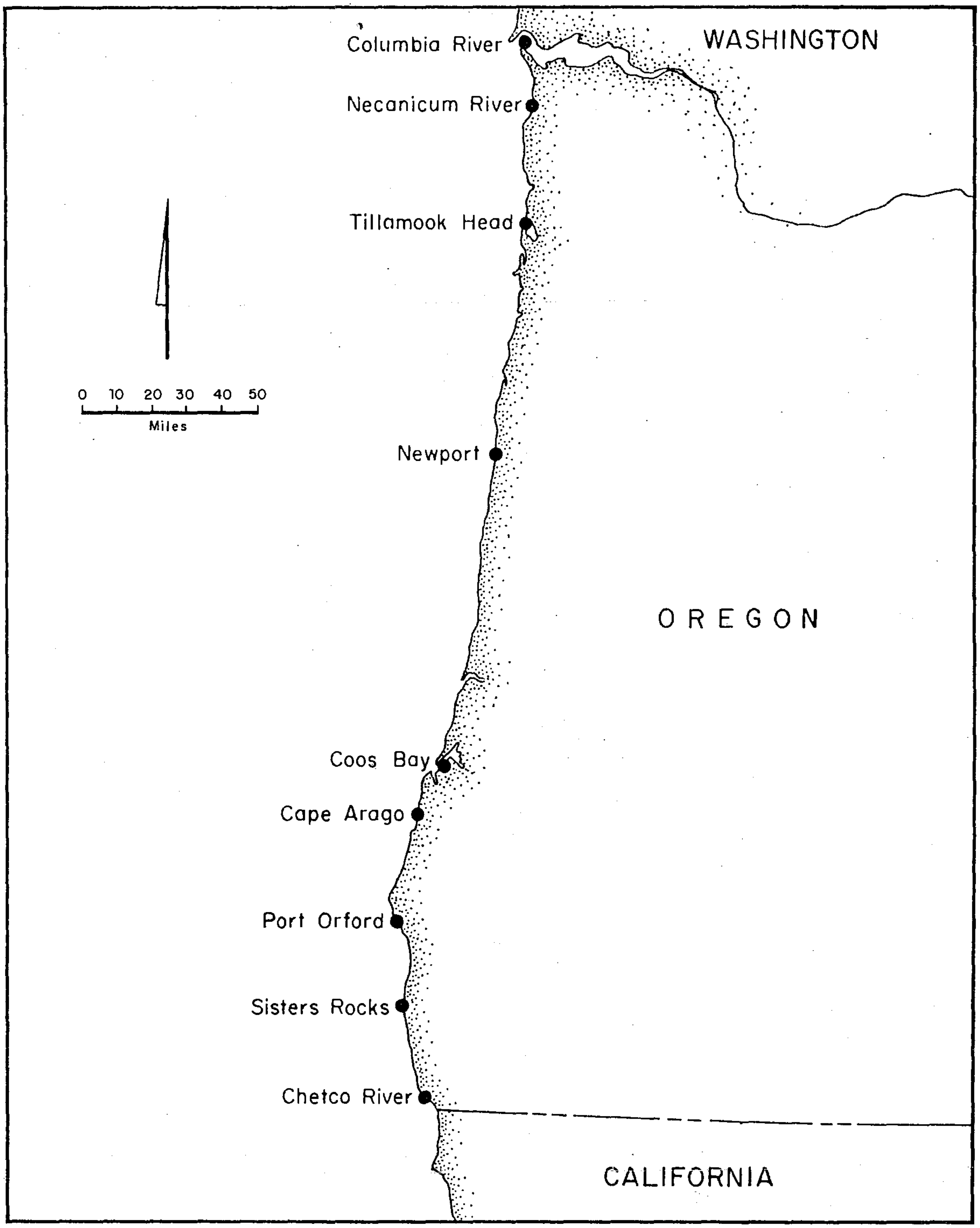


Figure 46: Initial Sites in Oregon

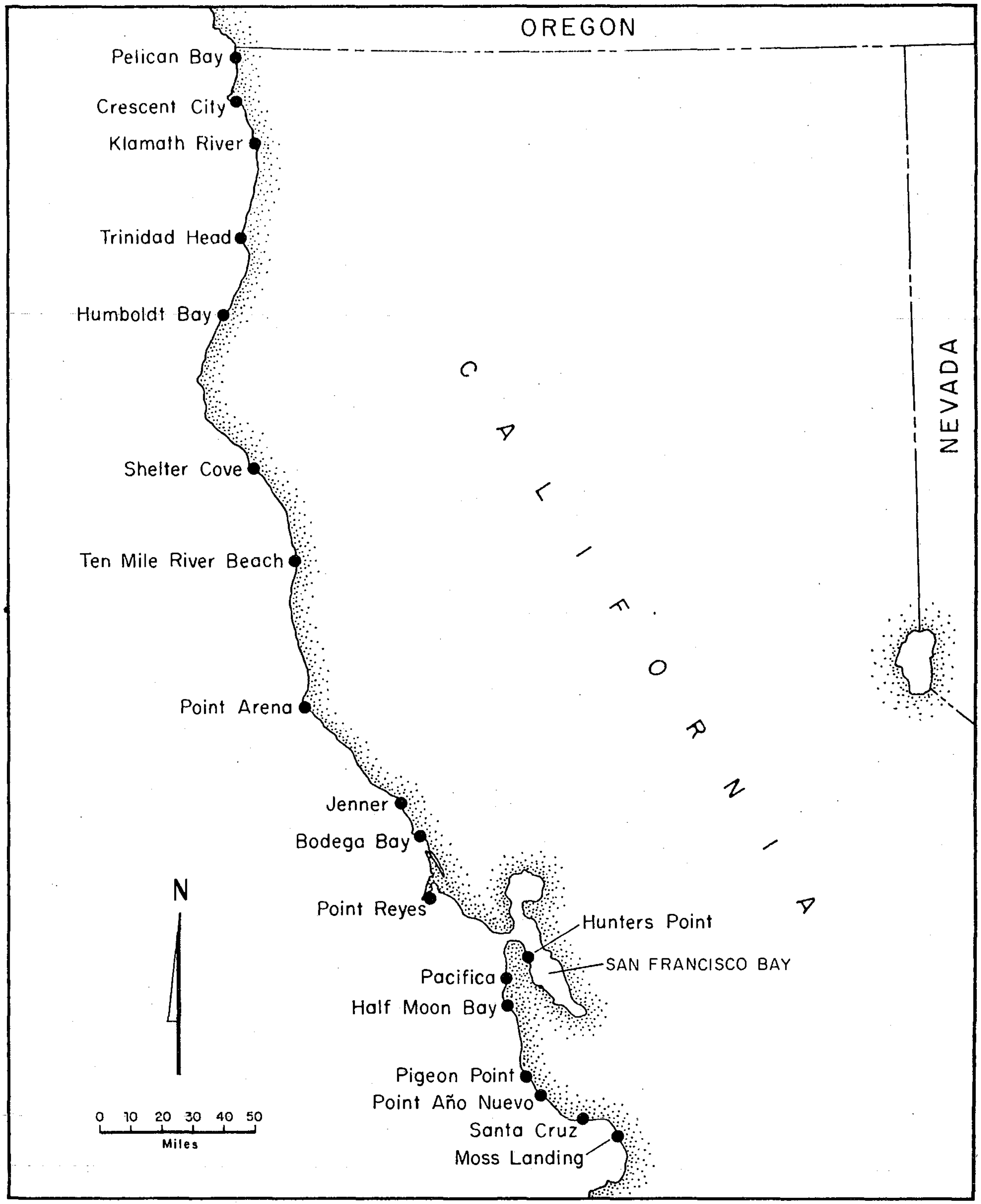


Figure 47: Initial Sites in Northern California

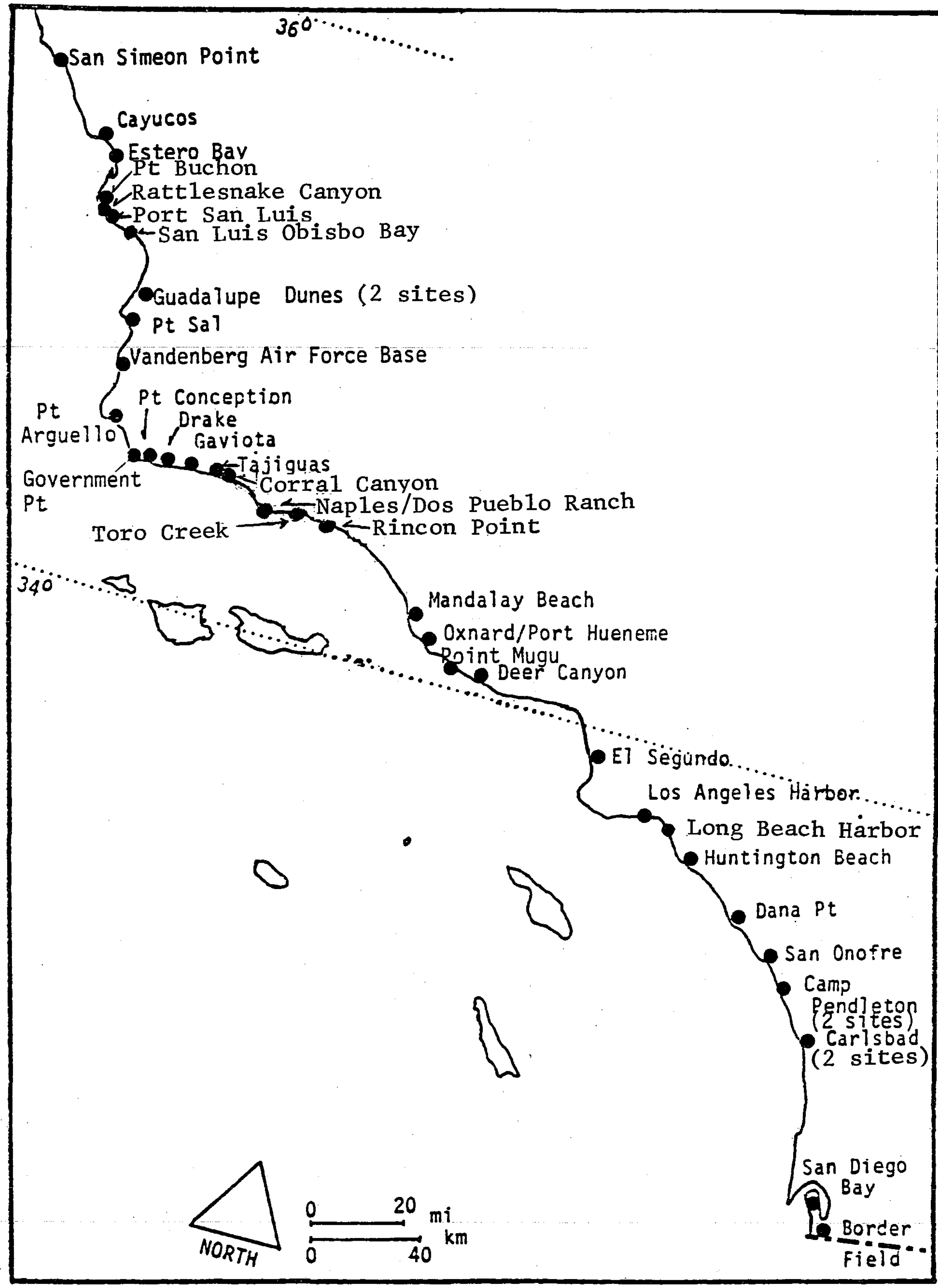


Figure 48: Initial Sites in Southern California

TABLE 54

POTENTIAL LNG SITES REMAINING AFTER INITIAL ELIMINATION PROCESS

Site (Latitude)	Comments
Port Angeles (48°10')	Extensive amount of pipeline connecting other states would be required. Could be developed with sufficient lead time. Rejected as serious alternative.
Columbia River (46°10')	Possible flooding and limited area of required water depth to handle large number of LNG cargo ships. Same pipeline problems as Port Angeles. Rejected as serious alternative.
Hunters Point (37°44')	Presently inactive Navy shipyard which is regarded as important resource in event of national emergency. Without converting shipyard facilities, there may be insufficient land available; some land of marginal foundation conditions. Industrial development at Hunters Point or any other locations in San Francisco Bay would involve lengthy negotions with local governmental agencies; subject to strict local regulations; would be controversial and time consuming with no reasonable certainty of concluding a satisfactory negotiation for LNG facility. Rejected as serious alternative.
Davenport (37°02') (3 sites)	Severe sea conditions. Cryogenic pipeline would cross State Highway 1, a major disadvantage. The San Gregorio Fault, active by California's 11,000-year standard, passes through or close to the sites. Rejected as serious alternative.
Piedras Blancas-San Simeon Point (35°36')	Between these two points is an area of high scenic quality. San Simeon is a state historical resource area. The Piedras-Blancas-Arroyo de la Cruz area is one of botanical significance. Most sites would probably be visible from Hearst Castle, a major tourist attraction. The Hosgri Fault, active by California's 11,000-year standard, runs along the coast close by and would affect almost any site located in this area. Rejected as serious alternative.
Cayucos (25°30')	Severe sea conditions. Cryogenic pipeline would cross State Highway 1, a major disadvantage. Would require moderate site preparation. Shoreline part of the sea otter refuge. Rejected as serious alternative.
Estero Bay (35°20')	Standard Oil Company of California presently has active refinery in the area. Weather downtime at LNG terminal would be fairly high but possibly not prohibitive. Land available for LNG facility is presently used for primitive tourist facilities; negotiations would be controversial and time consuming. Rejected as serious alternative.
Point Buchon (35°13')	Weather downtime would be high but could be mitigated. A sensitive marine biological environment. Adjoins Montana de Oro State Park and Beach. Numerous outlying rocks/submerged ledges could pose navigational hazards. Rejected as serious alternative.
Rattlesnake Canyon (35°11') (near Diablo Canyon)	Weather downtime would be high but could be mitigated. Numerous outlying rocks and reefs nearshore could pose navigational hazards. Site consists of 200 acres of level coastal terrace and is well enclosed by adjacent ridges and mountains which could serve as natural containment features and mitigate aesthetic problems. Cryogenic line would not have to cross any major highway or railroad. Land may soon be obtained by PG&E, a major advantage. Site is 4 miles south of the PG&E Diablo Canyon Nuclear Power Plant. The CCC has retained this site (and staff agrees) for further study.

TABLE 54 (con't.)

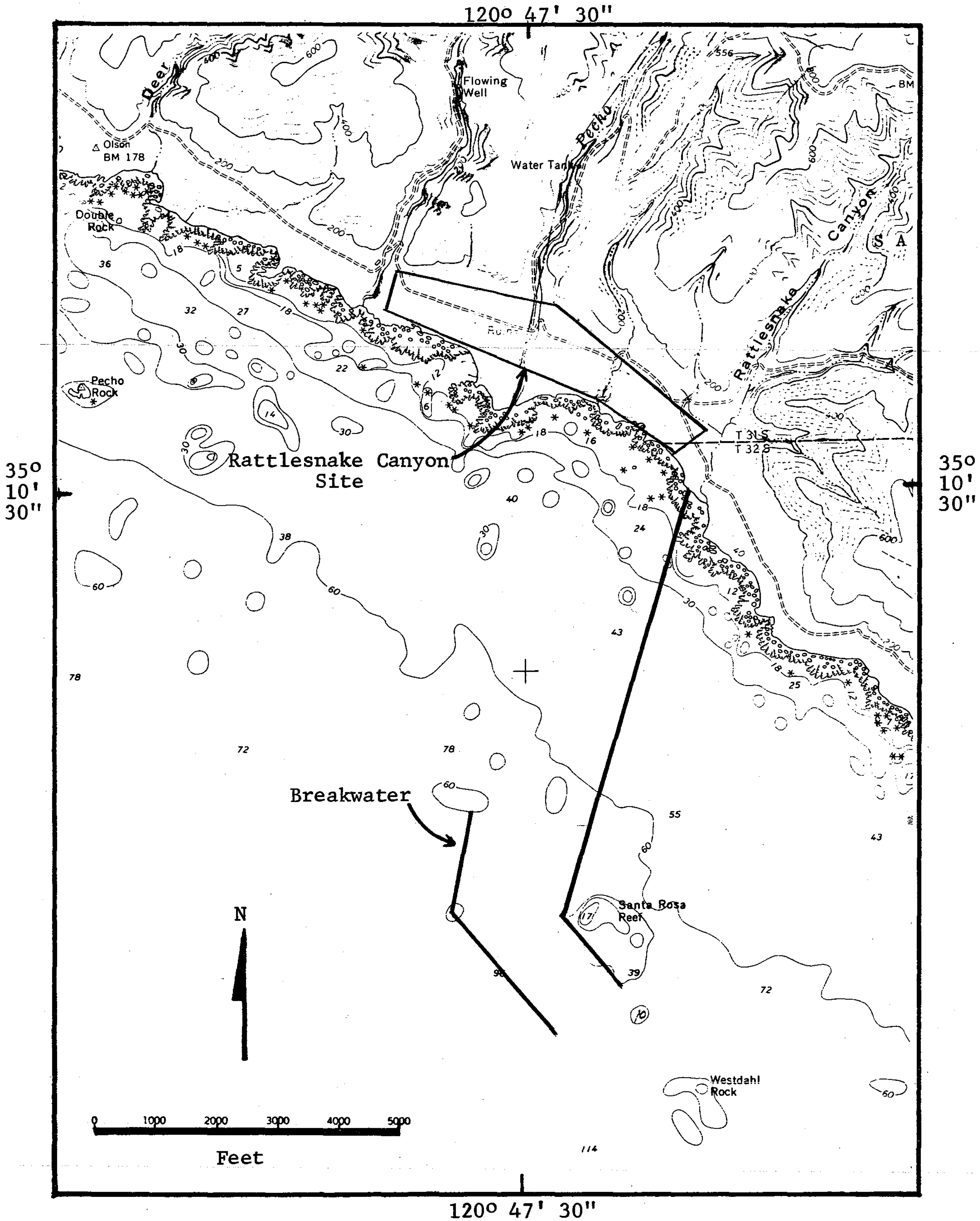
Site (Latitude)	Comments
Port San Luis (35°10')	Site would have to be created by an extensive landfill--exceeding 6 million cubic yards--requiring considerable costs and environmental impact. Heavy swell conditions. Numerous outlying rocks/submerged ledges could pose navigational hazards. Rejected as serious alternative.
San Luis Obisbo Bay (35°10')	Weather downtime higher than Estero Bay and possibly prohibitive; tsunamis could be problem. Land available presently used for tourist facilities; negotiations would be controversial and time consuming. Rejected as serious alternative.
Guadalupe Dunes (2 sites): Oso Flaco Lake (35°02') Mussel Point (34°56')	Both sites have major drawbacks because of heavy recreational use of the surrounding beach and lake area. Considered by the California Department of Fish and Game as "The largest and most beautiful coastal dune-lagoon complex in California." Aesthetic impact would be severe. The Oso Flaco Lake site would require a cryogenic transfer line over 3 miles long. The Mussel Point Site would offer a poor foundation for LNG facilities. The CPUC has retained the Dunes Area for further study as an LNG site. The CCC has not. Both sites should be rejected as serious alternatives.
Point Sal	On isolated corner of Vandenberg Air Force Basin property. Air Force operations involve missile and space shuttle testing that present risks. Location on Air Force property seen as an institutional control which could render the site unavailable. Rejected as serious alternative.
Vandenberg Air Force Base	See Point Sal.
Point Arguello	Site lies within Pacific Missile Range. Ship traffic would be within the restricted military area which extends from 3.5 miles south of Point Arguello north to Point Sal. Rejected as serious alternative.
Government Point (34°31')/ Point Conception (34°30')/ Drake (34°28')	The three sites are all close to one another and therefore have characteristics similar to the proposed Point Conception site. Since the issuance of staff's DEIS, the Point Conception site has been found to contain a fault which is active. Therefore, the staff finds the site to be unacceptable. The CCC also would have eliminated this site for seismic reasons but retained the site solely because the Liquefied Natural Gas Terminal Act required the CCC to rank the site. The proposed Point Conception site is, however, retained solely for comparison.
Gaviota (34°27')	Marginal space to develop LNG facility; only available area would meet with extreme controversy. Entire area designated as open space by County of Santa Barbara and CCC. Rejected as serious alternative.
Tajiguas (34°27')	Cryogenic pipeline would cross U.S. Highway 101. Agricultural land. Marine Biological Environment and sea conditions similar to those at Point Conception. Existing commune would require relocation. Extensive site preparation would be required. The CPUC has retained this site for further study. The CCC has not. The site should be rejected as a serious alternative.
Corral Canyon (34°27')	Extensive site preparation would be required. Cryogenic line would cross U.S. Highway 101, a railroad, an oilfield, and would have to rise 200 feet above sea level. The trestle would be located between two state beach parks. Rejected as serious alternative.

TABLE 54 (con't.)

Site (Latitude)	Comments
Naples/Dos Pueblos Ranch at Los Varas Canyon (34°26')	There are several possible site configurations in this area. The site group experiences a weaker wind and sea regime than the Point Conception site. Visibility and current conditions about the same as at Point Conception. Area consists of a wide, level to rolling coastal terrace presently used for grazing and orchard crops. Cryogenic lines would not have to cross U.S. Highway 101 and possibly not the railroad. No immediate population. The Dos Pueblos Ranch site, since issuance of staff's DEIS, has been found by the CCC to contain a minor but active fault. However, there is no basis given by the CCC on how this determination of activity was arrived at. Thus, it cannot be categorically stated at this time whether the fault on the Dos Pueblos Ranch site is active. Further research would be needed to study this fault to determine the desirability of a site at either Dos Pueblos Ranch or Naples. The CCC did not specifically study the Naples site but retained the Dos Pueblos Ranch site at Los Varas Canyon for further study. Both sites retained for further study.
Toro Creek (34°26')	There is not a defined site here, but land may be available west of Toro Canyon Road. A long trestle and cryogenic line would be necessary and a crossing of the railroad and U.S. Highway 101. Seaward of the site is Leon Point, which is subdivided into large, exclusive beachfront home properties. Rejected as serious alternative.
Rincon Point (34°26')	There is not a defined site here. The only possible site is inland of U.S. Highway 101 in an agricultural area bordered by a small industrial park and a private airport. A site here would require moderate preparation. A long trestle and cryogenic line would be necessary and a crossing of the railroad and U.S. Highway 101. Rejected as serious alternative.
Mandalay Beach (34°12')	Continental shelf relatively flat over 1 mile offshore to desired water depth. Area seismically active; possibly prone to liquefaction. Ecologically appealing with nearby power plant, although CCC does not share this viewpoint for this specific power plant. Cryogenic pipeline would cross Harbor Blvd. Site at end of Ventura County Airport. Intensive development adjacent to site. Rejected as serious alternative.
Oxnard (34°08')	Near Pacific Missile Range; area seismically active but less so than sites directly north. Excellent land use compatibility. Seawater exchange potential with nearby power plant is appealing. Previously studied in an FPC final environmental impact statement. Site previously recommended by FPC and Department of Energy for LNG site development. The CPUC has retained this site for further study. The CCC has not. Selected by staff as alternative for further study.
Port Hueneme (34°08')	Initial concept involved questionable 2-mile long subsurface cryogenic transfer line. Land site would be suitable for future expansion of Oxnard facility. Rejected offshore facility; accepted land facility as option to Oxnard.
Point Mugu (34°06')	Immediately adjacent to the Navy's Pacific Missile Range. Cryogenic line could be lengthy. Preliminary communications with Navy expressed an extremely negative viewpoint to placement of an LNG facility in this area. Rejected as serious alternative.
Deer Canyon (34°04')	Site extremely constrained by topography. Ridges of canyon reach 700 feet elevation within 1,500 feet of the beach and extend 1,500 feet in elevation at the inland end of the canyon. Creating such a site in this area would require movement of approximately 25 million cubic yards of cut and fill, primarily rock. There is flash flood potential at this site because of the topography; average slope exceeds 60 percent. Cryogenic line would cross State Highway 1. The rocky coast is designated as an Area of Special Biological Significance by the State Water Resources Control Board. Site reportedly has significant cultural resources. Rejected as serious alternative.

TABLE 54 (con't.)

Site (Latitude)	Comments
El Segundo (33°55')	Heavily industrialized area; many oil refineries in the immediate vicinity Only land available could cause long subsurface cryogenic pipeline outside site boundary parallel to and under major streets. Distance to pump seawater without upsetting ecosystem marginal. Near large population center. Rejected as serious alternative.
Los Angeles Harbor (33°45')	Industrialized area; near large population center. Much ship traffic in area. Previous staff risk analysis identified that the risks to the public from proposed LNG shipping operations would, in staff's opinion, be unacceptable. Terrestrial biological impact minimal. Excellent pipeline routing. Site is located on a fault with known activity. Potential exists for generation of large vertical and horizontal displacements on the Palos Verdes Hills fault which could threaten the structural integrity of the plant facilities. Rejected as serious alternative.
San Onofre (33°22')	Near nuclear generating station; land presently part of Camp Pendleton and could be obtained through proper channels. Navigation would be have to be coordinated with offshore maneuvers of U.S. Marines. Offloading facility about 1 mile offshore. Low nearby population density. Pipeline routing and topographic factors good. While ecologically beneficial due to nearby power plant, the proximity to the nuclear station raises serious safety questions. The Nuclear Regulatory Commission has previously stated that the risk to the safety of the San Onofre Nuclear Generating Station from the proximity of an LNG terminal would exceed NRC criteria. Rejected as serious alternative.
Camp Pendleton (33°19') (2 sites)	The two sites are close to each other but on opposite sides of U.S. Highway 101. The site seaward of the highway is ample for the facilities but rather small for a buffer zone. Significant aesthetic impact on motorists along Interstate 5 would result. Both sites are on land presently part of Camp Pendleton. Use of the site's beach area would conflict with its present use for major Marine Corps and Navy Amphibious Assault Training Exercises. Unexploded ordinance in the training areas could exist. A marine trestle 9,000 feet long would be required, as well as a somewhat longer cryogenic line. Shipping distances from both Indonesia and Alaska would be considerably farther. The flexibility of shipping LNG in two ships from Alaska would be considerably tighter, although not prohibitive. Both the CPUC and CCC have retained this site for further study, although the CCC notes that the site may not meet the population requirements of the California LNG Terminal Act of 1977. The staff, however, feels that there would probably be significant institutional problems in obtaining the site, since it is controlled by the Federal Government. Its availability for a terminal is extremely uncertain. The Navy, owners of the land, expressed an extremely negative viewpoint of an LNG facility in this area. (See appendix T.) For these and the previously stated reasons, the staff has rejected these sites as serious alternatives.
Carlsbad (33°08') (2 sites)	Two possible onshore locations using same marine facility. The inland site would create long cryogenic pipeline and seawater exchange system that probably would be prohibitive. The lagoon site is a nesting area for the endangered least tern; all lagoon development opposed to California Coastal Commission Plan. LNG facility would conflict with present Master Plan of Carlsbad. Much residential development now occurring in lagoon area. Rejected as suitable alternative.
Border Field (32°35')	Near Tijuana Slough, an area set aside by San Diego as a natural preserve; many rare or endangered species frequent. Development of the slough as recreation area has been rejected by local agencies. Cryogenic pipeline traversing Border Field State Park would be extremely controversial. Rejected as suitable alternative.



335 Figure 49: Location of Alternative LNG Site at Rattlesnake Canyon, California

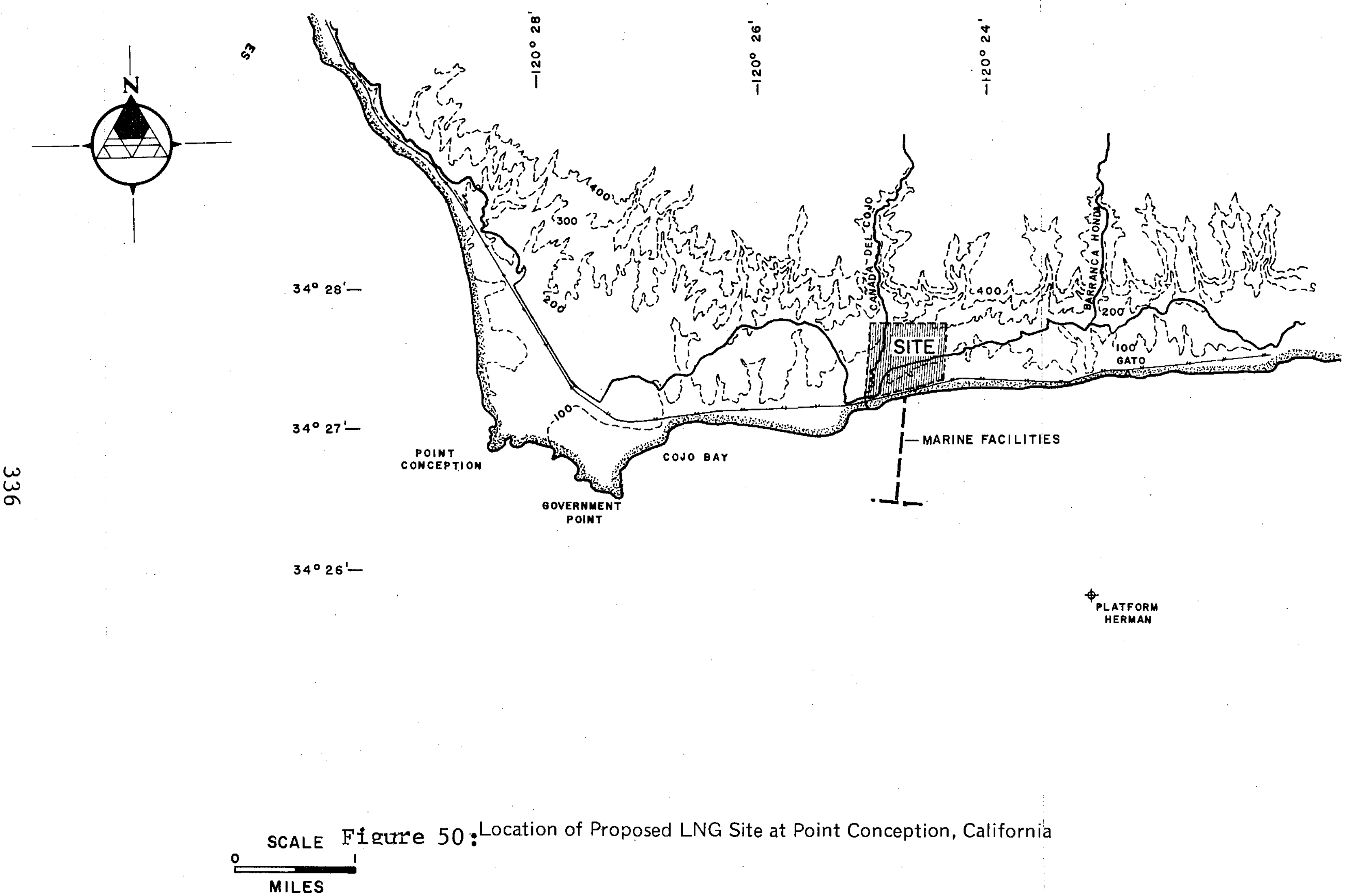


Figure 50: Location of Proposed LNG Site at Point Conception, California

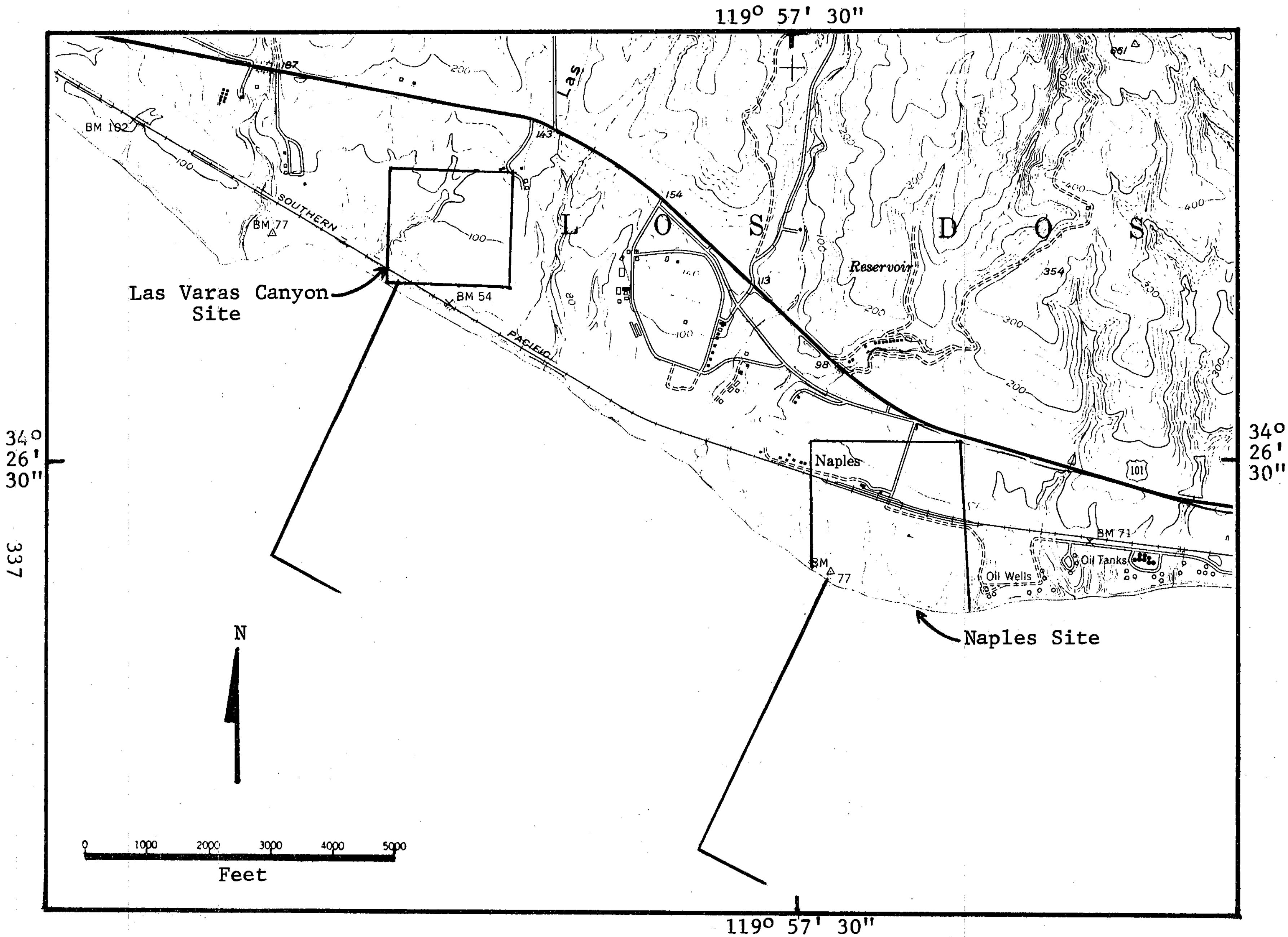


Figure 51: Location of Alternative LNG Sites in Dos Pueblos Ranch Area, California

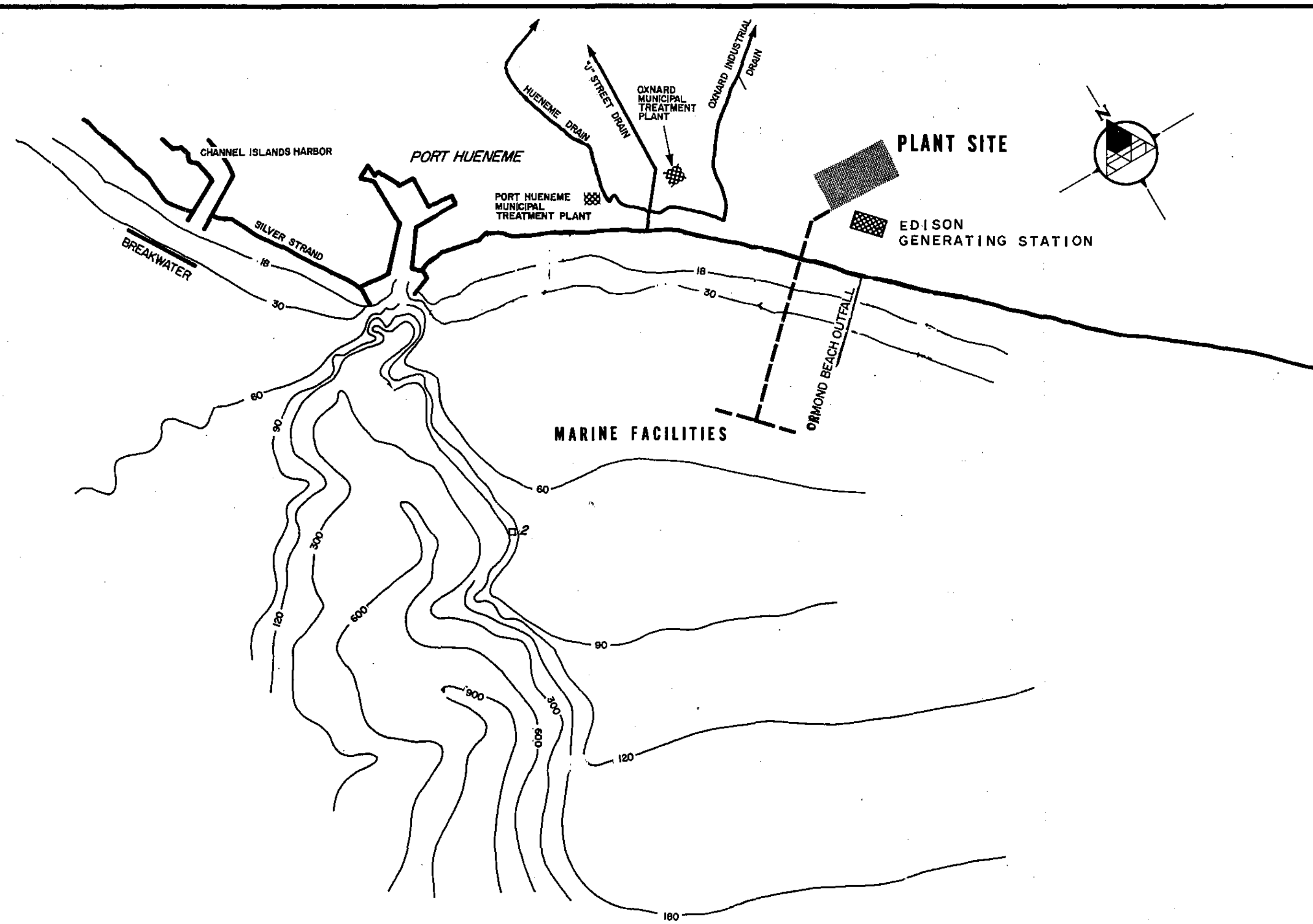


Figure 52: Location of Alternative LNG Site at Oxnard, California

DEPTH IN FEET

0 1/2 1

SCALE IN NAUTICAL MILES

i. Rattlesnake Canyon

Topography and Geology

This site, on a coastal terrace at an elevation of 80 to 100 feet, is bounded on the northwest and southeast by Vineyard and Rattlesnake Canyons, respectively, and on the northeast by the access road to the Diablo Canyon Nuclear Power Plant. Pecho Creek bisects the site, which is approximately a mile long and 1,500 feet wide. The bluff upon which the terrace deposits are situated varies from 40 to 80 feet in height above a narrow rocky beach. More detail on foundation conditions would be necessary to fully understand them; however, there is expected to be very little difference between the terrace deposits at this site and at Point Conception.

By and large, this site is more level than Point Conception and would require less site preparation. However, it is split into three sections by two streams which pass through it, so extensive filling of gullies on the southeast end of the site would be required before that portion could be used. Flooding could be a problem if the existing drainages were blocked with no provision for continual flow. Several landslides have been identified at the extreme southeastern end of the site and their presence would complicate the use of this portion. However, sufficient space is available elsewhere on the site so that no important facilities need be placed near the slides. Only the terrace deposits are involved in slides; the bedrock is stable.

The Hosgri fault, an active fault capable of a magnitude 7.5 earthquake, passes about 3.5 miles offshore. Hazard from seismic events at the Rattlesnake Canyon site would appear to be similar to that for the Point Conception site, if no onsite fault had been discovered.

Water depths of 60 feet are encountered about 4,000 feet offshore, but many shoal areas are present beyond this. A substantial breakwater would be required because of oceanographic conditions which are more severe than at Point Conception. No significant sand beaches exist in the immediate area, but the breakwaters would affect whatever longshore sediment transport exists.

Soils

The Rattlesnake Canyon site is located on a gently sloping (2 to 9 percent) marine terrace and is occupied by two soils, Still gravelly sandy clay loam and Conception loam. The Still series covers approximately 25 percent of the site and is underlain by a stratified gravelly clay loam. The Conception series has a clay subsoil and a sandy clay loam substratum. The site is moderately well to well drained, although permeability is low. Runoff is slow to medium, and the hazard of erosion slight.

Still soils have moderate limitations for road construction and building sites. Conception soils, because of their ability to shrink and swell and their low strength, have more severe limitations. They would be difficult to pack on embankments and require more consideration in foundation design.

Soil characteristics on this site area are similar to those at Point Conception. However, the greater relief at Point Conception would require more extensive site preparation.

Hydrology

Domestic water supplies in the area are obtained principally from local reservoirs. Groundwater is not an important resource in the area of the site. Anticipated adverse impact of constructing and operating an LNG facility at this site would result primarily from terrain modification and potential increases in erosion and sedimentation.

Oceanography

As depicted in figure 53, the overwhelming majority of the wave energy incident to the California coast comes from the northwest quadrant of the compass. The Rattlesnake Canyon site, north of Point Conception, does not have the same protection from waves from the northwest and would experience 6 feet or greater wave heights on an annual average about 25 percent of the time. Studies performed by the U.S. Army Engineer Waterways Experiment Station and John J. McMullen, Associates, Inc. (McMullen) both indicate that a substantial breakwater would be required to mitigate the relatively high wave- and swell-caused berth downtime projected for the Rattlesnake Canyon site. For example, it has been estimated that without a breakwater the total amount of downtime due to waves, swells, winds, visibility, and currents would be about 190 days per year. The total amount of downtime with

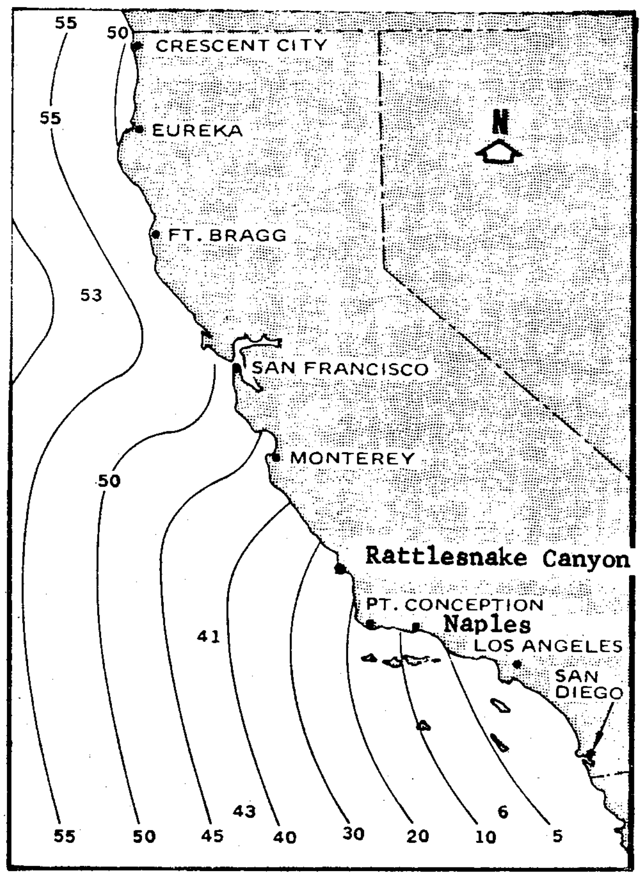


Figure 53: Average Annual Percentage Frequency of Wave Heights(H_s)_Six Feet Off the California Coast

a breakwater would be reduced to between 18 and 21 percent downtime per year. The CPUC estimate for Point Conception is less than 17 percent downtime per year. McMullen reports that with a breakwater of proper design, and removal or adequate working of hazards to navigation in the vicinity, Rattlesnake Canyon can be made a feasible site. However, these two factors would have a major impact on the cost of construction of a facility at the site.

There are several reefs and large rocks in the vicinity of the site, which would influence the location of a trestle, berth, and breakwater. The design used by McMullen takes advantage of two of the major hazards to navigation and uses them as part of the breakwater, i.e., Santa Rosa Reef and Westdahl Rock are used as part of the base of breakwater. The berth and breakwater locations are shown in figure 49. No dredging is required in this design, is the berth is placed approximately at the 50-foot depth contour with a trestle of about 4,800 feet to the shore. Area to turn the LNG carrier around during the docking is provided. A turning area about 2,250 feet across is available within the portection of the breakwater. Breakwater height was based on a maximum wave height of 48 feet. Cost estimates for the breakwater were based on several construction bids submitted to the Army Corps of Engineers for construction, modification, or repair of California coastal breakwaters. All costs were inflated to January 1978 dollars. The estimated cost for the 6,450-foot breakwater is approximately $173 million.

Another breakwater design propounded by the applicant (and apparently the only design discussed by the CPUC in their initial decision for the Point Conception LNG terminal) would require blasting of over 1.5 million tons of underwater rock and would cost over $300 million. This design is much more expensive and far more environmentally destructive than that recommended by McMullen (and adopted by the CCC). The staff can see no reasonable basis for adopting the applicant's design.

Unlike the coastal areas of the Santa Barbara Channel, where the tsunami hazard is low but potential for extensive damage exists, potential tsunami damage at Rattlesnake Canyon is moderate but the recurrence interval is high.

Physical and chemical impacts on the ocean environment associated with the operation of LNG vaporization facilities at Rattlesnake Canyon would be comparable to those projected for the applicant's site.

Vegetation

The plant communities native to the area of Rattlesnake Canyon are similar to those described for Point Conception. However, the coastal terrace at Rattlesnake Canyon is cultivated, and nearly all the native vegetation has been eliminated from the prospective site area with the exception of riparian woodland in the Pecho Canyon drainage which runs through the site. This drainage appears to be densely vegetated with low trees and shrubs. It probably contains coast live oak, willow, various sages, and perhaps big-leaf maple. Minor swatches of annual grassland (mostly brome grasses) are present around the field borders, and weedy roadside plants occur on the access road fill adjacent to the site.

The cliffs support a coastal bluff vegetation of *Dudleya*, various composites, and other perennials in the more stable niches, although many of the cliffs are bare.

This exposed coast has a narrow beach that is probably often submerged by wave and tide. It is unlikely that any significant strand community has developed there.

Construction of an LNG terminal on this site would have little, if any, adverse impact on local terrestrial vegetation. It would be possible--and desirable--to build the facilities without significantly disturbing the Pecho Creek drainage, and much of the cultivated land around the facilities could be allowed to revegetate naturally. Moreover, an existing access road, security perimeter, and an adjacent power plant would eliminate or reduce the impact associated with construction of these ancillary facilities. Construction of an access road to Point Conception, by comparison, would have as much adverse impact as construction of facilities themselves. An LNG terminal at this site would therefore compare very favorably with the Point Conception proposal in its impact on terrestrial vegetation on the site.

The extensive rocky headlands, reefs, and emergent rocks of the Rattlesnake Canyon shoreline support a luxuriant intertidal vegetation significantly different from that of Point Conception, where intertidal communities are poorly developed. A survey of nearby intertidal shorelines documented 113 species of marine algae and flowering plants, including species of all three major groups of benthic marine algae (green, red, and brown algae). The rocky subtidal reefs support kelp beds where the kelp Nereocystis luetkana (bull kelp) is more common than Macrocystis, the type found at Point Conception. Many species of these communities, including bull kelp, have annual life cycles, leading to marked seasonal variations in composition of the marine vegetation and probably a greater annual light penetration below the kelp--partly accounting for the great diversity found here. Most annual algae grow abundantly during summer and begin to die out in October and November, which would therefore be an appropriate season for construction of the trestle and breakwater. The kelp beds of the Rattlesnake area are probably less productive in total yearly biomass than the beds at Point Conception because of the annual habit of bull kelp and perhaps because of greater wave stress; however, both beds are harvested commercially.

Locating an LNG terminal at Rattlesnake Canyon would probably have greater adverse impact on marine vegetation than the Point Conception proposal (at least temporarily) for two reasons:

- Construction in rocky intertidal areas supporting large amounts of plant life would be necessary. Most of the intertidal area at Point Conception is sandy and does not have this type of vegetation. Further, some offshore reef areas at Rattlesnake might have to be reduced to remove navigational hazards, eliminating additional marine vegetation.

- A breakwater which would cover benthic habitat would probably be necessary at Rattlesnake and could cause siltation damage to marine plants over a large area. However, in the absence of continuous siltation, the breakwater itself would serve as algal habitat.

A positive aspect of the Rattlesnake site would be the environmental monitoring programs and biological surveys planned in connection with the nearby nuclear power plant. Monitoring the LNG site could be an extension of existing activities.

The possibility of a seawater exchange system with the nuclear power plant has been considered by staff, but extensive pipeline construction would be required, and the project may not prove to be environmentally beneficial. Twin 7-foot diameter pipelines between the two facilities would be required--each 22,000 feet long--for transporting seawater to and from a basin at the power plant. The pipes would cross several intervening ridges and ravines, reaching a maximum elevation of 172 feet. The volume of water required would be reduced by over 10 percent because of its greater heat content, but the pumping capacity required would be more than double that of the proposal. Safety and operational modification of the power plant may also be necessary.

Construction of such large pipes along this coastal area would involve significant impact of terrestrial ecosystems and archaeological resources. This system would seem to provide only modest environmental benefits, if any, at large additional capital and operating cost. A properly designed cold water outfall from the LNG terminal would probably have little adverse effect on marine plants. Phytoplankton entrained in the chilled water plume would experience temporary reduction in metabolic rates and produtivity, but would otherwise be unaffected. The mixing process would return most entrained organisms to normal temperatures in a short time.

Wildlife

The Rattlesnake Canyon area is typical of the central California coast. A mixture of coastal strand, sagebrush, chaparral, grassland, and woodland habitats create an environment which supports a wide variety of wildlife. However, the entire site is devoted to agriculture, and construction of the LNG terminal facilities would not destroy surrounding natural habitats.

The coastal strand, bluffs and offshore islands in the vicinity of the site are utilized by many species of birdlife. Pelagic cormorants, which nest at Point Buchon, and Brandts cormorants, which nest at Lion Rock, feed offshore at Rattlesnake Canyon. These nesting colonies are 10 and 6 miles, respectively, northwest of this alternate site. Though increased boat traffic and other activities associated with a major construction along the coast could disturb these sensitive birds during nesting, the potential for any significant impact is small if precautions are taken to avoid disturbing the nesting colonies.

Two small streams occur within the Rattlesnake Canyon site. The aquatic biota in such small streams along the California coast are usually sparse, except where the streams empty into the ocean. A number of small lagoons there often support an interesting assemblage of small fishes and invertebrates.

These small streams are often bordered by areas of scrubland and riparian woodland which are extremely important to local wildlife, especially woodland birds. Woodlands also afford nesting sites for raptors such as the white-tailed kite and red-tailed hawk. Woodlands also supply essential cover for deer and larger mammalian predators such as the coyote and gray fox.

Construction of an LNG terminal at Rattlesnake Canyon would result in little loss of wildlife habitat, since the land is currently used for agriculture. Construction noise and activity could cause some disruption of nearby wildlife, including several species of marine mammals. Most of the wildlife habitat of the rocky coastline could be preserved. There would be no need to construct additional access roads or create a new corridor for electrical transmission lines. Though both the Point Conception and Rattlesnake Canyon sites are located in areas of significant wildlife value, the impact to those resources would be significantly less at Rattlesnake Canyon.

The offshore areas are used by several species of cetaceans, including the California gray whale, during annual north-south migrations. The California Coastal Commission indicates that there are seal rookeries on the shores fronting the Rattlesnake Canyon site. Double Rocks, located about 2 miles northwest of the site, has been used by up to 60 harbor seals as a hauling out area and additional hauling out areas occur in the vicinity. Lion Rocks is a major sea lion hauling out area and may be used as a breeding site as well. Pecho Rock, only 1 mile from the site, is also a major habitat for sea lions.

During construction of a breakwater for the Diablo Canyon Nuclear Generating Station (approximately 4 miles north of the Rattlesnake Canyon site) harbor seals which had used the area were displaced. Although it was expected that the seals would return after construction, they did not. It is now considered a possibility that the displacement of the harbor seals could be permanent. Based on this evidence and the known sensitivity of these species, the construction of a terminal at Rattlesnake Canyon could have a severe impact on these marine mammals.

The Rattlesnake Canyon site is within the present range of the sea otter, a species listed as "threatened" under Federal law. About 100 sea otters frequent the area within about 1 mile of the site, especially near Pecho Rock. These otters would probably be displaced during the construction of a LNG terminal and breakwater.

Although the construction of a breakwater would result in impact to the marine biota in additional to that expected at Point Conception or the other alternatives, the breakwater would also be a source of artificial vertical substrate which would have beneficial effects on marine biota.

Construction and operational impacts associated with LNG vaporization facilities should be similar to those indicated for the proposed Point Conception site.

Land Use

The site is approximately 181 acres of agricultural land located on the coastal terrace. The most significant development in the surrounding area is the PG&E Diablo Canyon Nuclear Power Plant, located 4 miles north of the site. The town of Avila Beach (1980 projected population--450) is located approximately 2 miles east of the proposed site.

The majority of land use in the site area is agriculture and open space used for grazing. Much of the property in this area is privately held as large land grants, which discourages spot industrial and residential development. For this reason, there is very little development seaward of a line from Morro Bay west of Point San Luis.

The site area would be served by a private access road previously constructed by PG&E. The road is fenced and guarded at Port San Luis, and only area workers are permitted to use the road. An estimated 1,500 people per day presently use it.

It is possible that PG&E may gain a leasehold interest or title to the site and surrounding land at the conclusion of bankruptcy proceedings involving the present owner. This issue should be settled within several months. Such action would further reduce any potential land use conflict arising from industrial development of this site.

Construction of an LNG terminal on this site would conflict with current land use. However, land use in this region has not been deliberately developed; rather, it is a passive response to present ownership patterns. In fact, the 1975 California Coastal Plan makes no recommendations for this stretch of coastline. It is inappropriate, therefore, to characterize this conflict as a severe land use impact. While it may be generally undesirable to locate industrial facilities in undeveloped areas, Rattlesnake Canyon is superior to Point Conception in its land use impact.

Recreation

A 12-mile stretch of coastline bordering Diablo Canyon (including the site area) is virtually devoid of recreation facilities. Much of this land is privately owned. The area is mountainous, with no public road for access, and the shoreline is rocky. The California "Comprehensive Ocean Area Plan" indicates that this area is too rough for water use.

The nearest major recreation facility is the Montana de Oro State Park, approximately 7 miles to the northwest. This nearly 10,000-acre facility is a primitive camping and hiking area with 50 campsites. Trails wind throughout the park and up the prominent peaks in the area, Valencia Peak (1,347 feet) and Alan Peak (1,649 feet). The only other developed recreation facility is the Avila Beach County Park, a 4-acre facility. However, the entire shoreline in the Avila Beach area is a popular recreation area with facilities for recreational boating and fishing, as well as swimming.

Construction of an LNG facility in this area would have a negligible impact on recreation. There would be little, if any, impact to users of developed facilities, and unorganized recreation along the site beach areas is minimal. In this respect, this site would be superior to Point Conception.

Aesthetics

This site has significant aesthetic advantages and disadvantages. The area is undeveloped and clearly of scenic value for that reason. However, the site would only be visible to private citizens from a few limited locations--the offshore waters of the Pacific Ocean and the upper peaks in the Montana de Oro State Park. Of these, the scenic vistas from the state park would be most impacted; however, the view in this area already includes the nuclear power plant. Therefore, the addition of another industrial facility in the same general viewing area would not have a significant impact. The breakwater and marine facilities would be visible to the south as far as Pismo Beach. The view of LNG tankers would contribute to the appearance of an industrialized presence in the area and would therefore detract from the scenic quality of the area for recreational users.

The California Coastal Commission has not designated any of this area to exclude power plants, due to the presence of the nuclear generating station and its associated facilities. It seems apparent, then, that the construction of an LNG terminal at this site would have an aesthetic impact, although it would not be significant. In this respect, this site would be superior to Point Conception.

Socioeconomic Considerations

At least two areas in San Luis Obispo County are reported to have felt a relatively important impact from construction of the Diablo Canyon Nuclear Power Plant--the small town of Port San Luis (population less than 500) near the entrance to the site and vicinity of Pismo Beach (total population of 20,000). The major effect of construction on these areas has been a substantial increase in residential dwellings. Also, a measurable drop in unemployment in the county coincided with the start of construction. Similar impact might occur from construction of an LNG terminal at Rattlesnake Canyon.

The economic effects of construction would have a small economic impact on San Luis Obispo County overall, but substantial economic growth might occur in local areas. The combined effect of the nuclear power plant and the proposed LNG terminal might produce significant expansion of existing local towns, in turn necessitating the expansion of existing social services.

Archaeological and Historical Resources

The Rattlesnake Canyon alternative site area is located within the Rancho de los Osos y Pecho y Islay National Register Archaeological District. (See figure 54.) Five large archaeological sites and the ruins of a nineteenth century adobe house are on the alternative LNG site, while another ten designated archaeological sites and five apparent areas of artifact scatter are included within the district. This site density is unusually high for California outside the San Francisco Bay and Channel Coast areas. Although the terrace is used for agriculture, restricted access for decades has kept the district sites relatively undisturbed compared to other coastal areas. A wide variety of site types which probably spans some 9,000 years of cultural history exists here.

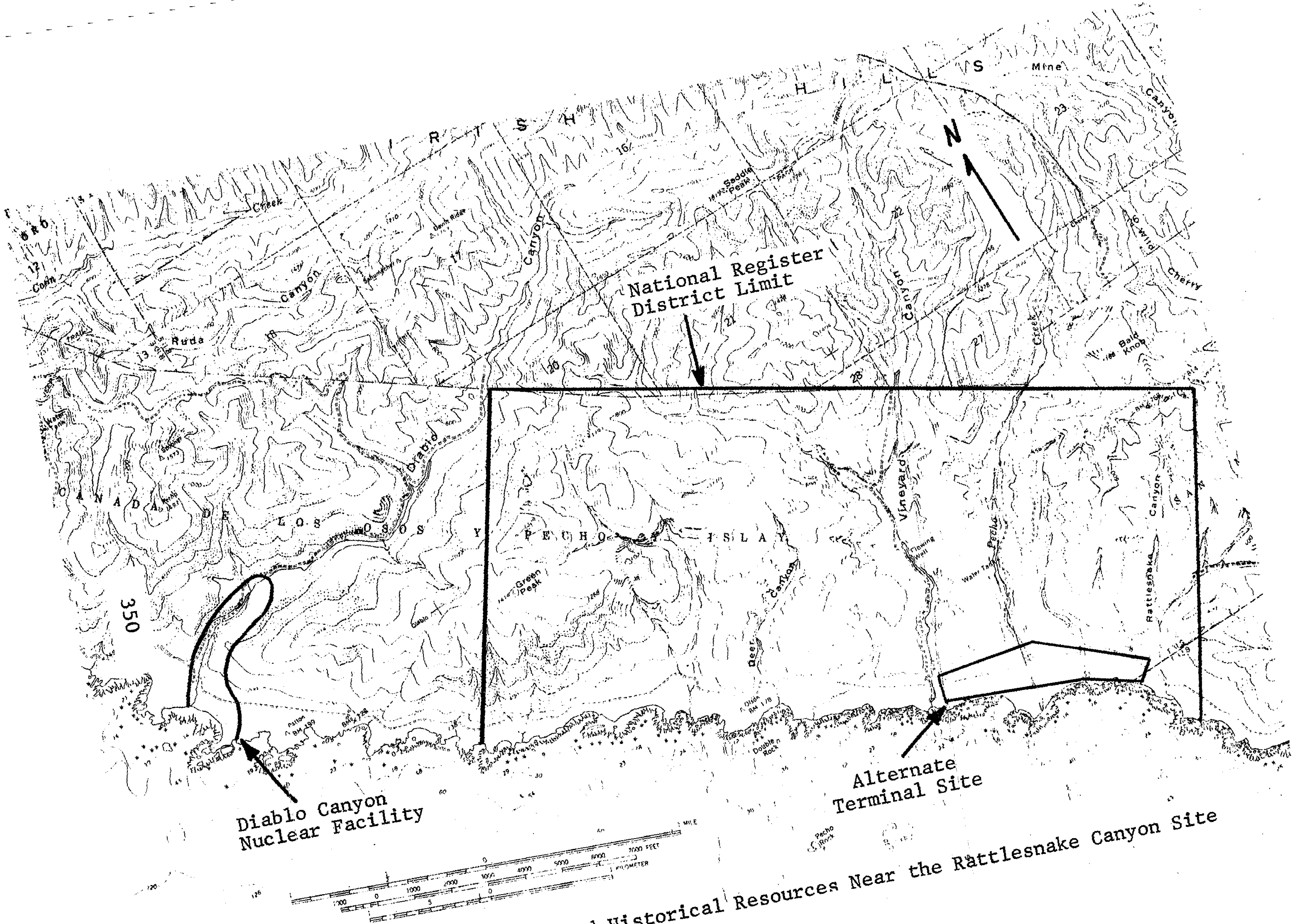


Figure 54: Archaeological and Historical Resources Near the Rattlesnake Canyon Site

This area does not have the spiritual significance to Native Americans that the Point Conception site has, but disturbance of aboriginal villages and accompanying cemeteries would cause the same concern for deferential treatment of human remains. The scientific significance of the cultural sites at Rattlesnake Canyon cannot be known until they have been tested, but it is unlikely that they would be more significant than those at the applicant's proposed sites because of the historical records, the known intensity of interaction along the Channel Coast, and the spiritual importance of the Point Conception area. However, the Rattlesnake Canyon sites cannot be avoided.

Air Quality

The alternate site at Rattlesnake Canyon is located in San Luis Obispo County, which is included in the South Central Coast Air Basin. The entire county is designated a "nonattainment area" for PO_x, indicating that ambient concentrations exceed the National ambient air quality standard. The area is classified as having attained the standards for CO and NO_2, while TSP and SO_2 remain unclassified because of insufficient sampling data.

The nearest complete air monitoring station is located in San Luis Obispo, about 12 miles northeast of this site. Recent air quality data summarized below show all pollutant levels except PO_x within the standards. PO_x levels exceeded the National standard eight times in 1976. The air monitoring data from San Luis Obispo are influenced by urban activities and indicate a poorer air quality than would be expected at the site. Although sampling data are not available for the site, it is expected that SO_2 levels and annual TSP levels should be within the standards. The 24-hour standards are occasionally exceeded in remote areas in California such as this site.

AMBIENT AIR QUALITY DATA 1/

1976 SUMMARY

Pollutant	San Luis Obispo
I. TSP	
Annual Mean ($\mu g/m^3$)	52.1
24-hr Max. ($\mu g/m^3$)	12.2
No. Primary Std.	0
No. Secondary Std.	0
No. Calif. Std.	3
II. PO_x	
1-hr Max. (ppm)	.11
Hrs. Primary Std.	9
III. NO_2	
Annual Avg. (ppm)	.015
1-hr Max. (ppm)	.15
IV. CO	
1-hr Max. (ppm)	16.0
8-hr Max. (ppm)	7.5
No. 8 hr Std.	0

The topographic setting at this site is very severe and poses a great potential for adversely affecting plume dispersion. The plant site would be on a narrow coastal terrace, with the base of the Irish Hills located immediately north of the site, and although the marine terminal would be more than 9,000 feet from the plant, tanker plumes could encounter elevations of 300 feet above sea level (the estimated plume rise for an LNG tanker under stable atmospheric conditions) within 1.4 miles. At Point Conception, this elevation is about 1.6 miles from the marine terminal. Therefore ambient concentrations would be expected to be somewhat higher than at Point Conception.

1/ California Air Resources Board. San Luis Obispo station moved during year. Data combined from both stations.

Since it is likely that TSP and SO_2 levels in the area are within the ambient standards, EPA's regulations on PSD would apply to this site. The primary impact of these requirements would be to further restrict the increase in ambient SO_2 and TSP concentrations and to require that BACT be employed to reduce project emissions.

The impact of an LNG facility at this site on regional air quality would be similar to the impacts at Point Conception.

Noise Quality

The noise environment at the Rattlesnake Canyon site is expected to be similar to that at Point Conception. The area is mostly undeveloped and used mainly for cattle grazing. In the absence of any nearby residences or noise sensitive areas, the plant would have a negligible impact on noise quality.

Safety

The Rattlesnake Canyon site meets the population exclusion criteria established in the California LNG Terminal Act of 1977. 1/ The site is isolated on the coastal terrace about 2.5 miles west of Point San Luis. The nearest residential population would be located 2.5 miles to the southeast at Avila Beach; however, mountains with heights of 400 to 600 feet lie between the site and these residences, providing a buffer in the event of an accident. The nearest potentially exposed population would be located at the Diablo Canyon Nuclear Generating Station, about 4 miles northwest. The nuclear station would have a total working population of about 70 persons on a three-shift work schedule. The Nuclear Regulatory Commission (NRC) staff believes "that it is feasible to design an LNG storage and gasification facility such that a severe accident at that facility is very

---

1/ The environmental staff has been advised by staff counsel that Federal law forecloses the state of California from unilaterally determining that certain LNG sites are unacceptable.

unlikely and even should an accident occur, it would not jeopardize the continued safety of a nuclear generating station four or five miles away." 1/ The NRC however also stated that as to the acceptability of locating an LNG facility within 4 to 5 miles of Diablo Canyon Nuclear Generating Station that there is insufficient information available for the NRC to make a determination at this time. 1/

A detailed risk analysis of the marine transportation of LNG to this site is presented in Attachment A. In addition, the relative safety risks of this site are compared to the other four possible alternative sites in subsection (f) of this alternative site analysis.

ii. Naples/Dos Pueblos

Topography and Geology

The Naples site is situated on coastal terrace deposits at an elevation of 60 to 120 feet. The Southern Pacific Railroad line bisects the site, which is approximately 0.5 mile square. The bluff bordering the ocean is about 60 to 80 feet high. Dos Pueblos is similarly situated, although somewhat smaller. Its elevation is 80 to 120 feet, with the northwest third of the site being separated from the remainder of the site by a ravine. The bluff is similar to that at Naples.

The Naples site is approximately 1.5 miles from a possible offshore extension of the More Ranch-Arroyo Parida fault system, which is active and may be capable of a magnitude 7.5 earthquake. This fault crosses the coast 2.5 miles east of the site. The potentially active Glen Anne-Goleta fault passes 2 miles north of the site. The Dos Pueblos site, while approximately 1 mile farther from the More Ranch-Arroyo Parida fault, is closer to the Glen Anne-Goleta fault. In addition, the Dos Pueblos and Eagle faults pass within 3,000 feet of the northern end of the site. Onsite study 2/ of the Dos Pueblos site has uncovered the presence of a fault similar in form and apparent displacement to that discovered at Point Conception. It displaced the bedrock abrasion surface which may be 40,000 or 85,000 years

---

1/ NRC letter to FERC dated July 14, 1978.

2/ Woodward-Clyde Consultants. Geotechnical Evaluation of Five Potential Mainland California LNG Import Terminal Sites. Prepared for the California Coastal Commission. Orange, California. April 28, 1978.

old. As the bedrock surface at the site has not been dated, no more precise estimate for the age of faulting may be made. The fault is possibly active as a topographic depression coincides with its projected position.

These sites are within an area which contains many geologic faults in addition to those noted. There does not appear to be any evidence that these other faults are active or potentially active or that any of them cross these sites. However, because the orientation and nature of these faults is similar to known potentially active and active faults in the area, the staff has serious reservations about the suitability of these sites. Before either could be recommended, they would have to be subjected to intensive onsite scrutiny to resolve seismic safety issues.

Seismic hazard at either of these sites would be the same as at Point Conception because of their proximity to the More Ranch-Arroyo Parida fault. Foundation conditions would probably be similar to those at Point Conception, but verification of this would require detailed onsite studies.

Both of these sites are more level than the Point Conception site and might require less site preparation. However, sahllow gullies in the southern portion of the Naples site would have to be filled. No new access roads would be necessary at either site.

Soils

The Dos Pueblos area is occupied primarily by Conception, Milpitas, and Positas soils. The Milpitas and Positas soils are found in such an unpredictable pattern that they are mapped as one unit and called the Milpitas-Positas complex.

Approximately 75 percent of the Naples site area is occupied by Conception soils; the remainder of the Naples site is made up of the Milpitas-Positas complex. Slopes on the site generally range between 2 to 9 percent; however, a small area on the south central portion of the site has slopes ranging to 30 percent. Soil conditions in this area are very similar to those found in the Dos Pueblos area.

All of these soils have fine sandy loam surface textures and clay subsoils underlain by a deep clay loam substratum. They are moderately well drained, but the dense clay subsoils are responsible for their slow permeability. The subsoil of the Conception series, which is approximately 1 foot deep and found 2 to 3 feet below the surface, has a moderate shrink-swell potential. On the Milpitas-Positas complex, the subsoil is approximately 2 to 3 feet thick and has a high shrink-swell capacity. The substratum underlying the area has a low to moderate shrink-swell potential. The construction of dikes and embankments would be limited by the ability of these soils to shrink and swell and by their low strength. The design of foundations and footings would have to reflect these soil limitations. The subsurface soils of the area are rated as poor for road fill. They also have poor workability, especially when wet.

The center of the area exhibits the most relief, with slopes of 15 to 30 percent. The rest of the Dos Pueblos site has slopes of 2 to 15 percent. Runoff is medium to rapid, and the erosion hazard is moderate to severe, depending on the slope. Effective erosion control could mitigate any potential erosion-related problems.

The water table in both the Dos Pueblos and Naples site areas should be well below any excavations. However, because of their poor permeability, the dense clay subsoils may cause prolonged periods of wetness in depression areas after rainy periods.

The soils of the Naples/Dos Pueblos area are similar in character to those found on the Point Conception site. No major soil-related problems would cause significant differences in terminal construction or impact.

Hydrology

The alternative sites are in a coastal drainage region which lies between the east-west oriented Santa Ynez Mountains and the Santa Barbara Channel coastline. Drainage areas are perpendicular to the coastline. As a result of the steep slope and the unfavorable water retention characteristics within the watershed, stream channels are deeply incised and runoff is rapid. After major storms, the streams in the vicinity of the alternative sites are susceptible to flooding and debris movement. Surface water is not used extensively because all major streams are intermittent. During spring months, however, surface runoff is used for irrigation.

Unconsolidated aquifer material in the vicinity of the sites is limited to thin, narrow deposits of alluvium along the stream channels. Consolidated formations include the Rincon, Monterey, and Sisquoc formations, which overlie and confine the underlying Sespe and Vaqueros formations. The Vaqueros and Sespe formations yield small to moderate quantities of water to wells. Monterey Shale yields more than 100 gpm to wells in areas where siliceous shale is highly fractured. In general, the quality of the groundwater in the vicinity of the sites is poor. Groundwater has been used primarily for irrigation.

Anticipated adverse impact from constructing and operating an LNG facility at either of these sites would primarily be terrain modification and potential increases in erosion and sedimentation. Any unconfined groundwater near the surface encountered during excavation would be drained. An increase in the consumption of groundwater could also occur.

Oceanography

The sites are on the Santa Barbara Channel, approximately midway between the Point Conception and Oxnard sites.

Astronomical tide data is as follows:

Extreme High Water	8.0 ft.
Mean Higher High Water	5.3 ft.
Mean High Water	4.6 ft.
Mean Tide Level	2.8 ft.
Mean Low Water	1.0 ft.
Mean Lower Low Water	0 ft.
Extreme Low Water	-2.5 ft.
Extreme Range	10.5 ft.

For the Naples/Dos Pueblos site area, McMullen calculated that annual average significant wave height, equal to 6 feet or greater, occurred 15 percent of the time or less. Figure 43, based on data supplied by the U.S. Navy Weather Service Command, depicts this type of information for the California Coast. If significant wave heights of 6 feet or greater are used as the limiting criteria for LNG transfer at a potential site, Figure 43 provides an approximation of transfer downtime as the result of wave action.

The deepwater wave climate of the Santa Barbara Channel is relatively mild compared with that of the open ocean. The orientation and geography of the channel limit the entry of swell except from the west and southeast. Seas within the channel are severely restricted because of limitation in fetch at various nearshore locations. Wave data from various sources indicate that the normal wave direction in the Santa Barbara Channel is from the west. Wave heights of 6 feet or less occur approximately 80 percent of the time, and waves 10 feet or greater approximately 10 percent of the time.

Storm wave conditions estimated for the Santa Ynez Unit (located between 5 and 31 miles west of the Naples site) predict a maximum significant wave height of 21.5 feet for a storm having a 100-year recurrence interval. The sites are considered to have low risk of damage from tsunamis. Wave heights of 6 feet would be expected in the vicinity of the site because of tectonic displacement of the sea floor outside the Santa Barbara Channel. Locally occurring earthquakes could produce tsunamis with run-up elevations of less than 10 feet.

Surface water temperatures were observed to range from 61°F to 66°F in the summer and 57°F to 63°F in the winter.

Assuming that any LNG facilities constructed at these sites would be similar to those proposed for Point Conception, impact on the physical marine environment should be nearly identical to that indicated for the proposed facilities.

Vegetation

The plant communities of the Naples/Dos Pueblos site area are the same types found at Point Conception and are distributed similarly. The narrow coastal strand is virtually devoid of vegetation, and the bluffs are vegetated by shrubs of the coastal sage plant community and other perennials. The terrace at Naples is a wide, level grassland broken occasionally by small arroyos and washes with sparse coastal sage vegetation. Near Dos Pueblos, the terrace is interrupted by two relatively large canyons lined with eucalyptus trees and arroyo willow. The streambanks in these canyons may have dense growths of cattail and bulrush in their lower reaches. The seaward edge of the terrace near the ranch is lined with trees. Part of the ranch land is cultivated with lemon and avocado orchards.

An LNG terminal here would have vegetational impact qualitatively similar to the Point Conception proposal, but it would probably be less severe because a much shorter access road would be required which could be oriented in a north-south direction that would not cross many drainages, if any. Less grading for site preparation would be necessary near Naples than near Dos Pueblos, where parts of the canyons might have to be filled. Existing eucalyptus stands at Dos Pueblos Ranch could be preserved as visual screening.

The composition of marine plant communities at the Naples and Dos Pueblos sites is similar to that of Point Conception but the communities are not as well developed. Although a large area of kelp occurs around Naples Reef, most of it could be avoided by locating marine facilities southwest of the Naples site. Kelp is poorly developed offshore of Dos Pueblos Ranch, probably because of sedimentation from the canyons. Although kelp does occur on sandy substrate in the central Santa Barbara Channel--most likely because of the moderating influence of the offshore islands on wave action--it does not form the dense, productive stands common to rocky substrates.

The staff believes that an LNG terminal at this site would have significantly less impact on marine vegetation than would the Point Conception proposal. Although Naples Reef should be considered an ecologically sensitive area, nearby terminal facilities would not necessarily have significant adverse effects on vegetation if adequate design and construction precautions were taken. Elsewhere in this site area, only marine communities of relatively low density would be affected by terminal facilities, resulting in less total impact.

Wildlife

These two sites are located on the Santa Barbara coast about 25 miles east of Point Conception. Because of their relative proximity, the wildlife resources of the three sites are similar in many aspects. However, wildlife habitat in the vicinity of the two alternative sites has been more intensively altered by agriculture and oil development than that at Point Conception. Also, the remote location of Point Conception has helped it retain the larger, more secretive mammals such as deer and bobcat.

Like most areas along the Santa Barbara Channel, the coastal strand attracts a large variety of shorebirds, gulls, and terns. The coastal strand east of the Naples site is used by a significant number of harbor seals as a "hauling out" area. The mixture of scrubland and grassland on the sites support many songbirds and small mammals such as the brush rabbit, dusky-footed woodrat, deer mouse, and California vole.

Small streams near the two sites are intermittent and support relatively sparse populations of invertebrates and a few small fish. Construction at either of the two sites should be possible without any significant impact on these small streams.

The endangered California brown pelican and California least tern frequent the coastal area to nest and feed, but breed elsewhere. The protected white-tailed kite is found throughout the Santa Barbara coastal plain, including the two alternative sites.

Site preparation and construction of a LNG terminal at either site would destroy or alter a large trail of wildlife habitat, mostly grassland and coastal sage scrub. The magnitude of this impact would be less than at Point Conception, where the wildlife is more diverse and abundant. Also, the impact of access road and electrical transmission line construction would be much less than at the more remote Point Conception site.

In the inshore zone, medium sand substrate are dominated by sand dollars and or clam species. Very fine sand and silty substrates farther from shore are dominated by two clam species and several forms of polychaetes. Fishes characteristically found in shallow, low relief, areas of the Santa Barbara Channel are flatfishes, croakers, and surf perches. High relief areas generally support a more diverse fauna, including rock fishes, kelp and sand bass, wrasses, greenlings, blacksmith, and some perches.

Naples Reef, approximately 1 mile offshore of the site to the south is considered a principal sportfish area. Sport catches in this region are dominated by rockfish and rockbass. Anchovies, Jack Mackerel, white sea bass, rockfishes, bonito, and flatfishes account for most of the commercial fish landings. Naples Reef represents an ecologically sensitive area as well as an educational resource. For these reasons, it has been considered as a candidate Area of Special Biological Significance under the California Comprehensive Ocean Area Plan and has been recommended for consideration for legislative protection as an underwater park in the state park system.

The beach front east of the Naples site has been identified as one of several mainland sites used by harbor seals as haul-out grounds and possible breeding grounds. These haul-out grounds appear to be used primarily at night and have largely escaped detection. The most important site identified to date is at

Burmah Beach, immediately east of the Naples site, where up to 165 seals have been observed.

Construction and operational impact associated with LNG vaporization facilities should be very similar to those indicated for the proposed Point Conception site. However, two areas of unique biological significance exist in the vicinity of the sites, and consequently any disturbance would assume added significance. Along the California coast south of Point Conception, seals and sea lions have abandoned many of their previously established coastal breeding grounds, primarily because of disturbances by human activities. Construction and operation of the facilities would probably reduce or negate the use of the adjacent beach as one of the remaining mainland pinniped haul-out grounds.

Without information on the location of the trestle and pier and the vaporizer, intake, and discharge lines, it is difficult to assess what effects constructing and operating LNG facilities would have on Naples Reef. However, the likelihood that fauna inhabiting the reef would be disturbed would increase significantly with the construction and operation of LNG facilities at this site.

Land Use

The major land use in the Naples and Dos Pueblos site areas is open space mainly used for grazing. Although the Santa Barbara metropolitan area has been expanding in this direction, the Burmah Ellwood Oil Field operation has served as an effective barrier to this expansion. The only evidence of development in the Naples site area is an oil well on the coastal side of the railroad tracks.

The town of Naples, which was formerly a railroad stop, no longer exists. The only residences in the general area are located outside the site boundary to the northeast. The Naples area is zoned U (Unlimited Agriculture) by Santa Barbara County. Such zoning would not permit the construction of an LNG terminal; however, the California Liquefied Natural Gas Terminal Act of 1977 exempts the applicant from local permit (zoning) requirements.

The land use in the surrounding area is extremely varied. The Santa Barbara suburban areas of Ellwood and Goleta Valley are located approximately 6 miles to the east. The center of the Burmah Ellwood Oil Fields is approximately 2 miles to the east. The Dos Pueblos Orchid Farm is located approximately 1.5 miles to the west.

Highway 101 provides a major access route to this area. The 1977 average annual daily traffic count (ADT) at the El Capitan park exit was 17,100. This increases considerably in the summer, however, with ADT during the peak month of 26,000 cars.

Construction of an LNG terminal on either of these two sites would conflict with the current land use. However, the presence of the industrial operations at the Burmah oil fields would somewhat diminish this impact. The overall land use impact, then, would be less than that at Point Conception. Construction traffic impact would be similar to that at Point Conception. Considerably fewer access roads would have to be built at Naples, which would reduce that impact. A powerline from Goleta to Naples would affect much less area than the proposed powerline from Goleta to Point Conception.

Recreation

There is one ocean park in the vicinity of the Naples site--El Capitan State Beach, a 133-acre facility located approximately 3 miles west. The park has 85 developed sites for camping, and the major activities are picnicking, swimming, and fishing. Much of the remaining beach area is privately owned, and access to the public is restricted. The level of use here is similar to that at Point Conception. Increased access may result if the state Department of Parks and Recreation completes the El Capitan State Beach Coastline Trail that it is trying to develop.

The offshore area of the Naples site is part of the South Coast Intertidal Preserve, designated to protect the abundant marine life. This marine life attracts a number of sport fishermen and divers to the area. Boaters would be accommodated if the county completes plans to acquire the existing Signal Pier on Burmah's Ellwood property. If acquired, the pier would be developed as a fishing and boating recreation complex.

The impact of an LNG terminal on recreation here would be more severe than at Point Conception. The Naples site is only 3 miles west of the heavily used El Capitan State Beach Park. In fact, the state plans to extend the park to as close as 0.5 mile away. The construction and operation of a large industrial facility would significantly impact the users of this park. Since the beach at the Naples site is not as isolated as that at Point Conception, the disruption to beach and offshore recreation would be somewhat greater. Tanker traffic would be required to travel farther up the Santa Barbara Channel, increasing the disruption of recreational boating, fishing, and diving in the offshore area.

Aesthetics

The Naples and Dos Pueblos sites are in an area of the coast which is generally regarded as aesthetically pleasing. Located at the edge of the Goleta Valley urban area, the area has thus far avoided the direct effects of urbanization and continues to represent a relatively undeveloped, almost pastoral landscape. The California Coastal Commission has designated this stretch of coastline as an area of "Scenic and Visual Quality." These site areas would generally be visible from Highway 101 and the Southern Pacific Railroad to the north and from prominent elevations to the east and west. Since the land slopes downward from Highway 101, however, the sites could be effectively screened by a row of trees near the highway. The sites would also be visible from offshore waters.

Construction of an LNG terminal at either of these sites would significantly degrade the scenic quality of the area. Although substantial, the impact would be somewhat less severe than that at Point Conception. This is because of the presence of other industrial equipment such as drilling rigs already in the area and because of the increased possibility of screening Highway 101 since the site area slopes away from the highway. The aesthetic impact to users of El Capitan State Beach could not be mitigated in this manner, and that impact would be severe.

Socioeconomic Considerations

Several residences are located at Dos Pueblos Ranch near the alternative sites. Oil is produced on adjacent properties. The socioeconomic impact on business activity, public revenue, personal income, and employment would be similar to that expected for Point Conception. Proximity to a major population center, Santa Barbara, and the availability of highway transportation would ease the construction impact associated with housing construction personnel and delivering construction materials. In addition, a major population center such as Santa Barbara could provide essential services for operation personnel without requiring a significant expansion of existing social institutions or social services.

Archaeological and Historical Resources

The Naples/Dos Pueblos Canyon alternative sites are flanked by a number of archaeological properties recorded in the Santa Barbara County site files, although none lie within the boundaries outlined for the sites. The Dos Pueblos site is more likley to contain cultural properties than the Naples site, since it is nearer fresh water, but either alternative would have a good possibility of their occurrence. It is unlikely that the alternative sites would be as sensitive to construction impact on cultural resources as the Point Conception site. Although two historic period sites are recorded near the two alternatives, this area has not been as well protected from relic collectors and damage from agricultural and construction activities.

Air Quality

The alternate sites at Naples and Dos Pueblos are located in the South Santa Barbara County Air Basin, the same basin as the proposed Point Conception plant site. This region is designated a "nonattainment area" for PO_x, CO, and TSP, indicating that ambient concentrations of these pollutants currently exceed their respective ambient air quality standards.

The nearest air monitoring station is at Goleta, located about 8 miles east of the Naples site. A summary of 1976 air quality data for this station is presented in table 32. TSP levels measured at this site were within all ambient air quality standards except the California 24-hour standard, which was exceeded once. The National standard for PO_x was exceeded 97 times, which is typical of the oxidant problem in this basin. NO_2 and CO levels were within all National and California standards. While SO_2 and particulate sulfate data for the region are relatively sparse, the available data indicate that concentrations of these pollutants are within their respective standards.

The topographic setting of the two sites presents obstacles to plume dispersion similar to those at Point Conception, although the terrain here is not quite as severe. Plumes from LNG tankers at berth would encounter the complex terrain of the Santa Ynez Mountains, but at greater distances inland. For example, elevations of 300 feet above sea level (the estimated plume rise for an LNG tanker under stable conditions) are located within about 1.6 miles of the proposed marine terminal at Point Conception and about 1.9 miles from a terminal at Naples. Air quality impacts would be similar to that at Point Conception.

Since the sites are located about 25 miles east of Point Conception, LNG tankers would travel farther within the air basin and make a greater contribution to regional emissions. The increased tanker emissions estimated for the additional transit time in the Santa Barbara Channel for both the proposed project and the maximum development are listed below.

LNG TANKER EMISSION INCREASE
(ton/yr)

	PM	SO_2	NO_x
Proposed Project	12	48	19
Maximum Development	17	72	29

As a moving source, LNG tankers would not significantly increase short-period pollutant concentrations at any specific coastal location. However, the substantial increase in regional SO_2 emissions from tanker transits would contribute to sulfate formation in the region.

The site would have the potential for a slightly greater impact on regional oxidant formation than the Point Conception site. NO_x emissions would still be the primary oxidant precursor for these sites, but the longer tanker route would increase NO_x emissions in the region, as listed above. The sites are also closer to the more urbanized parts of the air basin, and NO_x emissions from plant process equipment and moored tankers would not undergo as much dilution by atmospheric dispersion before entering the oxidant process. While regional oxidant formation is most sensitive to the organic precursors, the emissions from the sites would make a greater contribution to PO_x than the Point Conception site.

Noise Quality

The existing noise environment is higher at Naples and Dos Pueblos than at Point Conception because of its proximity to Highway 101 and oil processing areas. The nearest residences are located within 3,000 feet of the center of the Naples plant site, which is closer than potential noise sensitive areas at

Point Conception. Noise from plant operations would slightly increase existing levels, but the resulting noise environment should still be within EPA's range of acceptability.

Safety

The Dos Pueblos site area meets the population exclusion criteria established in the LNG Terminal Act of 1977.[1/] However, it is questionable that the Naples site, which lies about 1 mile southeast of the Dos Pueblos site, would meet the exclusion criteria. Assuming that the California act is flexible enough to recognize a borderline case, the Naples site could be acceptable under the population exclusion test. In any event, the FERC staff would consider the site, pending the outcome of the detailed risk analysis, regardless of whether it meets the criteria in the California act.

The resident population nearest either of these sites would be at the Dos Pueblos Ranch where an estimated 25 people live. This ranch lies about 0.5 mile southeast of the Dos Pueblos site and 0.5 mile northwest of the Naples site. A detailed risk analysis of the marine transportation of LNG to this site is presented in Attachment A of this EIS. The relative risks at this site are compared to the other retained alternate sites and Point Conception in subsection (f) of the alternative site study.

1/ The environmental staff has been advised by staff counsel that Federal law forecloses the state of California from unilaterally determining that certain LNG sites are unacceptable.

iii. Oxnard

A detailed analysis of the Oxnard site was previously presented in a staff Final Environmental Impact Statement for the Pacific Indonesia LNG Project and circulated in December 1976. A comparative summary of this material is presented below.

Topography and Geology

The Oxnard site is virtually level, with an elevation of approximately 5 to 10 feet. Water depths of 50 feet are reached about 1 mile offshore.

The nearest significant fault is the Malibu Coast fault, about 8 miles away and capable of a magnitude 7.5 earthquake. Surface soils at the site are subject to liquefaction. Flooding from tsunamis is possible at the site, although waves sufficient to inundate the site have not been experienced in historical times. The only form of seismic hazard at Oxnard would be the liquefaction potential of the soil.

~~The topography~~ of the site would not require extensive site preparation. However, to mitigate the hazard from the liquefiable soils, significant excavation would be required for the foundation of at least the LNG storage tanks. Disruption of longshore sediment transport should not be a problem as long as no breakwater or small boat harbor were required.

The topographic impact of facilities at Oxnard would be significantly less than that of the proposed Point Conception facilities because of the extensive screening suggested by the CPUC.

Soils

The Oxnard site consists of Camarillo sandy loam, Camarillo loam, and Pacheco silty clay loam soils. Camarillo soils cover approximately two-thirds of the site. They have loamy or fine sandy clay loam subsoils and a fine sandy substratum, while Pacheco soils have formed over stratified alluvial deposits of silt and sand. The soils have moderately slow to moderately rapid permeability; however, the lack of relief (0 to 2 percent slopes) has been partially responsible for their poor drainage.

The soils are deep to bedrock and would provide few limitations for excavations. The major limitation of these soils for excavation and construction would be their wetness. The water table is within 2 to 3 feet of the surface, and the area is subject to infrequent flooding. The soils are rated as fair to good for road fill; however, embankments and dikes would be limited to a degree by low strength, low stability, and a susceptibility to cracking. Runoff is generally slow to very slow, with ponding a potential problem. There would be little hazard of erosion.

Hydrology

The site is located on the Oxnard Plain within the South Coastal Subregion, which encompasses an area of almost 11,000 square miles. Principal river basins include Ventura, Santa Clara, Los Angeles, San Gabriel, Santa Ana, Santa Margarita, San Luis Rey, and San Diego. Principal streams do not flow near or affect the site. Surface waters in the Oxnard Plain are not used for water supply, primarily because of inadequate runoff and lack of storage potential.

Aquifers beneath the Oxnard Plain are Pleistocene and Recent granular sedimentary units associated with the Santa Clara River, its floodplain, delta, and estuary. The three principal aquifers in the property area are the Oxnard, Mugu, and Fox Canyon. Saltwater intrusion has occurred in the Oxnard aquifer at Port Hueneme, which is near the site. Groundwater in the Oxnard Plain is suitable for most irrigation and can be satisfactory for domestic use if treated for hardness.

Dewatering of excavations at this site would be required to remove water from the near surface water-bearing materials. Drawdown from dewatering could dry out the saltwater marsh adjacent to the site for the duration of the dewatering process. No additional significant hydrologic impacts are anticipated during the construction or operation of the LNG facility.

Construction impact on hydrology at the Oxnard site would be comparable to that expected at Point Conception. However, if groundwater in the vicinity of the Point Conception site were used for plant operations, the potential for hydrological impact during plant operation would be greater than that expected for Oxnard.

Oceanography

The marine trestle would be located offshore of Ormond Beach on the south-central coast of California, which is within an area commonly known as the Southern California Bight. Two major submarine canyons (Hueneme and Mugu) are important features affecting the nearshore circulation.

The astronomical tides are characterized as mixed semi-diurnal. The present MLLW at Port Hueneme is 2.8 feet below the predicted mean tide. The highest tide predicted at Port Hueneme is 7.1 feet above MLLW. The extreme high water recorded between 1940 and 1961 was 7.6 feet above MLLW, and the extreme low water recorded was 2.5 feet below MLLW.

Because of its geography, the Port Hueneme area is exposed to deep water waves from the following sectors:

140° - 180° : south-easterly waves

160° - 235° : south-westerly waves (i.e., from the Southern Hemisphere)

270° - 285° : westerly waves

For directions between 100° and 290°, locally generated waves may reach the site.

On the basis of wave refraction analysis, the probability of equivalent duration of combined wave heights exceeding specified values of 4, 6, 8, and 10 feet near the terminal ($119^\circ11'$W, $34^\circ07'$N) are:

Wave Height (feet)	Winter Direction ($250-270^\circ$)	Direction ($250^\circ-270^\circ$)	Summer Direction ($170-180^\circ$)
4	2.2	0.4	0.4
6	0.8	0.1	0.1
8	0.2	-	-
10	-	-	-

One hundred-year storm waves over water of 20-meter (65 foot) depth would not exceed 21.7 seconds and 8.2 meters (26.9 feet). An estimate of runup for 100-year tsunamis at Oxnard is 5.0 feet. However, in the harbor at Port Hueneme, runup could be as much as 10.1 feet.

Minimum average monthly ocean surface temperatures of approximately 56°F typically occur in February; maximum average monthly surface temperatures reach approximately 62°F in September.

Impact on the physical marine environment would result from the marine facility construction and from discharges of groundwater and hydrostatic test water into the sea. During operation of the facilities, physical impact on the marine environments would result from the LNG vaporizer discharges and could result from fuel-oil spills.

The baseload heat source designed for the LNG vaporization facility originally proposed by Western at Oxnard is a seawater exchange system with the Ormond Beach Generating Station (OBGS). The existing seawater intake rate of OBGS is approximately 475,000 gpm; the seawater temperature is raised 18°F to 23°F at its heat exchangers. Ultimate development projections for LNG facilities specify a 400,000-gpm seawater exchange rate, with an average warmed seawater temperature depression of 13°F. In the worst-case event of a complete generating plant shutdown, the LNG plant would continue to operate and would produce a seawater discharge having a temperature 5°F to 15°F below ambient. The OBGS chlorination and heat treatment would be sufficient to prevent fouling in both facilities.

Waves would cause some impact on the berthing of LNG tankers. Based on calculations with the optimum pier configuration (i.e., a finger pier oriented at 220° to 240°), berthing would be curtailed at the site approximately 3 to 4 percent of the time because of wave action.

Oceanographic conditions offshore of the Oxnard site would have fewer limitations on berthing and unloading operations than would the conditions at Point Conception. The most clearly defined difference between the two sites is the possibility of using a seawater exchange system at Oxnard. This would mitigate the present impact from discharging warmed water into the marine environment, rather than creating additional impact.

Vegetation

The Oxnard site differs from Point Conception and the other alternatives in having a relatively wide beach where coastal strand vegetation has stabilized the backshore dunes. About 2 acres of strand would be included in the site, part of which would be temporarily disturbed by trestle construction. The site would include 38.5 acres of salt marsh. Although only 3 acres of this would be cleared, the rest of the marsh could be dried by dewatering of the storage tank foundations. The rest of the 210-acre site is disturbed by agriculture or other uses and would suffer no significant vegetation impact. The existing access and power facilities would further reduce the impact of constructing a terminal at this site.

The sandy substrate offshore does not support kelp within 5 miles of the Oxnard site, although some marine algae exist on the sandy bottom and on artificial structures in the area. Studies have recorded 34 algal species near the terminal site, mostly on rocks of a breakwater.

Because an LNG facility at Oxnard would share the seawater used by an adjacent power plant, no additional seawater uptake would be necessary for the LNG gasification plant, practically eliminating any impacts on marine environment which would be associated with this procedure.

Wildlife

The natural terrain and vegetation at the Oxnard site has been greatly altered by agriculture, building construction, channelization of existing streams, and recreation activity. Approximately 40 acres of salt marsh and vegetated dunes remain from the once extensive lagoons, salt marshes, and dunes. The agricultural and industrial development limits the variety of wildlife at the site; none of the larger mammals such as deer, coyote and bobcat are found there. The most common mammals are the western harvest mouse, California vole, and house mouse.

In spite of the meager natural habitat remaining at the proposed terminal site, there is an excellent variety of bird life, most of which can be attributed to its coastal location and the small, seasonally flooded salt marsh. Bird populations are especially high and diverse during the winter and migratory periods. The salt marsh supports a breeding population of the Belding savannah sparrow, a subspecies considered endangered by the State of California. According to a 1976 least tern survey by the California Department of Fish and Game, 16 to 18 pairs of least terns nested successfully at Ormond Beach. The

California brown pelican is seen occasionally in the vicinity of the site but does not nest in the area.

Almost all of the construction at Oxnard would be confined to agricultural lands which are low-value wildlife habitat. Only 3 acres of the 38.5-acre salt marsh would be disrupted during construction, and none of the marsh would be permanently destroyed. The coastal strand, probably the second most important wildlife area at the site, would not be significantly altered by construction and operation of the terminal. Least tern nesting at Ormond Beach would probably be significantly curtailed during construction, but could resume during operation. Although the LNG terminal would add significantly to the industrialization of the immediate vicinity, much of the site's wildlife, notably the budlife associated with the salt marsh and coastal strand, could be preserved.

Since the LNG terminal would be located in an area where wildlife has previously been impacted by development and since so little long-term impact is anticipated from the terminal, the Oxnard site would be preferable to the Point Conception site.

The species comprising the various marine communities or associations are typical of similar areas found elsewhere along the southern California coast. The dominant and most conspicuous biological element of the inshore zone to a depth of about 13 meters is a sand dollar bed. This species may occur in densities exceeding 1,000 per square meter.

Of the surf and bay fishes in southern California, the most abundant is the northern anchovy. Barred and walleye surf perch, California corbina, and spot fin croakers are the dominant and the most sought-after surf zone fishes. Dominant deepwater fishes are Pacific and speckled sanddabs. There is no important commercial fishery in the area. Sportfishing is mostly confined to rocky habitats and adjacent sedimentary habitat.

Marine mammals which would be expected to occur in the Port Hueneme region (with the exception of the harbor seal) are either oceanic or reach peak abundance around the Channel Islands.

The primary construction activity which would cause adverse impact on the marine ecosystem would be the trestle and berthing facility installation. Hydrostatic testing of the LNG tanks and any dewatering of the plant site would also result in some adverse effects.

The impacts associated with the operation of the proposed LNG vaporization facilities would be less significant at Oxnard than at the Point Conception site and the remaining alternatives. No additional entrainment or impingement to that already existing at the OBGS would occur, and typically the difference between the ambient water temperature and the OBGS discharge water temperature would be reduced by the cooling influence of the LNG vaporization facilities.

The LNG plant would greatly increase the time that plankton would be exposed to the generating plant's temperature and chemical stresses. In addition, it would then impose its own temperature stress for an extended period. Mechanical stress in the LNG seawater system would be added to that produced in the generating station and would probably be greater in the LNG seawater system than in the generating station seawater system.

The above-ambient discharge of the combined facilities would produce cooler effluent and a smaller thermal field at the surface than the existing generating station discharge. However, the periods when the combined discharge would be subambient would probably impose lethal or sublethal effects on benthic biota within a significant area around the existing discharge.

Land Use

The proposed Oxnard alternative site, a 210-acre parcel owned by Western LNG Terminal Associates, is located at Ormond Beach within the City of Oxnard. Although the site is zoned for heavy industrial use, general agriculture currently occupies approximately 138 acres; 38.5 acres are salt marsh. A railroad spur, extending from the present tracks of the Ventura County Railway Company, runs through the western half of the site.

In the general area, land use is predominately industrial and agricultural. The site itself is located in the Ormond Beach Industrial Area. Land to the north of the site is dominated by various industrial complexes which produce polyester resins and metal fabrication. The port of Port Hueneme, 2 miles north, is the principal maritime center between Los Angeles and Santa Barbara. To the west is the Oxnard Sewage Treatment Plant. Truck crops are cultivated east of the site.

Residential development begins 0.75 mile north of the site and becomes denser nearer the centers of Oxnard (population 93,297) and Port Hueneme (population 19,597). These centers lie 4 miles north and 1.3 miles northwest of the site, respectively. In recent years, these two cities have continued to merge into an urbanized unit. Other large population centers in the vicinity include the Naval Seabee Center (2 miles northwest of the site), which employs 10,000 workers and houses 6,000 workers and families, and Point Mugu Naval Air Station (4.6 miles southeast), which employs 10,504 and houses 2,773.

The total permanent population within 4 miles of the site numbers approximately 105,000, a density of 3,229 persons per square mile. Within 1 mile of the site, there is a permanent population of 6,139, including 600 industry workers in the area near the site. The resulting density is 1,849 persons per square mile. Ninety percent of the permanent residents are housed in apartments and condominiums. The Surfside Three Condominiums, located 0.9 mile northwest of the site within the Port Hueneme city limits, have recently been completed and currently house 1,000 persons. Surfside Three is the southernmost part of a projected 1,599-unit residential townhouse development that is slated for completion in 1979. A beachfront motel, restaurant/coffee shop, and supporting retail facilities are part of the Surfside master plan.

Highway 1, located 2 miles from the site, would be the major access road in this area. The 1977 average ADT at the Oxnard exit was 27,000 cars. This increases considerably during the summer, however, with an ADT during the peak month of 33,000 cars. Hueneme Road would also be used as an access road. The 1972 ADT for this road was 8,330 cars.

Construction of an LNG terminal on this site would be compatible with the existing industry in the area. In fact, the land has already been committed to eventual industrial zoning by the City of Oxnard. In this respect, the Oxnard site is much more favorable for this project than Point Conception. The land use compatibility is even further enhanced by the possibility of a seawater exchange system with the existing Ormond Beach Generating Station, an environmental advantage.

Recreation

Ormond Beach, the beach nearest to the proposed site, is relatively wide and minimally utilized. Lack of accessibility and of convenient parking areas account for the area's low recreational use. In addition, the industry in the area reduces the desirability and aesthetic value of the beach. The nearest county facilities, Hollywood and Silver Strand Beaches, are located 3 miles northwest of the proposed site.

The construction of an LNG terminal at this site would have a minimal impact on recreation. The current industrial nature of the area has already reduced adjacent beach use considerably, and it is unlikely that any additional reduction would occur with the construction of a new facility. Oxnard, then, would be superior to Point Conception in this respect.

Aesthetics

The location of the Oxnard alternative in an industrial area would significantly reduce the aesthetic impact of the proposed LNG terminal. Although the site area is currently used for agriculture, it is committed to eventual industrial development. Therefore, although construction of an LNG terminal would introduce a new industrial facility into the area, the overall aesthetic impact would be minimal. In this respect, the site is significantly superior to Point Conception.

Socioeconomic Considerations

The economic base of Ventura County is composed of agriculture, oil extraction, military activities, and beach front development. The total resident civilian labor force in June 1974 was 180,100 persons. In recent years, the profile of Oxnard's labor force has been changing rapidly toward commercial and industrial activities. Higher earnings in nonagricultural employment have added impetus to the trend away from agriculture.

The availability of housing and a larger labor pool in the area would help eliminate construction impact. Since the Oxnard site is only 60 miles from Los Angeles, skilled laborers could commute, reducing the need for temporary housing. In addition, the major population centers close to the site could provide the essential services needed by operating personnel without significantly expanding existing social institutions or social services.

Archaeological and Historical Resources

The Oxnard terminal site was surveyed for cultural resources by the UCLA Archaeological Survey in 1974. No sites were found on the alternative terminal location. Since most of this tract is used for agriculture, this assessment is probably reliable. Village sites are known near the tract, but the potential impact to these is much less than at Point Conception.

Air Quality

The alternate site at Oxnard is located in Ventura County, which is part of the South Central Coast Air Basin. The portion of Ventura County south of the Los Padres National Forest is designated a "nonattainment area" for PO_x and TSP, indicating that ambient concentrations of these pollutants currently exceed their respective ambient air quality standards. This area has attained the standards for CO and NO_2 and the National primary standard for SO_2.

Recent air quality data for Port Hueneme, located near the alternate site, and for Camarillo about 10 miles inland are summarized below. TSP levels in the vicinity of the site exceed the annual standards and the California 24-hour standard.

AMBIENT AIR QUALITY DATA 1/

1976 SUMMARY

Pollutant	Port Hueneme	Camarillo
I. TSP		
Annual Mean ($\mu g/m^3$)	83.9 2/	74.1 2/
24-Hr. Max. ($\mu g/m^3$)	153	131
No. Primary Standard	0	0
No. Secondary Standard	1	0
No. California Standard	9	15
II. PO_x		
Hrs. Primary Standard	84 2/	113 2/
III. NO_2		
Annual Avg. (ppm)	.024 2/	.025
1 Hr. Max. (ppm)	.17	.17
IV. CO		
1-Hr. Max. (ppm)	-	9
8-Hr. Max. (ppm)	-	3.9
No. 8-Hr. Standard	-	0

1/ California Air Resources Board.

2/ Based on data for partial year.

In 1976, the 1-hour standard for PO_x was exceeded 84 times at Port Hueneme and 113 times at Camarillo. The highest PO_x levels and most hours exceeding the standard normally occur farther inland. The prevailing daytime seabreeze transports the oxidant precursors emitted at coastal locations across the Oxnard Plain and into the interior regions of Ventura County, where subsequent photochemical reactions increase PO_x levels. At night, the prevailing wind reverses direction, transporting pollutants toward the coast. At times, high pollutant levels from the Los Angeles area can spill over into Ventura County and increase PO_x levels. NO_2 and CO levels in the vicinity of the site are within all National and California standards.

Unlike the proposed Point Conception site, the topography of the Oxnard area poses no unusual features which would intercept plumes from LNG tankers or plant process equipment. The local impact on SO_2 and NO_2 levels could be high under some meteorological conditions but should still be within the appropriate ambient standards.

As the most easterly site selected along the Santa Barbara Channel, the Oxnard alternative would cause the greatest increase in regional emissions resulting from LNG tankers traveling a longer distance in the channel. The additional tanker emissions listed below for the proposed project and maximum development would affect both the South Santa Barbara County Air Basin and the southern portion of Ventura County.

LNG TANKER EMISSION INCREASE
(tons/yr)

	PM	SO_2	NO_x
Proposed Project	26	110	44
Maximum Development	39	165	65

As a moving source, LNG tankers would not significantly increase short-period pollutant concentrations at any specific coastal location. The increase in regional SO_2 emissions from tanker transits would contribute to sulfate formation in the region.

As a result of the longer tanker route and the site's proximity to other sources of oxidant precursors, the Oxnard site would have potentially greater impact on regional oxidant formation than either the proposed Point Conception site or the Naples alternate. For the maximum development, project emissions would increase NO_x emissions in Ventura County by about 0.6 percent and by about 1.2 percent for the immediate area of the site (regional statistical area 3). The prevailing seabreeze would transport these emissions into interior regions, where they would contribute to oxidant processes.

Noise Quality

The Oxnard alternate site is located in an area of industrial development. The operational noise levels which have been estimated for this project should conform to the uses of this area and not adversely affect the noise environment.

Safety

The Oxnard site would not meet the population exclusion distance criteria established in the California LNG Terminal Act of 1977.[1/] If such criteria were the only yardstick used to find an acceptable site, Oxnard would be rejected. However, the FERC staff believes that a detailed analysis of the risks at a particular site is superior to the use of arbitrary criteria and has retained the Oxnard site in its analysis. Furthermore, a detailed FEIS has previously been prepared for the Oxnard site which concluded that the risks from LNG operation at that site were acceptable.

For the sake of comparison with other alternative sites and to update that previous risk analysis, the Oxnard site has been included in the risk analysis presented in Attachment A of this EIS. In addition, subsection (f) of this alternative site study compares the public safety of the Oxnard site to that of the other retained alternative sites.

1/ The environmental staff has been advised by staff counsel that Federal law forecloses the state of California from unilaterally determining that certain LNG sites are unacceptable.

e) Pipeline Routes From Alternative Sites

i. Rattlesnake Canyon to Kettleman Route

The most advantageous pipeline route from Rattlesnake Canyon would be one to Kettleman Station, near Avenal in Kings County (figure 55). From the terminal site, this pipeline would go northeast across the Irish Hills to Los Osos Valley and pass north of San Luis Obispo to Highway 101 just south of Cuesta Pass. This section would be 15 miles long, of which 3.8 miles would parallel existing right-of-way along dirt roads above the Pecho Canyon drainage and along Coon Creek Road in the Irish Hills. The pipeline would then follow Highway 101 and the Southern Pacific Railroad across Cuesta Pass for 4 miles, cross the Santa Margarita and Salinas valleys north to Adobe Canyon, and continue north to SCE's 10-inch diameter gas pipeline east of Atascadero. This route segment would be 13 miles long; 9 miles would be new right-of-way. From there the pipeline would follow the 10-inch diameter pipeline 52 miles to a tie-in with PG&E's 34-inch diameter north-south pipeline near Kettleman Compressor Station. All of this segment would be along existing right-of-way. The Rattlesnake-Kettleman pipeline would be 80 miles long. Sixty-one miles, or 76 percent of the route, would parallel existing rights-of-way. Approximately 3 miles of private land within the Los Padres National Forest would be crossed in the Cuesta Pass area where the route would follow Highway 101.

Topography/Soils

The route from the Rattlesnake site would cross topography typical of southern California, as well as the same types of soil as the proposed Point Conception route.

Approximately 49 miles (61 percent of the route) would cross uplands where soils are thin, erosive, and located on slopes up to 50 to 75 percent. Disturbances caused by right-of-way and access road construction would decrease soil stability. Revegetation would be complicated by a high erosion hazard and infertility, shallowness, and droughtiness of the soil cover. Ripping or blasting is generally needed for construction in such areas.

Twenty-five miles of the route would cross soils formed on alluvial deposits in valleys where impact would be minimal. However, most agricultural lands are located in the valleys, and while there would be little impact to the soil from erosion, etc., agricultural productivity could be reduced if the soil profile were altered.

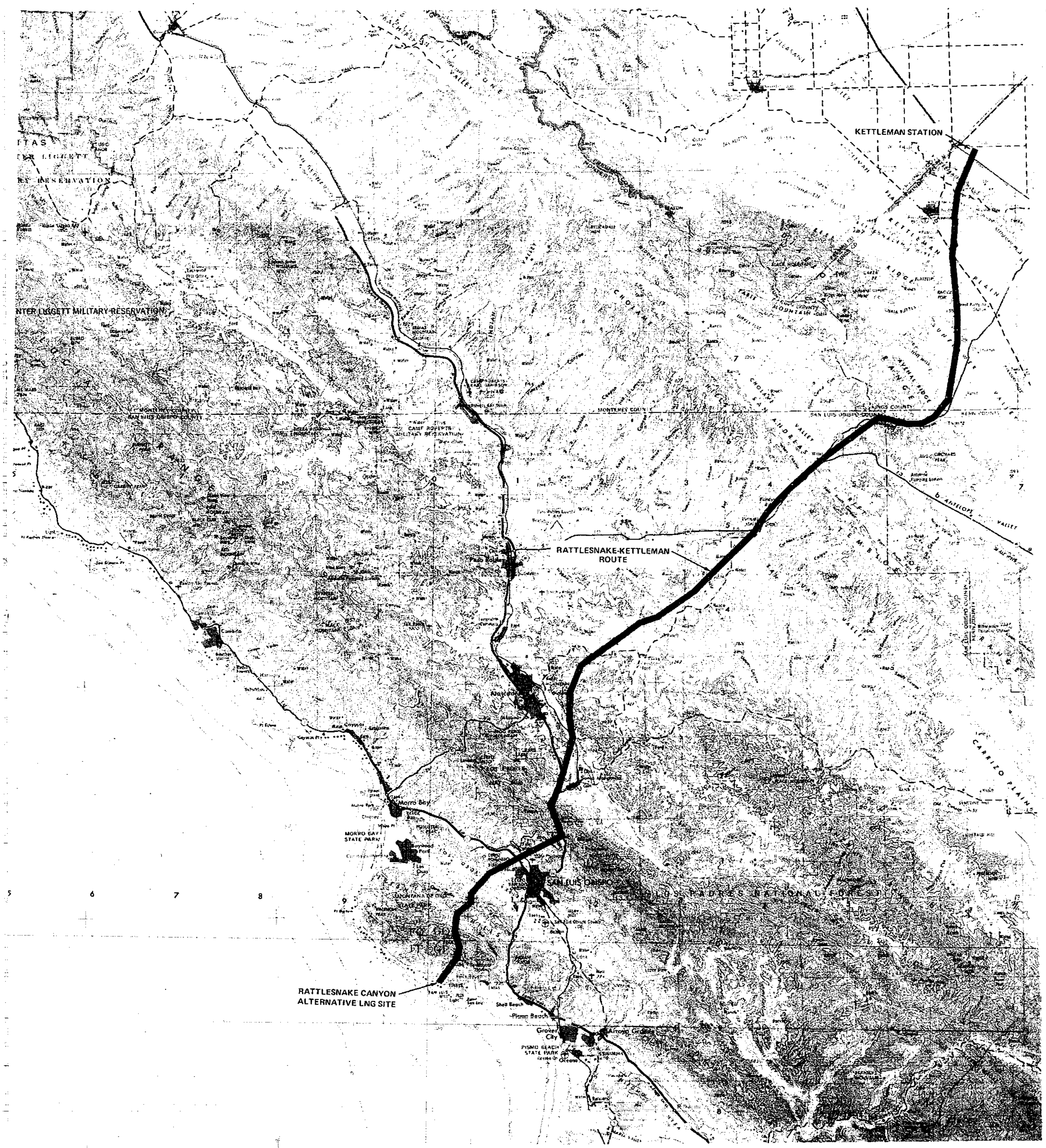


Figure 55: Location of Rattlesnake-Kettleman Pipeline

The remainder of the route, approximately 4 miles, would cross terrace soils. These areas, located along the edges of valleys, separate the valleys from the upland mountains. Generally, slopes are moderate; however, terraces receive runoff from higher elevations, especially in heavy rainstorms, and are susceptible to gully formation. Geologic hazards would be similar to those along the proposed Point Conception route.

Major impacts and problems involving soils (erosion, revegetation, construction in bedrock on thin soils) are directly related to relief or topography. Generally, impact will be most severe in the upland areas. Significant potential for impact also exists in areas where the route would cross or parallel natural drainage channels. The impact in these areas, however, could be lessened considerably by constructing in the dry seasons. The Point Conception route would cross approximately 66 miles of upland soils, while the Rattlesnake route would cross 49 miles. The general soil maps of the counties indicate that both routes would cross roughly the same number of seasonal drainage channels. All other factors being equal, the soil-related impact for the Rattlesnake route would be less than the proposed route by virtue of its shorter distance.

Hydrology

The alternate route from Rattlesnake Canyon to Kettleman would cross three major river basins: the Coastal Drainage Region, the Salinas River Basin, and the San Joaquin River Basin.

The pipeline would stretch 16 miles across the Coastal Drainage Region. One perennial stream--Stenner Creek--and about 15 intermittent drainages would be crossed, none of which are gauged.

The Salinas River Basin drains over 4,100 square miles. The pipeline route would cross the basin in its upper quarter, where all of the streams to be crossed by the route flow intermittently. About 50 such crossings would be required along the 41-mile length of pipeline across the basin. Gauging stations on streams of this basin show no-flow conditions for extended periods each year. Maximum discharges, up to several thousand cubic feet per second, occur in winter and early spring.

About 24 miles of the route would be within the San Joaquin River Basin, where it would cross 18 intermittent streams. There are no perennial streams in the vicinity of the route. Only one of the streams, Avenal Creek, is gauged; its records show the area to be even drier than the portion of the Salinas

River Basin crossed. Average discharge over 14 years was less than 3 cfs, although a maximum discharge record of 2,600 cfs shows that very large flows occasionally occur.

With equivalent erosion control programs, the Rattlesnake-Kettleman route would create less hydrologic impact than the proposed Point Conception route. Not only would the Rattlesnake route be shorter and cross fewer major basins, but the areas it would cross are drier overall than those along the proposed route.

Vegetation/Wildlife

The Rattlesnake-Kettleman pipeline would traverse a wide range of vegetation and related wildlife habitats. In the central coastline area, it would cross mixtures of coastal sagebrush, chaparral, and grasslands much the same as those described along the proposed Point Conception pipeline route. It would encounter mixed evergreen forest on the north side of the Irish Hills. These tree stands are more closely spaced than the sparse woodlands in the central coastal area. Transition zones between forest and chaparral or grassland communities provide habitat for upland game species, including California quail, morning dove, cottontail rabbit, and brush rabbits.

Vegetation utilized for grazing or crop production dominates the foothill woodland areas in the plains of the Salinas Valley. Junipers and blue oak are very common in the less arid hills of the interior. Several species of waterfowl are also common, since this area falls within the corridor of the Pacific flyway.

The final portion of the pipeline would traverse the saline plains of the Cholame Valley and the San Joaquin Valley Province. This province has a semiarid to arid climate; its vegetation consists of herblands and saltbush.

The impact of pipeline construction on vegetation would be qualitatively similar to that described for the applicant's prime route. Clearing of vegetation along pipeline right-of-way in woodland areas would be more critical to wildlife populations than clearing through grassland or chaparral terrain. Grassland and chaparral could reestablish more quickly, whereas woodland vegetation would require considerably longer periods of time before returning to their original habitat characteristics.

Bishop pine stands in the Irish Hills region are at their southernmost distribution. Pipeline construction through these local stands could reduce their southern geographical range.

The Irish Hills also contain some of the tallest oaks and largest manzanitas in the entire San Luis Obispo County.

Pipeline passage through the Cuesta Pass region would affect a few plant species confined to one or several extended population(s). The U.S. Forest Service has designated part of the pass as an official botanical area. Sidalcea hickmannii ssp. anomala is a rare local plant located in a grove of Sargent cypress in the Cuesta Ridge area.

Many of the streams or creeks that would be crossed are intermittent, supporting only sparse amounts of riparian vegetation. Pipeline construction across the Estrella River would produce temporary siltation that would reduce aquatic productivity for a short time.

This pipeline would pass approximately 2 miles northwest of Laguna Lake near the city of San Luis Obispo, which is surrounded by marsh habitat. Pipeline construction would probably not affect this marsh. A heronry located near the lake shore could be affected by construction nearby.

Two endangered species, the California condor and the blunt-nosed leopard lizard, and one rare species, the San Joaquin kit fox, are found in San Luis Obispo County. The condor's local range includes mountainous areas east of San Luis Obispo, which are unlikely to be significantly affected by pipeline construction. The impact of pipeline construction upon the two other protected species would be similar to that described for the applicant's prime route.

Land Use

The 80-mile long pipeline from Rattlesnake Canyon to Kettleman would pass through three counties: San Luis Obispo (57.4 miles), Kern (4.5 miles), and Kings (18.1 miles). The route would cross several types of agricultural land, including 21 miles of cropland and 0.6 mile of orchards or vineyards. The remainder of the pipeline route would cross primarily grazing/open space lands. Nearly 53 miles of the route would parallel an existing pipeline, and 8 miles would parallel road or railroad rights-of-way. In the Cuesta Pass area, 2.4 miles of this route would pass through the Los Padres National Forest. However, the areas actually affected would be privately owned land within the forest boundary.

Should a 100-foot wide construction right-of-way be necessary, 970 acres would be impacted. However, this acreage would probably be reduced where the route would follow the existing gas pipeline.

Primarily because of its shorter length and the reduced acreage required as a result, this route would create less overall land use impact than would the proposed route.

Archaeological and Historical Resources

Topographic maps of a pipeline route from Pecho Creek to Avenal show three obvious areas of potentially major impact to cultural resources. This route would follow U.S. 101 along Santa Margarita Creek, a natural corridor linking the Los Osos Valley and the Salinas River region. Stephen Horne, an archaeologist with the Los Padres National Forest, has confirmed that archaeological resources in this area are likely to be sensitive to construction impact. The wide valley floor of Cholame Creek links the Cholame and San Juan Valleys, while Cottonwood Canyon connects Cholame Valley and Sunflower Valley. These valleys may have been used in prehistoric and historic times for settlement and trade routes. The impact to cultural resources in these three areas would depend on how closely the proposed pipeline paralleled U.S. 101 and the existing pipeline, as well as the degree of disturbance these have already caused to any properties crossed. The impact of pipeline construction along this route would probably be comparable to that along the proposed route from Point Conception, although a quantitative comparison cannot be made without a survey of the Rattlesnake-Kettleman route.

ii. Naples/Dos Pueblos to Quigley Route

The staff has evaluated two feasible pipeline routes for delivering gas from the Naples-Dos Pueblos area to market (figure 43). One route would deliver the gas to the applicant's proposed delivery point at Gosford; the other would deliver it to Quigley in Los Angeles County, a proposed delivery point for gas received at an Oxnard LNG terminal.

The pipeline route from Naples to Gosford would utilize the applicant's proposed Point Conception pipeline route between MP 26, just north of Los Alamos, and MP 112.4, the proposed Gosford delivery point. Between the Naples site and Los Alamos, the pipeline would cross the Irish Hills through either of two natural passes--Gaviota Pass or Refugio Pass. A pipeline from Naples through Gaviota Pass to Los Alamos would be 7 miles longer than a route through Refugio Pass; it would cross more environmentally sensitive coastal ravines, more potential archaeological sites on the coastal terrace, and would pass through Gaviota State Park. Therefore, the route through Refugio Pass would be the best means of reaching the applicant's proposed pipeline route at Los Alamos. The pipeline distance from Naples to Los Alamos would be approximately 31 miles; the entire Naples-to-Gosford pipeline would be 117 miles long.

The Naples to Quigley pipeline route would be 29 miles shorter than the Naples to Gosford route and would deliver gas directly to the vicinity of Los Angeles, one of the state's major markets. Because it would cross fewer upland and undisturbed areas, its impact on soils and the biological environment would be less than that of the Naples-Gosford route. It would have greater land use impact than the Naples-Gosford route because of the extensive urban lands it would cross. Nevertheless, considering its short length and reduced impact on wildlife, vegetation, and soils, the Quigley route would be better for delivering gas received at the Naples/Dos Pueblos site. Therefore, for the purposes of this preliminary evaluation, only the Naples-Quigley pipeline route has been retained for further discussion.

Except for the portion of the route between Point Conception and Naples, which would be deleted, the Naples-Quigley pipeline route (figure 43) would be the same as Alternative D to the Point Conception pipeline (section H.i). From Dos Pueblos Canyon, the pipeline distance to Quigley would be about 88 miles. Short connecting pipelines to stations along the way (La Vista, Castaic Junction) might also be necessary. From these stations, gas could be distributed to the urbanized area of southern California and could also be transported to other parts of the United States.

Topography/Soils

This alternative route would cross fewer upland soils than the applicant's proposed route. Approximately 16 miles of the alternative would cross uplands, primarily on Laguna Ridge and along the side of Santa Paula Ridge. Erosion hazard would be greatest in these areas.

Approximately 26 miles of the right-of-way would traverse terrace soils, which are not highly susceptible to erosion but are susceptible to gully formation if runoff on exposed areas is not controlled.

The majority of the route (46 miles) would cross alluvial valley soils, deep, well-drained soils with a slight potential for erosion. However, river wash soils along major rivers such as the Santa Clara are subject to flooding, scouring, and deposition during and immediately following heavy rainstorms. Soils on the floodplain farther from the river are not subject to this frequent flooding. The valley soils are agriculturally productive, and it appears that this route would cross many orchards. Orchard production on the permanent portion of the right-of-way would be lost for the life of the project, while production on the temporary construction right-of-way would be lost until replanted trees could reach production size. Construction in these agricultural areas would reduce fertility along the trench and interrupt irrigation.

Geologic hazards would be fewer along this route than along the Point Conception route because the pipeline would not cross the San Andreas fault.

Hydrology

The pipeline route from Naples to Quigley would cross the Coastal Drainage Region, the Ventura River Basin, and the Santa Clara River Basin.

Within the Coastal Drainage Region, it would parallel the coast for about 30 miles, where it would cross about 37 intermittent streams and 1 stream which flows perennially in the vicinity of the route crossing.

In the Ventura River Basin, which drains an area of about 200 square miles, the route would cross about 12 intermittent streams and 2 perennial streams--Coyote and San Antonio Creeks. The average annual discharge in Coyote Creek over an 18-year recorded period was 6.36 cfs. The maximum discharge recorded was 8,000 cfs. No-flow conditions occur at times. Lake Casitas is just downstream of the Coyote Creek crossing. San Antonio Creek's average annual discharge is 11.0 cfs, with a maximum of 16,200 cfs.

In the Santa Clara River Basin, which drains 1,612 square miles, the route would cross perennial Sisar Creek and follow the streambed for 2 miles before following the Santa Clara floodplain for several miles. This valley is wide, and much of the streambed is dry. A gauge upstream of the pipeline route records an average annual discharge of 35.7 cfs, with a maximum recording of 68,800 cfs. The route would cross 36 intermittent streams in this basin.

Vegetation/Wildlife

Vegetation along the Naples to Quigley pipeline route consists of coastal sage scrub, chaparral, and agricultural areas such as orange, avocado, and lemon orchards; commercial flowers and truck crops. Because of urban growth along much of the pipeline route, fewer areas of natural vegetation would be affected than along the proposed pipeline.

This route would pass 3 miles south of the Sespe Wildlife Area, part of which is the Sespe Condor Sanctuary--a nesting area for the endangered California condor. Pipeline construction could adversely affect breeding if it were too close to nesting birds. However, since the route would follow Highway 150 and cross an oil field on Santa Paula Ridge--the area where it would pass near the condor sanctuary--the additional activity during construction is unlikely to affect the birds.

Land Use

In Santa Barbara County, the route would cross 4.7 miles of high density, 8.7 miles of medium density, and 4 miles of low density residential areas. In Ventura County, over 2 miles of urban areas would be crossed. Approximately 13 miles of agricultural/rural lands would be crossed in the two counties. The remainder of the pipeline route would affect mainly open/grazing land.

Approximately 58 miles of this route (68 percent) would follow highway or railroad rights-of-way, and part of the remainder would cross oilfields or other disturbed areas. An estimated 908 acres of right-of-way would be required, assuming that right-of-way width would be reduced by half in crossing urban areas. The route would require 121 acres of right-of-way in urban areas, the severest land-use impact of any of the pipeline routes considered. However, this impact could be substantially mitigated by adhering to the railroad right-of-way through Santa Barbara. Although 5.8 miles of the Los Padres National Forest would be crossed, only 1.1 miles of the land is actually owned by the Forest Service; the rest is private.

Cultural Resources

This route would follow U.S. 101 and the Southern Pacific Railroad to Santa Barbara through an area likely to contain many cultural properties. East of Santa Barbara, the route would pass through the Pueblo Lands of Santa Barbara, which have a number of known sites that would be directly impacted. Inland California prehistoric sites are reportedly easier to avoid, but several areas, including the Ojai Valley and the Santa Clara River Valley, may have a relatively large number of sites.

iii. Oxnard to Quigley Route

The staff's previous impact analysis of the proposed LNG terminal at Oxnard included a detailed evaluation of a proposed pipeline from Oxnard to Quigley. (See Pacific Indonesia Project: FEIS, 1976, and figure 43 of this EIS.) Briefly, the pipeline proposed for this earlier project would have delivered 550 million Mcfd to La Vista Pressure Limiting Station, 12.4 miles from the Oxnard terminal, through a single 42-inch diameter pipeline. Ultimate development of the terminal to 4-Bcfd capacity would have required twin 42-inch diameter pipelines to Quigley. Should the Oxnard site be utilized for the presently proposed smaller project, a single 53.5-mile pipeline to Quigley would probably be sufficient. Certain volumes could be taken off-line at the La Vista Station to facilitate distribution.

Topography/Soils

Approximately 36 miles (67 percent) of this pipeline route would cross upland or loose terrace soils with high erosion potential. The rest of the route would cross either highly productive soils of the Oxnard Plain or valley soils in the Santa Clara Basin. Construction impact on the upland soils would be somewhat mitigated since the route would parallel an existing 34-inch diameter gas pipeline and could use parts of the existing right-of-way.

Hydrology

The Santa Clara River is the only major waterway which would be crossed; eight drainage channels of the Oxnard Plain would be crossed, as well as a number of intermittent washes along Oak Ridge. The pipeline would have no significant effect on hydrologic resources.

Vegetation/Wildlife

Beyond the agricultural Oxnard Plain, the pipeline would traverse grassland, coastal sage scrub, chaparral, oak woodland, and riparian woodland plant communities similar to those along the Point Conception pipeline route. Half the pipeline would cross sage or chaparral communities, and about 10 percent of the route would cross oak or riparian woodland. Wildlife in these habitats would also be similar to corresponding habitats along the Point Conception pipeline. The biologic impact of pipeline construction along this alternate would not differ qualitatively from impact associated with the applicant's proposed pipeline. However, total impact would be considerably less because the Oxnard pipeline route would be shorter, would follow existing rights-of-way in traversing most of the natural vegetation, and would cross a proportionately greater amount of agricultural or other disturbed lands.

Land Use

Over 18 miles of this route would cross prime agricultural lands of the Oxnard Plain. Most of the rest of the route would cross general open space/grazing land, with small inclusions of agriculture or oil fields. Small amounts of commercial and industrial lands might be affected in the Saugus-Newhall area. The route would parallel 41 miles of existing pipeline rights-of-way, and most of the route in the Oxnard Plain would parallel roads. Thus, existing rights-of-way would be used for much of the required construction space, considerably reducing the impact this pipeline would have on land use. Assuming a 100-foot wide construction right-of-way, about 650 acres would be affected during construction.

Cultural Resources

The alternative pipeline route was also investigated by UCLA. (See section B.10.) Site records checked by the CPUC study for the Point Conception project show that the corridor from Oxnard to Castaic Junction has fewer recorded cultural resources than the proposed Point Conception pipeline. Two historic villages and several rock shelter sites are within the corridor, as is one National Register property, the "CSO" 4 oil well.

f) Comparison of Impact

i. Topography and Geology

The Point Conception site and pipeline route would require the most cut and fill operations and have the greatest erosion potential of all the sites; Oxnard would have the least. The Rattlesnake Canyon, Naples, and Dos Pueblos sites are more level than the Point Conception site. Although filling of gullies would be necessary on all four sites, Rattlesnake, Naples, and Dos Pueblos would require less cut and fill for pipeline and access road construction. Oxnard would require the least site preparation and the least pipeline construction through uplands.

The greatest seismic hazard at Oxnard would be the liquefaction potential of the soil. However, the site is further from significant faults than all the other sites and would have the least seismic hazard. Seismic hazard at the Naples and Dos Pueblos sites might be the same as at Point Conception because of each site's proximity to active or potentially active faults. Hazard from seismic events at the Rattlesnake Canyon site would be less than for the Point Conception site.

ii. Soils

Soils at Oxnard appear to be the best suited for a terminal site. The site is nearly level, would require minimal excavation and site leveling, and has little potential for erosion. The major limitations of the Oxnard site are water-related. Excavation and construction would intersect the high water table, thereby necessitating groundwater pumping and/or artificial drainage to lower the water table. Also, structures to prevent periodic flooding of the site might be needed.

The other sites, including Point Conception, are not limited by high water tables or flooding; however, they would require more excavation and grading. The shrink-swell and soil strength and stability ratings for their soils indicate they have slightly greater limitations for construction of commercial buildings, dikes, and embankments.

The Oxnard pipeline would cross upland and terrace soils having moderate to high erosion potential and highly productive soils of the Oxnard Plain and Santa Clara River Valley.

Although erosion hazard is slight on these valley soils, areas close to rivers or natural drainage ways are subject to scouring and cutting during and after heavy rainstorms. Much of the impact through the nonagricultural portions of the route would be mitigated by the fact that the Oxnard pipeline would parallel an existing right-of-way. The route from the Naples and Dos Pueblos sites to Quigley would be similar, although longer than the Oxnard pipeline. The Rattlesnake Canyon to Kettleman route would be similar to the Point Conception pipeline route, but shorter by 31.7 miles.

iii. Water Resources

Although the hydrologic characteristics of the Rattlesnake Canyon, Naples, and Point Conception sites are similar, use of groundwater in operating the Point Conception facilities might impact the water supply of adjoining Hollister Ranch properties. Access road construction at Point Conception would require fill in a greater number of coastal ravines than would be required at Rattlesnake Canyon or Naples.

Oxnard is distinct from these sites in having a near-surface water table which would probably necessitate dewatering the site foundation. This could lead to temporary drying of an adjacent marsh. Dewatering would not affect the abundant adjacent irrigation and potable water supplies.

The pipeline from Oxnard would clearly produce less hydrologic impact than pipelines from the other sites, since the Oxnard pipeline would cross about half as many water courses. The pipelines from Rattlesnake Canyon or Naples would cross approximately as many watercourses as would the Point Conception pipeline.

A terminal at Oxnard would have far less impact on marine water resources than at the other sites. The shared seawater discharge system proposed for the Oxnard facility would preclude the need for additional seawater extraction and might lessen the present impact of the power station's seawater system by lowering the temperature differential between the seawater effluent and ambient seawater. Facilities at Naples or Point Conception would have similar, intermediate impact on marine waters stemming from construction-related turbidity and the cold-water plume. A facility at Rattlesnake Canyon would have the highest impact on marine waters. The required breakwater would cause additional turbidity and sedimentation and could affect local current patterns.

The Oxnard site would have the least impact on water resources. Terminal facilities at Naples/Dos Pueblos would have slightly less water resource impact than Point Conception or Rattlesnake because relatively little access road construction and no breakwater would be necessary.

iv. Vegetation

Of the four sites being considered, Oxnard would experience the least vegetation impact from an LNG facility because the site has little natural vegetation, the marine flora is poorly developed, and the pipeline is shortest.

Naples/Dos Pueblos would be the next most acceptable site for vegetation impact. The site vegetation is comparable to the other coastal terrace sites, but a pipeline route is available which would traverse a greater percentage of disturbed areas and is intermediate in length. In addition, the marine flora is poorly developed offshore of Dos Pueblos Canyon. Naples Reef, with a large kelp bed, could be avoided.

Rattlesnake Canyon would be less acceptable than Naples/ Dos Pueblos because the marine flora is relatively rich there and the pipeline would cross at least two potentially sensitive vegetation areas--the Irish Hills and Cuesta Pass. In other respects, facilities at these two site areas would entail similar vegetational impact.

An LNG terminal at Point Conception would have the most serious impact on vegetation. The marine facilities would directly influence one of the most productive kelp beds in the state. The proposed pipeline from Point Conception is the longest and would use little existing right-of-way; ridge-cutting along this route would have substantial vegetation impact.

v. Wildlife

The least impact on terrestrial wildlife of any of the sites would occur at Oxnard. Although two endangered bird species frequent the adjacent salt marsh and strand, impact on them would probably be temporary. The relatively short pipeline from Oxnard to Quigley would pass primarily through disturbed areas and have only minor wildlife impact. A terminal at Oxnard would also have the least impact on aquatic wildlife. Marsh wildlife would be affected temporarily, but the shared seawater system would produce no additional entrainment of marine organisms. The area also has relatively sparse marine life.

A terminal at Rattlesnake or Naples would be the next most acceptable for wildlife. The sites are more agricultural than Point Conception, and the pipelines would disturb less habitat than Point Conception's pipeline. The Naples to Quigley route would create less wildlife impact than the Rattlesnake pipeline. However, the shore near both sites is apparently frequented by harbor seals, and sea otters occur near Rattlesnake. The Naples area supports the larger recorded seal population. Both sites have offshore reefs. Rattlesnake probably has the richer marine biota because of its diverse intertidal vegetation and would probably suffer more significant entrainment losses than Naples but less than Point Conception. Impact from breakwater construction would be serious but temporary. Following construction, the breakwater would serve as additional reef-like habitat for marine organisms.

At Point Conception, the terrestrial wildlife impact would probably be most adverse. The site is presently the least disturbed and supports the most diverse, abundant wildlife. The proposed pipeline is the longest and would use relatively little existing right-of-way. Marine fauna impact would probably be greatest at Point Conception. The seawater intake would be located in or near well-developed kelp beds, and the particularly diverse marine fauna of the area would probably experience more significant entrainment losses than would occur at the other sites.

vi. Socioeconomic Considerations

The primary differences in socioeconomic impact would occur during construction of the project because construction costs and employment requirements would differ, as would the ability of the communities surrounding the alternative sites to provide the labor, housing, transportation services, and field materials required. The magnitude of operations impact would be similar in each community.

The availability of construction labor within daily commuting distance of the terminal site is a major element determining impact. The proposed Point Conception site could draw on the labor supply from both northern and southern Santa

Barbara County, and with a more extended commute, from Ventura County. New permanent residents would be few, although a significant number of long-distance commuters would remain in the county during the work week. The least impact would occur at Oxnard, which is within the large Ventura County labor pool and can draw on the large Los Angeles pool. The availability of labor at the Naples and Dos Pueblos sites is similar to that of the Point Conception site, except that accessibility is greater at Naples/Dos Pueblos. The Rattlesnake Canyon area would experience greater impact, since it is more remote from the Ventura County labor pool than Point Conception and would depend largely on Santa Barbara and San Luis Obispo counties.

In general, construction housing availability appears adequate for all the sites.

Impact on the local economic base would be least where there is presently a large, diversified base capable of absorbing both the project's local purchase requirements and the impact of employee expenditures. The economic base of Santa Barbara County is moderate in size compared for example to Los Angeles County; little inducement to expansion is expected from the Point Conception project. Least impact would be expected at Oxnard because of the larger economic base of Ventura County. Impact from a terminal at the Naples or Dos Pueblos site are expected to be indistinguishable from those at the proposed site. Again, Rattlesnake Canyon would receive the greatest stimulus from this project, since it is farther from the metropolitan base of Santa Barbara and the coast southward.

The revenues from the project would be greater than local costs in all cases. Its impact would depend on the size of the population and economic base near a particular site. It would be least for Oxnard, greatest for Rattlesnake Canyon, Point Conception, Naples, and Dos Pueblos.

Relative impact on the transportation services at the alternate sites are a combination of two factors: the system changes required to accommodate the additional transportation of labor and materials and the residual impact on those presently using the system. The site's proximity to rail service for moving equipment and materials and to good roads and highways for the commuting labor force is important. Point Conception has excellent access rail service, but it would require a difficult 10-to 12-mile long access road through a private ranch, and adverse short-term impact on the existing road could be major if not mitigated. Naples, Dos Pueblos, and Oxnard have equally excellent access to rail service. The Naples and Dos Pueblos sites would require improving approximately 2 miles of access roads. Oxnard is presently served by an extensive street system; however, traffic at peak construction periods might require some street widening and signal installation. The Rattlesnake Canyon site already has an existing access road which would be adequate to handle movement of equipment and materials; there would be no rail service to this site. Pipeline construction would necessitate extensive access roads on all routes through undeveloped areas. Principal impact would be in urbanized or significant environmental resource areas, as noted in "Land Use."

vii. Land Use

The primary contrast in the sites is between Oxnard, an urban industrial location, and the other sites which are all remote from population and urban development. The project at Oxnard would be highly compatible with the existing and potential industrial use of land near the site. Immediately adjacent to the site is an electric power plant that offers cryo-utilization opportunities. Although residential and recreation areas are nearby, this project would not generate new land use conflicts with its neighbors, particularly in comparison with the other sites.

Agricultural uses, particularly cattle grazing, are also highly compatible with the project and are characteristic of the Rattlesnake Canyon, Naples, and Dos Pueblos sites. In the past, grazing was the prevailing land use at Point Conception, but that area's recreation potential and visual character are now the primary determiners of its land use value. However, the Rattlesnake Canyon site and access road may soon be owned and controlled by PG&E, and in that event, the impact of constructing the project there would be less than at either the Naples or Dos Pueblos sites, since over 1,000 construction personnel presently utilize the access road daily.

The greatest conflict in land use would exist at Point Conception. It is within an undeveloped coastal area and considered a particularly valuable coastal open space resource because of its size, lack of development, natural beauty, and recreation potential.

Land use impact from the pipelines serving each terminal alternative are determined largely by length of the pipeline through populated areas with structural development or significant environmental resources such as national and state forests, parks, etc. Impact to crop farming is generally less significant, although damage to orchards and vineyards can last several years. Utilizing existing pipeline right-of-way would also lessen environmental impact. The Oxnard route would parallel or follow existing rights-of-way its entire distance. The proposed Point Conception pipeline, on the other hand, would traverse some 13 miles of national forest land. Land use along the various alternative routes is shown below. The numbers in parentheses indicate the percentage of the route which would follow or parallel existing rights-of-way.

LAND USE ALONG ALTERNATE ROUTES
(miles)

Land Use Category	Point Conception	Oxnard	Rattlesnake	Naples/ Dos Pueblos
Grazed/ General Open	73.2	23.4	58	54.6
National Forest, etc.	13	0	0	1
Intensive Agricultural	8.0	14	22	13
Oil Field	17.5	0	0	-
Urban/ Residential	0	16	0	19.4
	111.7 (8%)	53.4 (100%)	80 (76%)	88 (68%)

viii. Aesthetics

Visual impacts are closely related to land use, in that they influence land use development patterns and are themselves defined in part by contrast to land use character. Significant impact would occur at all the sites, although Oxnard would experience the least adverse visual impact.

The Point Conception area is noted for its unspoiled natural beauty. The project would contrast harshly with this setting and would be highly visible along and off the coast and from a growing number of dwellings on the hills behind the site. The resident population is limited, however, and no heavily traveled highway has a major exposure to the site.

The Naples and Dos Pueblos sites would be highly visible from Highway 101 and along the coast. However, the site areas are primarily used for agriculture and nearby oil-related activities; they do not constitute an area of unspoiled natural beauty. The Rattlesnake Canyon site would not be visible from any major highway, and the existing access road is closed to the general public. The facilities, as at the other sites, would be visible from off the coast but not necessarily along the coast.

The Oxnard site, in contrast, is in an industrial area close to an existing fossil fuel power plant. The onshore facility would be visible from urban areas to the north and northeast and from the beach, but would only reinforce an existing visual condition rather than initiate a change. The marine facilities, however, would have major visual impact along the shoreline.

Aesthetic impact from the pipeline would be relatively minor compared to that of the terminal, and in most cases it could be mitigated.

ix. Archaeological and Historical Resources

Comparing the alternative sites for potential loss of cultural resources, Oxnard would incur the least damage. No cultural properties were found by a survey of the potential site, and the pipeline could probably be routed to avoid a large percentage of sites along the final alignment.

Point Conception and Rattlesnake Canyon are nearly equally undesirable. Although Rattlesnake Canyon is a National Register property, the Point Conception site will undoubtedly qualify for that designation and may be of higher scientific significance. It is unlikely that the plan under consideration to rearrange the proposed plant layout would avoid impact to the Point Conception site because of the locations of the temporary construction yards. An access road to Rattlesnake Canyon would cause much less damage than one to Point Conception. Impact of a pipeline from Rattlesnake Canyon could be higher than for the proposed route from Point Conception.

The Dos Pueblos Canyon locations would rank between Oxnard and the other two. Although no surveys have been made of the Naples-Dos Pueblos sites, they are in a high-density prehistoric area. However, any sites there would not have been as well protected from vandalism as those at Point Conception and Rattlesnake Canyon. Although there would be few impacts because of increased accessibility, the pipeline route from Naples to Quigley would include several miles of the very sensitive coastal terrace and a portion of the Pueblo Lands of Santa Barbara.

x. Air Quality

The Rattlesnake Canyon, Naples, Dos Pueblos, and the Point Conception sites are located in areas where topography would have a major influence on the behavior of plumes from plant equipment and LNG tankers. The Oxnard site has no unusual topographic features which would affect pollutant dispersion. Local impact should be within the standards.

The proposed Point Conception site and the Rattlesnake Canyon alternate site are located in remote areas and would have an insignificant impact on regional air quality. The Naples, Dos Pueblos, and Oxnard alternate sites are located near the more urbanized areas of their air basins. NO_x emissions for these sites would make a slight contribution to oxidant formation in their respective regions. Although the contribution of a single source to regional PO_x levels cannot be accurately quantified with the available models, the additional NO_x emissions for the Naples and Oxnard alternate sites would be contrary to regional strategies for attaining the PO_x ambient standards. The increased SO_2 emissions from the longer tanker routes to the Naples and Oxnard alternate sites would also contribute to regional sulfate levels.

The gas transmission pipelines for the proposed and alternate sites would have no operational impact on air quality.

xi. Noise Quality

Operational noise levels from the regasification equipment of the LNG plant would blend in with background noise levels within a mile of the plant site in rural or remote locations and at much closer distances in areas having a higher noise environment. An LNG plant would not adversely affect noise quality at any of the alternate or proposed sites.

The gas transmission pipelines for the proposed and alternate sites would have no operational impact on air quality.

xii. Safety

A comparison of risk to the public from the marine transportation of LNG at the three retained alternative sites and Point Conception does not reveal any clear-cut advantage or disadvantage at any of the sites. The risk analysis performed by the staff shows that the risk at all the sites would be on the order of 10^{-7} fatalities per exposed person per year. This order of magnitude of risk is equivalent to the risk from natural events such as hurricanes, lightning, and tornadoes.

It is generally agreed that an LNG terminal at a remote location would be safer than a terminal that is nearer population concentrations. The staff does not dispute this generalization, but points out that a well-designed LNG terminal at Rattlesnake Canyon, Naples/Dos Pueblos, Oxnard, or Point Conception could be operated in a manner which would not pose an unacceptable hazard to local populace.

g) Summary

Of the potential LNG sites analyzed in this study, Oxnard emerges as the clear choice on environmental grounds. (See table 55.) The California siting law would eliminate this site on what appears to be an arbitrary criteria of population density. The staff disagrees that the public safety issue should be determined by population density alone. A detailed risk analysis, such as performed by the applicant and independently performed by the staff, is a reliable and more thorough analysis than that of the California siting law. The conservative risk analysis performed by the staff shows that the risk at all the sites would be on the order of 10^{-7} fatalities per exposed person per year. This risk is equivalent to the risk from natural events such as hurricanes, lightning, and tornadoes.

Of all the other sites considered, including Point Conception, the Rattlesnake Canyon site with the required breakwater would create the least adverse environmental impact. The Naples and Dos Pueblos sites, while comparable in most impact areas to Rattlesnake Canyon, are unattractive because of their proximity to a potentially active fault and other possible active faults in the area. This is particularly true of the Dos Pueblos site. The Point Conception site, as proposed, is eliminated due to the presence of an active fault on the plant property.

The California Coastal Commission also stated that the Point Conception site would have been eliminated from their site selection ratings due to the presence of an active fault at the site; however, the Liquefied Natural Gas Terminal Act of 1977 precluded that action. Since it is the applied-for site, it must be ranked by the Coastal Commission. Exactly why the site could not have been ranked "unacceptable" is not known to this staff.

The four sites ranked by the CCC in descending order are Camp Pendleton, Rattlesnake Canyon, Point Conception, and Deer Canyon. Yet, CCC notes that the third place ranking does not take into account the confirmed presence of a potentially active fault on the site because this fact would have caused the CCC to eliminate the site from consideration. The CCC also stated that if the CPUC does not impose the 31 CCC conditions recommended for a terminal

TABLE 55

RANKING OF ALTERNATIVE SITES BY ENVIRONMENTAL IMPACT

	Topography and Geology	Soils	Water Resources	Vegetation	Wildlife	Socioeconomic Impact	Land Use	Aesthetic Impact	Cultural Resources	Air and Noise Quality	Safety
LEAST ADVERSE IMPACT	Oxnard	Oxnard	Oxnard	Oxnard	Oxnard	Oxnard	Oxnard Rattlesnake Canyon	Oxnard Rattlesnake Canyon	Oxnard	Oxnard Point Conception Rattlesnake Canyon Naples/ Dos Pueblos	Point Conception Rattlesnake Canyon Naples/ Dos Pueblos Oxnard
INTERMEDIATE ADVERSE IMPACT	Rattlesnake Canyon	Naples/ Dos Pueblos Rattlesnake Canyon	Naples/ Dos Pueblos	Naples/ Dos Pueblos	----	Naples/ Dos Pueblos Point Conception	Naples/ Dos Pueblos	Naples/ Dos Pueblos	Naples/ Dos Pueblos	----	----
GREATEST ADVERSE IMPACT	Naples/ Dos Pueblos Point Conception	Point Conception	Rattlesnake Canyon Point Conception	Rattlesnake Canyon Point Conception	Naples/ Dos Pueblos Rattlesnake Canyon Point Conception	Rattlesnake Canyon	Point Conception	Point Conception	Point Conception Rattlesnake Canyon	----	----

at Point Conception, the site would be ranked fourth with Deer Canyon then be ranked third. Since the CCC rankings, the CCC has formerly intervened in the FERC proceedings since part of their 31 conditions were not adopted by the CPUC

The California LNG Terminal Act of 1977 presents a legal controversy of state versus Federal jurisdiction over approval of facilities such as an LNG terminal. It is not the purpose of the staff's EIS to resolve this issue, but it is an issue worthy of recognition and comments. If appropriate Federal authorities decide that the California LNG Terminal Act of 1977 and its population exclusion distances will be accommodated by the Federal Government, then the staff's consistent support of Oxnard as the environmentally superior site would be moot, since Oxnard would then be excluded as an acceptable site. In this event, the staff believes that the Rattlesnake Canyon site would rank as the next best environmental choice for the LNG terminal. (See section I of this EIS, "Conclusions and Recommendations.")

A further note on the subject of site selection and seismic criterion should be addressed. In the event that the staff relaxed its siting criteria that LNG terminals not be located on or adjacent to active faults (and staff is by no means advocating a relaxation of its criteria) the Point Conception site would still be ranked last. The ranking in descending order would be Oxnard, Dos Pueblos/ Naples, Rattlesnake Canyon, and Point Conception.

3. Alternate Terminal Access Roads and Systems

Of the various means of access to the site during construction and operation, a road for vehicles would be the most reliable and effective. Other options such as a railroad system for personnel and supplies or a barge transport system, discussed more fully in subsections of this analysis, would be influenced more by weather conditions, scheduling, and breakdowns; they would also have much less flexibility, resulting in delays and reducing reliability.

This section also discusses alternative access road routes along both the Hollister and Bixby Ranch properties on the coastal terrace and access roads paralleling the proposed and alternate pipeline routes which proceed north from the terminal site and traverse the Santa Ynez Mountains to intersect Highway 1. In addition, a discussion of the applicant's bus transport proposal and staging area is presented, along with a discussion of the potential benefit of expanding that bus service.

a) Barge Transportation

The applicant proposes to use barges to transport materials and equipment which are required for the offshore facility construction. Transporting personnel and/or equipment needed for the onshore facilities by barge would require construction of major unloading docks at Cojo Bay, with a roadway access through the cliffs at Cojo Bay up to the site, and at another staging area, possibly at Gaviota or Santa Barbara. Additional vehicles to transport personnel from an unloading dock at Cojo Bay up to the site might also be required. A breakwater at Cojo Bay to protect the barges and dredging close to shore might also be required. Good weather and oceanographic conditions would be essential to this transportation plan. Therefore, heavy reliance on barge transportation, except for the offshore facility construction, is not a reasonable or reliable alternative to an access road and railroad shipments to the site.

b) Railroad Transportation

At present, the applicant proposes to transport much of the material and equipment to the terminal site by rail. The applicant expects that an average of 10 railcars per day would be required and peak constructions would require about

14 railcars each day. During construction, an overall total of about 5,200 railcars, averaging 25 tons of cargo each, would enter the site from Southern Pacific Transportation Company's (Southern Pacific) mainline via a spur line to be constructed on the terminal site. The applicant has indicated that rail shipments would be used to the maximum extent possible to deliver materials and equipment to the site.

In its report, "Construction Site Access and Transportation Plan," the applicant's consultants have indicated that primary rail transport of all materials and equipment to the site would be feasible, although it would result in higher overall transportation costs. 1/ Primary rail transport would be accomplished by establishing an intermodal transfer point (ITP) at the Los Angeles terminal of Southern Pacific's trucking subsidiary, Pacific Motor Trucking Company (PMT). Small railcar loads and truck shipments could be consolidated into full railcar shipments at the ITP for transfer to the site. PMT's terminal is located a few miles north of downtown Los Angeles and is therefore centrally located in the Los Angeles freeway system. Truck shipments from suppliers in the Los Angeles Basin could easily be routed to the PMT terminal for transfer to railcars. Routing truck shipments to the PMT terminal for rail shipment to the site instead of implementing the direct truck shipment presently proposed would reduce truck traffic on the highways north of Los Angeles, eliminate conflicts between the trucks and other traffic in Gaviota Beach State Park, and significantly reduce overall use of the access road and the air and noise impact associated with the truck transport.

Although almost all of the presently proposed truck traffic to the site can be eliminated, it would be impractical to reroute supplies from areas north of Los Angeles (i.e., Santa Barbara or Ventura) by truck to Los Angeles for rail shipment to the site. In addition, the need for certain priority supplies could justify routing a few trucks (perhaps fewer than five per day) directly to the site. Some type of reliable access road should be available for such special circumstances.

1/ Fluor Engineers and Constructors, Inc., 1978.

In commenting on the DEIS, a number of major intervenors suggested transporting construction laborers to the site by rail, thereby eliminating the need for an access road. The staff believes that this would not be a prudent alternative for a number of reasons. The first and possibly the most significant is that both Southern Pacific and Amtrak have issued statements that put an end to further debate. Amtrak has indicated that its charter does not allow short commuter operations and that it is restricted to intercity transportation. 1/ Southern Pacific has indicated that fixed rail transport for such a few people is not financially feasible and that the company policy opposes contracting for passenger service. 2/ Southern Pacific has indicated that such passenger service could also have an adverse effect on freight train schedules.

In addition to these problems, there would be a logistics problem in transporting all the workers to the site via railroad. Multiple rail trips from a staging area to the site would not only be impractical and probably uneconomical, but would also increase the chances of interfering with the existing freight trains which use the Southern Pacific Railroad. In addition, transporting the workers by rail would require a staging area consisting of parking space and a loading platform for the laborers. Another spur line might be needed to serve the staging area; at the terminal site, an additional spur line could be required to handle the passenger trains if conflicts between the passenger cars and freight deliveries occurred. There would not be any advantage to using the Lompoc Valley Spur Line, since the staging area and its associated impact would only be shifted to the Lompoc area. The commuter trains would still be required to travel via the Southern Pacific mainline. This alternative staging area would also significantly increase the driving time and expense for the majority of the workforce (79 percent) which will come from east of the site. Furthermore, the 27-mile railroad trip from Lompoc to the site would be more likely to interfere with other rail traffic on Southern Pacific's mainline than a shorter rail transit from Gaviota to the site.

1/ Staff counsel has confirmed this fact.

2/ Staff counsel notes that Southern Pacific is also attempting to eliminate its passenger service in the San Francisco area.

Finally, both the barge and/or railroad transportation schemes have a major disadvantage because their inflexibility would severely hamper deliveries of materials, equipment, and/or personnel to the site. A fairly rigid schedule of trips to and from the site would be required, and economics may dictate that only one or two trips each way could be allowed per day. This sort of rigid restriction does not and probably cannot adjust for the oftentimes unforeseen, immediate need for specialized equipment or personnel which can develop on a jobsite.

c) Applicant's Alternate Access Routes

To accommodate low volume automobile traffic, special deliveries, and other circumstances when it would be impractical to arrange a special train or barge shipment, an access roadway would be needed to supplement the rail and/or barge transportation service. Certainly during operation of the LNG terminal--and probably during construction--it would be desirable, if not absolutely necessary, for emergency vehicles to have quick and reliable access to the site. Therefore, if the project is approved, an access road would be a necessary and possibly vital part of the terminal's construction and safe operation.

The applicant's consultant, Fluor Engineers and Constructors, Inc. (Fluor), has recommended that the access road have 24-foot wide pavement and 8-foot wide unpaved shoulders and be designed for a wheel load of 16,000 pounds. A cross section of the roadbed design is shown in figure 56.

The original access road proposal called for a 40-mph design speed road paralleling the railroad from Gaviota Beach State Park to the site. This route is no longer proposed by the applicant, nor is it supported by any party to the proceeding. In general, it was readily apparent that significantly superior alternatives to that route were available. The applicant's second proposal was the Improved Hollister Route with a design speed of 40 mph. This was originally identified as an alternative to the railroad access road proposal. As of March 27, 1978, however, the applicant has proposed a further modification of the Improved Hollister Access Road plan. In this latest proposal, construction

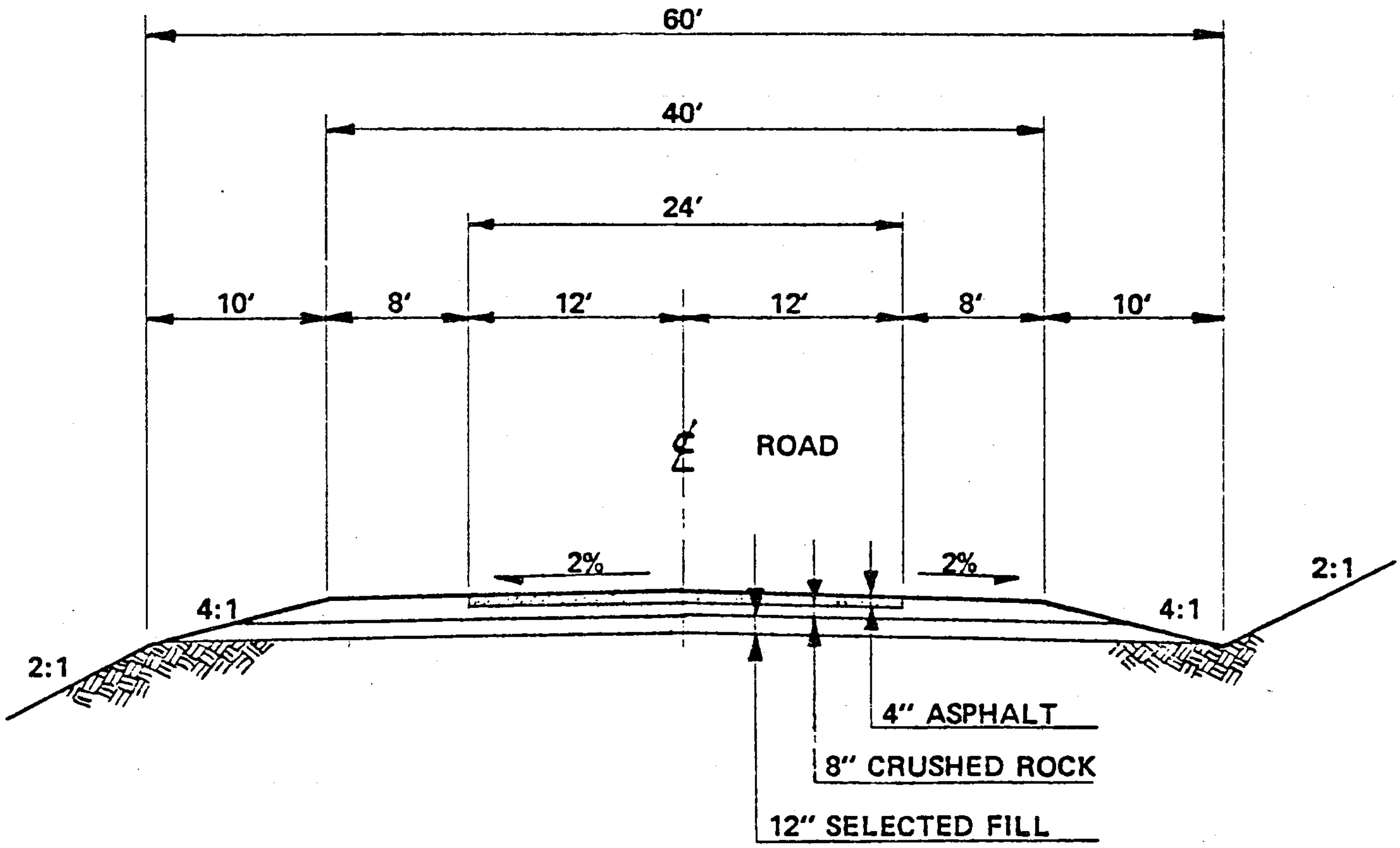


Figure 56 : Cross Section of Proposed Access Road

workers would assemble at a staging area to be constructed at a point about 1 mile east of Gaviota Pass, on property north of Highway 101 and adjacent to a small commercial complex. From this area, the workers would board buses and be transported to the LNG terminal site. This would require about 40 to 50 buses at the peak of construction, which is estimated to last about 3 months.

This current proposal would coincide approximately with the Improved Hollister Route, but it would be about 11.3 miles long and the design speed would be 25 mph instead of 40 mph. Reducing the design speed has apparently reduced the "new road" requirements for modifying the existing roadway on the Hollister property. A total of about 29 locations on the existing road would now require either regrading or increasing the radius of curvature for lengths of 100 to 800 feet. A new roadway surface would also be needed for the 25-mph Improved Hollister Route. At Canada de Alegria and 1 mile west of there, the road speed would remain 5 mph to avoid extensive fill requirements in the coastal canyons at these locations.

Construction of the 25-mph Improved Hollister Route would take about 60 workers 4 months to complete. The staging area where the laborers would board buses to the site would encompass about 12 acres of undisturbed land and would probably necessitate some modifications to entrance and exit turn lanes on Highway 101. An additional 60 acres of previously undisturbed habitat in a zone 75 to 200 feet wide would be affected by the improvements for the 25-mph Improved Hollister Route. Herbland with some coastal bluff vegetation and woodland would be impacted. Two rare or endangered animal species, 1 rare or endangered plant species, and 9 archaeological sites could be affected by the improvement.

The three alternative access routes presented here are alternatives to the latest proposal and are also described in Exhibit ICM-1, "Preliminary Environmental Impact Assessment--Proposed Access Road Route, Point Conception, California," prepared for Western LNG Terminal Associates.

Fluor's report for Western studied three alternative access road routes. (See figure 57.) The Railroad Route would parallel the existing Southern Pacific Railroad on a new right-of-way for about 10.6 miles from Gaviota to the site; the Improved Hollister Road would follow the existing private

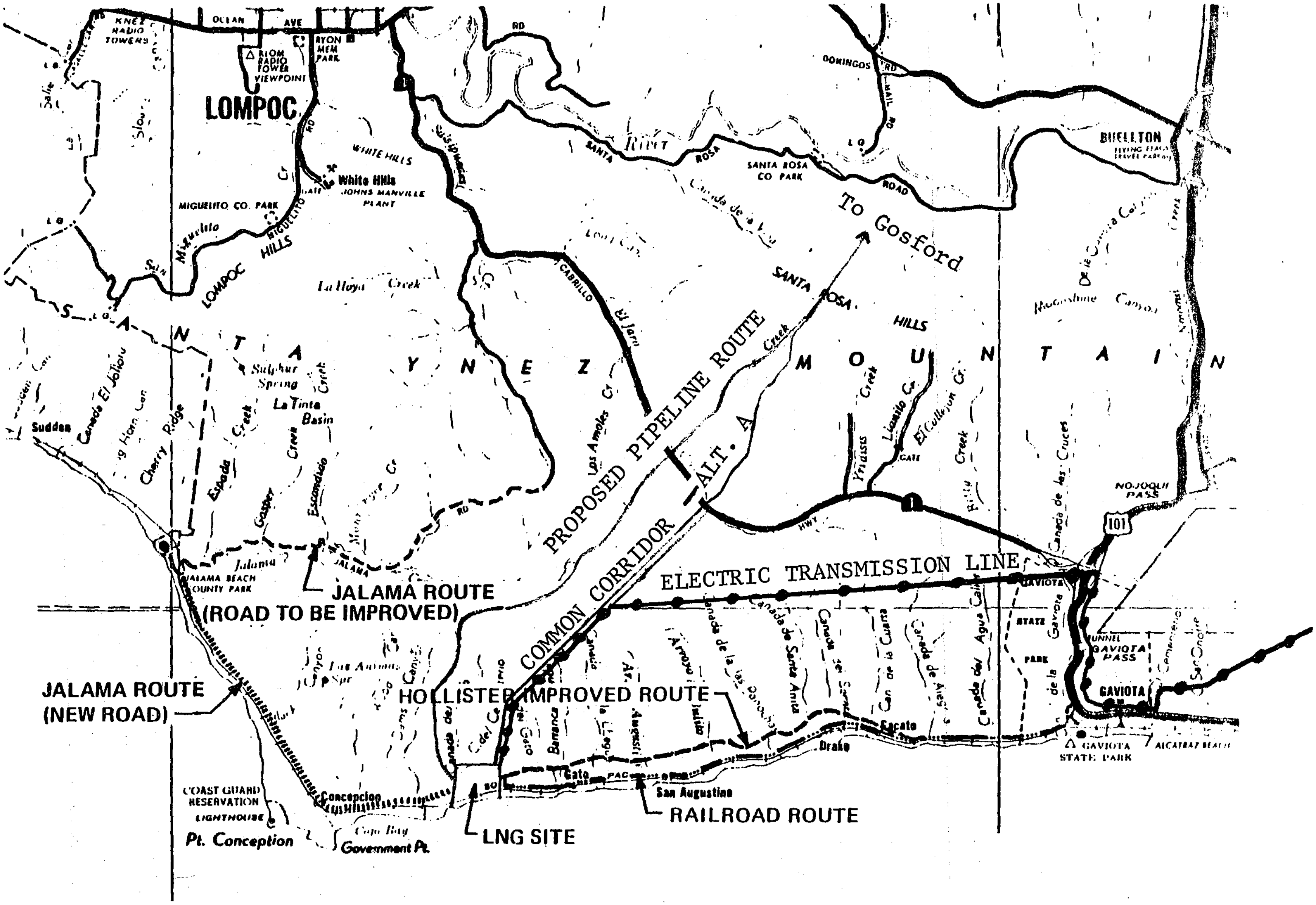


Figure 57 : Proposed and Alternative Access Roads and Corridors

410

ranch road fairly closely for about 10.8 miles from Gaviota to the site; the Jalama Route would approach the site from the existing Bixby Ranch Road for 7 miles from Jalama County Park to the site. The Jalama Route would also require improving about 9.7 miles of the existing access road leading to Jalama County Park in order to increase its design speed and safety for the construction traffic.

According to Fluor estimates, about 79 percent of workers at the site would come from the labor pools east of the site such as Santa Barbara, Ventura, and Los Angeles. The remaining 21 percent would come from the north, i.e., Santa Maria. At the peak of construction, 1,500 workers could mean 1,000 personnel vehicles or more requiring access to the site. Constructing either the Railroad Route or the Improved Hollister Route would require about 800 vehicles or more to turn left across the southbound lanes of U.S. Highway 101 into the existing access road to Gaviota State Beach and the Hollister Ranch. The existing access road to the park and the Hollister Ranch extends for 1.1 miles to the ranch boundary. Fluor has indicated that the existing road apparently floods during rainstorms. It would probably need to be improved if it were to be used as the primary access road to the site. Considering the volume of traffic expected, it would be necessary to either improve the left turn lane across U.S. 101 or eliminate the left turn and require the traffic to travel another 2.5 miles north on U.S. 101 to the intersection of Route 1, make a "U" turn, and travel southbound 2.5 miles to turn right into the access road. Consultation with the California State Highway Department would be needed for any improvements or changes to the existing left turn pattern.

Heavy use of the existing Gaviota Beach Park/Hollister Ranch access road by construction-related traffic would result in a significant impact to users of the state park, especially during rush hour.

From the state park to the proposed site, the Railroad Route and the Improved Hollister Road are about 10.6 miles and 10.8 miles long, respectively. The Railroad Route access road would be constructed entirely on new right-of-way which would need to be acquired from the owners of the 30 Hollister Ranch parcels crossed. This route would be immediately adjacent to the railroad in all areas except at Canada del Aqua Caliente and Canada de Algeria, where it would divert inland to more even ground. In general, this route would follow the rolling terrain which abutts the railroad right-of-way; however, the other numerous canyons which are traversed by the existing railroad would be filled in and crossed by the access road. The filling and grading process in these other canyons or ravines would have significant impact on the wildlife and vegetation and archaeological sites in these areas. A substantial (although unquantified) amount of cut and fill would be necessary to achieve a 40-mph design speed and to provide fill material for crossing the canyons.

Leveling and grading the proposed LNG site could be scheduled to coincide with access road construction. Part of the excess fill material generated during site preparation could probably be used as roadbed fill in drainages crossed by whichever access route is selected. This could reduce the need for cutting along the selected access route; however, in the absence of detailed grading plans for the site, it is not possible to determine the amount of cut and fill which could be reduced.

The Improved Hollister Road would use the right-of-way of the existing Hollister Ranch Road and the right-of-way previously designated for the SCE power plant access road at Point Conception. According to Fluor, about 75 percent of the proposed access road would be located on these designated rights-of-way. The existing ranch road has a very rolling profile, with numerous curves and bends. A substantial amount of cut and fill would be required to provide the straighter road required for LNG terminal construction and other vehicles. Eliminating the rolling profile and straightening the winding course of the road would be a significant change in the present character of the area. Thirty of the Hollister parcels would be traversed by the new road, and 18 of these would effectively be cut in half. The Railroad Route, situated toward the seaward end of the parcels, would divide those parcels less and would therefore have a less significant land use impact.

The Improved Hollister Road would create the same traffic problem at the entrance to the access road at Highway 101 as the Railroad Route. The driving time to the site over both roads would be similar--an estimated 18 to 19 minutes. However, if construction traffic were required to travel the 2.5 miles north to the intersection of Highway 101 and Route 1, make a U-turn, and travel south to the site access road, an additional 6 to 10 minutes of driving would be added to the total time.

The environmental impact of the Improved Hollister Road would not be as severe on wildlife and vegetation as the Railroad Route, since the majority of it would traverse the coastal grasslands and avoid the deeper canyon crossings of the Railroad Route. It would encounter archaeological sites, and detailed surveys and salvage of these sites would likely be needed. A significant reduction in impact could be achieved for the Improved Hollister Road by reducing the design speed below 40 mph, as in the latest proposal. An Improved Hollister Route designed for 30 mph or less could utilize more of the existing roadway. Substantial filling in canyons would still be required, however. Such a road would be longer than the Fluor design of 10.8 miles.

The Jalama Route would require the longest construction distance of any of the three studied by Fluor. A 9.7-mile stretch of the existing Jalama Beach Park access road from Highway 1 would be improved to carry construction traffic and a 7-mile long access road from the Jalama Beach Park to the site would be constructed. The improvements along the Jalama Route would be through rougher terrain than the Railroad or the Improved Hollister Routes would traverse; however, the 7-mile segment of roadway to the sites would be through less rugged terrain than the other coastal routes. A large amount of grading would probably also be required on the 9.7-mile and 7-mile road segments to accommodate the 40-mph design speed, and there would be over 100 mature oak trees removed during this construction.

Using Gaviota State Beach Park as a reference point, the Jalama Route would be approximately 28 total miles longer and require up to 40 minutes additional driving time than the Railroad or Hollister Routes. Of these 28 additional miles, about 11 would be on roads with lower speed limits, such as the existing Jalama Beach Road, and 17 would be on major highways such as Highway 101 and Route 1.

Largely because of the significantly longer driving distance and travel time for this route, it is the least favorable of the three studied by Fluor. Movement of construction vehicles nearby would also be a significant impact on the users of Jalama Beach Park. However, Santa Barbara County has planned improvements to the entire Jalama Beach access road, and the land along the 9.7 miles still in need of improvement has already been slated for such use. The fact that the county already considers the Jalama access road improvement desirable would reduce the environmental significance of performing these improvements for the terminal project. In addition, since the 7-mile long access road from Jalama Beach to the site could essentially follow an existing, one-lane paved road through less rugged terrain, there would be less cut and fill required. If Bixby Ranch is parcelled off for sale as Hollister Ranch has been, it is possible that early planning of the access road and parcel layout would create a more compatible blend of development.

Therefore, although the Jalama Route would have major disadvantages, it cannot be eliminated as environmentally unacceptable and should be retained for detailed study if the other access roads are not selected.

d) Multiple Use Right-of-Way Corridors

The applicant's proposal envisioned separate rights-of-way for the gas transmission pipeline, the electric transmission line, and the access road, which would have entered the site from the northwest, the northeast and the east, respectively. (See figure 57.) The staff, in its DEIS, had examined a multiple-use access corridor which appeared to have substantial environmental benefits and recommended in the DEIS that the applicant study the technical, economic, and environmental feasibility of such a corridor connecting to Highway 1 along alternative pipeline route A.

As a result of the applicant's response to the staff's recommendation and further revisions to and information about the applicant's access road proposals, the staff no longer supports a combined corridor route which would head north from the site along pipeline alternative A. This change has occurred because the roadway, which originally was to carry up to 1,000 cars per rush hour (during the 3-month peak construction), will now serve only up to 50 buses per rush hour. Also, most of the truck traffic to the site can be diverted to rail, significantly reducing traffic congestion along the access road.

In addition, an existing 16-kv electric transmission line which runs along the coastal terrace can be upgraded with 20- to 30-foot higher wooden poles, eliminating the need for steel tower transmission line facilities and the numerous small access roads which would have been constructed to the tower sites on the proposed inland transmission line route.

Further, although the staff's combined corridor would indeed be technically feasible, the enormous grading requirements make the combined corridor route technically, economically, and environmentally impractical. A similar type of combined corridor route which would follow the proposed pipeline corridor would be longer than the corridor envisioned by the staff, would still require large amounts of grading and disturbance, and would therefore be equally impractical. The disadvantages are especially apparent when these combined corridor routes are compared to the impact of the presently proposed 25-mph Improved Hollister Route and eliminating the electric transmission line through the Santa Ynez Mountains.

e) Summary of Findings

The staff believes that an access road is necessary to provide efficient and reliable access to the site during construction and operation of the proposed terminal. The proposed bus shuttle from the staging area to the site drastically reduces the traffic conflict on Highway 101 and at the Gaviota Beach State Park entrance, the potential conflict with users of Gaviota Beach, and the disturbance along the coastal terrace on an improved access road through the Hollister Ranch. Materials and equipment should be transported to the site by railroad through the ITP, and the access road should be used only by trucks delivering materials and equipment on an emergency or special priority basis. Eliminating the workers' vehicles and the proposed truck deliveries along the access road would substantially reduce the overall disturbance which would be created. In fact, because of the large reduction in the anticipated traffic load on the access road, the present plan to modify the Hollister Ranch Road could be further mitigated by performing only those cut-and-fill and regrading operations necessary for the safety of the buses carrying workers to and from the site. This would result in additional curves or grades with a 5- to 10-mph speed limitation, but the overall impact on project completion would not be severe. The improved access road would then resemble the existing ranch road much more closely, with minimized disturbance along the coastal terrace.

Construction of the project would generate up to 1,000 cars or more during the peak of construction and possibly 500 to 800 cars for a substantial part of the period (1½ to 2 years). Since the buses to transport the workers from the staging area to the site would have to be committed to the project, it would be relatively simple to extend the proposed bus service experimentally from Santa Barbara and Santa Maria directly to the site. It would be environmentally advantageous to eliminate unnecessary traffic on the highway system and the associated air, noise, and safety impact. Direct bus transport would also reduce traffic congestion entering and leaving the staging area.

The staging area would still be desirable because it would provide centralized control of worker access to the site, as well as flexibility for both the applicant and the workers. The experimental direct bus transport should be offered on a demand basis. For example, the service should be advertised to the workers and a meeting spot arranged. At least one bus should be sent initially to each selected city, and, depending on demand, the service to any one or all meeting spots could be expanded or curtailed. Since the system would be voluntary, its success would be contingent on acceptance by the workers; however, the benefits are substantial enough to warrant the attempt. (See section I, "Recommendations.")

4. Alternative Dredge Spoil Disposal Sites

As indicated in section C.5., the applicant has not selected a final spoil disposal site. Three alternatives to the approved Port Hueneme ocean dumping site were analyzed by the applicant and were the subject of a meeting among representatives of Western, the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Army Corps of Engineers, and the California Department of Fish and Game. No site was generally agreed on. A discussion of these alternatives is included in section C.5.

Aside from the aesthetic impact associated with the land site alternative, several biological impacts would occur, including the following:

1. Elimination of additional ravine habitat which is relatively undisturbed by grazing and which supports natural vegetation important to maintaining wildlife diversity.

2. Increased disturbance of wildlife, especially along shoreline and bluffs, from noise associated with additional construction, unloading dredge material, and truck transport.

3. Elimination of aquatic biota in small ravine streams.

4. Elimination of additional habitat by road construction, depending on the final choice of ravines.

While the staff prefers the offshore Coho site, the land site alternative would cover a larger area of ocean bottom than the Drake site alternative. As with the Drake alternative, dredge disposal at the Coho site could conflict with designated California halibut trawl grounds.

The applicant's suggestion that an artificial reef of dredge spoil be constructed at the Drake site has merit. However, although the anticipated quality of the dredge spoil qualifies it for ocean dumping without testing, the spoil does not meet U.S. Army Corps of Engeneers' permit criteria for the construction of artificial reefs. (See section C.7.) Additionally, the reef would have to be constructed 1 nautical mile seaward from shore to meet Army Corps of Engineers' permit criteria; this would be within the landward boundary of designated California halibut trawl grounds in the Drake area.

The staff believes that no spoil should be disposed of within designated California halibut trawling grounds or close enough to those grounds to interfere with halibut trawling operations in any way. However, if the applicant and appropriate state and Federal agencies agree on an ocean location in the Drake area or elsewhere and it can be ascertained that an artificial reef of the dredge spoil would provide some permanent beneficial habitat for marine biota, the staff would prefer this disposal plan.

If either or both of these aspects of the artificial reef disposal plan cannot be resolved, the staff believes that the approved Port Hueneme disposal site should be used. In view of the potential overall impacts associated with the proposed project, the staff feels that no impacts which can be mitigated should be permitted. Additional expenses incurred as the result of transporting the spoil over a longer distance should be included in the overall project cost estimate to aid in evaluating the suitability of Point Conception as a viable terminal site.

5. No Action or Postpone Action

The actions that are available are to grant the various permits that are sought, to deny them, or to postpone action pending further study. If action is postponed, one of the other two will ultimately follow.

Denial of the Point Conception terminal and its associated pipelines could result in: (1) no action on the entire system, (2) action on an equivalent alternative site with other associated pipeline construction, or (3) use of alternative energy sources. The alternative of "no action" means that the proposed volumes of gas would not be transported to California. Inasmuch as there is a need for natural gas, this alternative would appear to be unacceptable. 1/ The staff has recommended a superior alternative site with other associated pipeline construction. The environmental staff has previously expressed the view that all possible sources of energy supplies must be explored and that no one source of energy will be sufficient to meet all projected demands.

1/ The environmental staff recognizes that the "need for gas" is at issue in this case; however, this issue is beyond the scope of this FEIS. The environmental staff, in preparating both the DEIS and the FEIS, assumes that the "need for gas" is a valid assumption. If it can be shown that there is not an immediate need for the gas in California, alternatives such as offshore siting should be further considered.

I. CONCLUSIONS AND RECOMMENDATIONS

The environmental staff finds that there is a significantly superior alternative site to the one proposed by the applicant at Point Conception, California. The staff believes the Point Conception site should be rejected. This significantly superior site is located at Oxnard, California. (See section H, volume 2 of this EIS.) This EIS, like previous staff analyses, demonstrates that the Oxnard site would be environmentally preferable to all other sites considered. Various analyses and decisions which have considered the Oxnard site and other potential sites on the west coast show the following support for the Oxnard site:

1) The FPC staff supported Oxnard as the preferred site in two FEIS's--Alaska Natural Gas Transportation Systems FEIS, Docket No. CP75-96 et al., April 1976, and Pacific Indonesia Project FEIS, Docket No. CP74-160 et al., December 1976--and in the original DEIS on the Pacific Alaska project proposed for Los Angeles Harbor, Docket No. CP75-140 et al., September 1976.

2) Oxnard was the preferred site in two initial Decisions by FPC administrative law judges: Initial Decision, Alaska Natural Gas Transportation Systems, Docket No. CP75-96 et al., February 1, 1977, and Initial Decision on Importation of LNG from Indonesia, Docket No. CP74-160 et al., July 22, 1977.

3) The FPC's Recommendation to the President on the Alaska Natural Gas Transportation Systems, Docket No. CP75-96 et al., May 1, 1977, also identified the Oxnard site as the preferred site if LNG from the North Slope of Alaska were transported to the west coast. 1/

4) In its Opinion Number One on the Pacific Indonesia proposal, the Economic Regulatory Administration approved the Oxnard site as an acceptable site for an LNG terminal, contingent upon approval by the State of California.

5) The site is still actively proposed by the applicant.

1/ In fact, this recommendation to the President notes that the State of California, through its Public Utility Commission, filed a brief supporting Oxnard, although at least two California state agencies did not agree (page VII-19).

The FERC staff's analysis in this EIS again demonstrates that the Oxnard site would be the superior location for an LNG terminal facility. This conclusion has taken into account all environmental factors, including public safety, affected by LNG operations associated with the terminal.

Potential operational accidents during bulk handling of LNG would involve some risk to the public. The largest risk would be associated with the offshore operation of the LNG tankers. However, even considering much longer flammable vapor plumes than the staff believes possible--i.e., up to 27.1 kilometers (16.8 miles) long--the risk to the public at Oxnard is still within acceptable limits. These risks are discussed in detail in the "Analysis of Public Safety" and in attachment A. Although a major accident such as a tanker collision and subsequent release of LNG must be recognized as possible and the consequences of such an accident must be considered, such an accident is unlikely, particularly in view of the design safety features of the tankers and the operational safety measures being developed and enforced by the U.S. Coast Guard for shipping in U.S. waters.

The staff notes that the Oxnard site fails to meet the exclusion distance requirements of the California LNG Terminal Act of 1977 and realizes that it is within the authority of the FERC and/or the Economic Regulatory Administration to accommodate this act and thereby select a less desirable but still acceptable site. If Oxnard is not the site finally selected, the Rattlesnake Canyon site with a $125-million breakwater would be a superior site to the proposal for Point Conception and would be the staff's second choice. Another breakwater design proposed by the applicant (and apparently the only design discussed by the CPUC in their initial decision for the Point Conception terminal) would require blasting 1.5 million tons of underwater rock and would cost over $300 million. This design is much more expensive and far more environmentally destructive than that recommended by the CCC. The staff can see no reasonable basis for adopting the applicant's design.

The cost of a breakwater at Rattlesnake Canyon plus any other additional costs or savings would require detailed consideration in the FERC's overall analysis of a terminal at Rattlesnake Canyon. The same would ultimately be true of Point Conception where if, for example, all the mitigating measures recommended by the CPUC were adopted by the applicant, the additional costs would be significant. It should be further noted that the Oxnard terminal and pipeline could be built and operated for substantially less cost than the Point Conception terminal and pipeline.

The site at Point Conception should be rejected as a proposed site primarily because of the presence of an active fault on the site. Significant impacts to the cultural and historical resources of the area would compound the already undesirable aspect of locating a terminal on an active fault. The staff does not dispute the applicant's allegation that it is technically possible to design an LNG tank to be located over or near an active fault. However, the question is why it should be put there when other viable and superior alternative sites exist. The clear and only reasonable answer is that sites on or immediately adjacent to active faults should always be avoided. Even if the staff were to relax its seismic siting criteria (and the staff would strongly oppose doing so), the Point Conception site would remain the choice of last resort.

In the event that Point Conception site is, nevertheless, certificated by the Commission, the recommendations which follow are intended to mitigate environmental impact from the proposal and to promote its safe operation. These recommendations also encompass, where applicable, those suggested by the CPUC, CCC, and County of Santa Barbara.

It is recommended that:

(1) The LNG facilities be designed to withstand a maximum earthquake of Richter Magnitude 7.5 with a maximum peak acceleration of at least 0.6g. An earthquake of this size should not cause structural failure which could discontinue service from the facility.

To further analyze the sufficiency of the structural design of the facility, particularly the LNG storage tanks, the staff contracted with the National Bureau of Standards. It is recommended that the Commission specifically require that the study resulting from this contract be used in evaluating the adequacy of the final seismic design.

(2) Any significant changes in facility design, construction, operations, or operating philosophy from that described in this EIS be reported to the FERC on a timely basis.

(3) The applicant outline procedures to be utilized if the evacuation of nearby areas and the suspension of local shipping traffic were necessitated by a major accident. Such procedures should contain measures for the immediate notification of nearby inhabitants of any potentially dangerous situation and notification and mobilization of emergency personnel such as Civil Defense, hospitals, police, and fire departments.

(4) The LNG storage tanks be installed "below grade" to a depth of at least 80 feet, as fully discussed in the "Mitigating Measures" section of this EIS. Conventional double-wall tanks set in a basin should be used. Full tank-height concrete silo walls surrounding the tanks should not be constructed, and the tank basin should not be backfilled.

(5) The applicant create artificial ridges which shall be completely revegetated with native grasses and shrubbery as soon as possible in order to screen all sides of the facility from view to the maximum possible extent during operation and much of the construction of the terminal. The location of the ridges should be preplanned such that formation of them can begin coincident to excavation of the basin for the below-grade LNG storage tanks. Overburden materials taken from excavation of the basins for the below-grade storage tanks should be used to create the ridges. If necessary, the upper soil layers from the storage tank excavation should first be stockpiled and the rocky layers beneath should be used as a base for ridges and then covered with a layer of the higher quality topsoil prior to revegetation.

(6) The final design plans for the proposed LNG plant and marine terminal be submitted to the Commission for review before construction of the plant and marine terminal begins. In addition, the applicant shall consider using anchor bolts on the outer shell of the LNG storage tanks and provide reasons for using or not using such bolts in the final tank design.

(7) The applicant shall conduct "oral reviews" for the staff of the security measures to be enforced by Western at its California facility. An initial review shall be conducted at the time the final design plans for the proposed LNG terminal are submitted to the Commission. (See recommendation 6 above.) A more extensive review shall be conducted prior to the first full year of plant operation.

(8) If the terminal is approved for operation, the Commission require operational reports semiannually, within 45 days after each period ending December 31 and June 30, describing facility operations for the period covered, noting any abnormal operating experiences or behavior. Abnormalities shall include, but not be limited to, tank vibration rollover, geysering, cold spots on the tank, significant equipment malfunctions or failures, nonscheduled maintenance or repair (and reasons therefore), relative movement of the inner vessel after each cooldown and following local seismic activity, vapor or liquid releases, negative pressures (vacuum) within the storage tank, and higher than predicted boil-off rates. The technical information supplied by the applicant shall be submitted in a form acceptable to the Commission and shall be in sufficient detail to allow a complete understanding of such events consistent with the existing state-of-the-art or knowledge. The first of these semiannual reports shall be filed on the first reporting period after approval of the project by the FERC. The reports should identify the status of the applicant's compliance with the staff's recommendations prior to the reporting period and should give an indication of what compliance steps will be taken by the applicant in the ensuing reporting period. Such information can provide the Commission with technical data that may be applied to other LNG facilities. If an abnormality is sufficient to endanger the facility or operating personnel, the Commission shall be notified immediately.

(9) The applicant conduct studies to determine the hydrodynamic behavior of spilled LNG following a catastrophic failure of a storage tank or other credible spill scenario and the ability of the dikes to contain potential splashing or overflow from such a failure. Specific measures to reduce or eliminate such dike overflow potential shall be evaluated and implemented. Results shall be submitted with the final design plans.

(10) The applicant develop and implement a public information program to educate the public, particularly the frequent users of the LNG offshore project area, of the potential hazards resulting from an LNG spill.

(11) The trestle and other marine facilities be designed to minimize interference with longshore sediment transport. Such design shall conform to Coastal Plan Policy 19, p. 44, promulgated by the California Coastal Zone Conservation Commission.

(12) The applicant provide additional thermocouples on the tank floor and lower shell of the inner tank to obtain more comprehensive data on the thermal stresses imposed during cooldown. Previous experience with other LNG tanks indicates that at least 12 temperature sensors located in quadrants on the floor or footer plate and on the lower portion of the inner shell are necessary to obtain meaningful data on thermal stresses during tank cooldown.

(13) Linear movement indicators between the inner and outer tank shells be installed on the proposed LNG storage tanks to provide data on the relative position of the inner and outer shells. The indicators should be in quadrants at or near the floor of the inner shell and be either direct reading or electronic (linear motion transducer) type.

(14) The internal storage tank LNG temperature probe be located in such a way that the accuracy of its data sendout would not be thermally influenced by fluid circulation within the tank or by other structural members.

(15) The applicant install high and low liquid level indicators and alarms in addition to the two float-type gauges and traversing temperature probe presently proposed.

(16) The high and low temperature detectors be installed on all tank vent valves to indicate the venting of LNG vapor from the storage tank.

(17) Written notification of construction plans which would affect the marine environment, including date, location, and duration of construction be provided to appropriate representatives of the commercial fishing industry, local yacht clubs, and users of the boat launch facilities at Gaviota.

(18) The applicant give serious consideration to installing additional sectionalizing transmission line block valves, over and above those required by the minimum Federal safety standards, in areas such as the San Andreas fault where potential seismic activity represents a distinct potential of pipeline rupture.

(19) The applicant minimize interference with harvesting kelp from Bed No. 32 to the maximum extent feasible. If appropriate studies (conducted by independent consultants, the selection of which would be approved by the California Coastal Commission) indicate that terminal construction or operation would decrease the amount of kelp that can be harvested under the Department of Fish and Game lease, the applicant shall develop a program for approval by the California Coastal Commission in consultation with the Department of Fish and Game to minimize such decreases in harvestable kelp resources and to mitigate any losses suffered by the Bed No. 32 lessor or lessee. The applicant shall implement this program after it is approved by the California Coastal Commission.

(20) Western develop operational plans to minimize boat traffic and moorings in the denser kelp beds east of the trestle, concentrating instead on the west side.

(21) The applicant shall contract for an independent 5-year ongoing marine monitoring program to examine the effect of the seawater system to determine:

(1) The effect of the cold water discharge on marine biota.

(2) The approximate number of invertebrates and larger fish lost due to entrainment and impingement.

(3) The approximate number of eggs and larvae of fish and commercial invertebrate species lost due to mortality within the seawater system.

(4) Length of detention time and survival for those larger fish and invertebrate species commonly contrained.

(5) The distribution of species which are entrained and returned to the ocean.

The 5-year marine monitoring program shall also accomplish the following:

(1) Detection of the degree of severity and rate of occurrence of water quality impacts due to changed conditions.

(2) Determination of the effects of LNG terminal operations, including movement of tankers, bunker fuel vessels, tugs, line boats, and other small craft on kelp resources.

(3) Determination of changes in sediment transport and resulting changes in marine biota.

The selection of an independent consultant and the marine monitoring program shall be approved by the California Coastal Commission. The CCC shall ensure that the marine monitoring system complies with this recommendation and provides for publishing of results at reasonable intervals.

Upon completion of the 5-year marine monitoring program, the California Coastal Commission shall then determine the degree of marine monitoring that shall follow, at any time, the marine monitoring team, based upon the results of the marine monitoring, may recommend to the Coastal Commission changes in the seawater system or other aspects of the LNG terminal operation to protect the marine resources of the area. The applicant, after opportunity for rebuttal, shall implement all such changes the Commission determines, are feasible and necessary.

(22) Independent consultants be selected subject to the approval of the California Coastal Commission to complete the following studies prior to the beginning of construction of the proposed vaporization facilities:

(a) A thorough feasibility analysis of the offshore screenwell concept. This study should be sufficiently complete to make factual comparisons with the proposed system.

(b) A study that would be sufficient to factually demonstrate, relative to impacts on marine biota, the desirability or undesirability of locating the seawater intake in a kelp bed as proposed.

(c) A study of the prototype San Onofre fish return system sufficient to accurately discern the efficiency and appropriateness of the proposed system for all anticipated throughput cases.

(23) If the results of the study under recommendation 22(a) demonstrate that the use of the offshore screenwall would further mitigate impacts on marine biota when compared to the proposed intake system, and would be acceptable in terms of cost, maintenance and reliability, that the offshore screenwall concept be substituted for the proposed system.

(24) The applicant consult with appropriate state and Federal agencies to determine an appropriate ocean location for the disposal of the proposed dredge spoil. If an ocean location cannot be mutually agreed upon and/or, it cannot be ascertained that an artificial reef composed of the dredge spoil would provide some permanent beneficial habitat for marine biota, the approved Port Hueneme disposal site shall be used.

(25) Prior to grading and excavation on the terminal site, diversion ditches be constructed to intercept and convey offsite runoff away from the disturbed area to a suitable outlet and to channel onsite runoff into a holding basin or sedimentation pond.

(26) Alternate pipeline route B, discussed in section H.1 of this EIS, be utilized between MP 38.5 and MP 65.5, following the highway rights-of-way as closely as possible. Prior to construction along this alternative route, the right-of-way shall be surveyed for archaeologic materials and environmentally sensitive areas. The final alignment shall be adjusted to avoid any such areas.

(27) The applicant retain alternative pipeline route C (MP 80 to 102) as an option during the process of obtaining permits from agencies with jurisdiction over the land involved, and as an option for any realignments required as a result of endangered species or archaeological surveys.

(28) Construction equipment should not be operated off the pipeline right-of-way or access roads when avoidable.

(29) The applicant should be required to consult with the California Department of Fish and Game to select the final alignments, construction procedures, and mitigation measures for all access roads, utility corridors, and pipeline rights-of-way.

(30) Prior to completion of plan and profile drawings of the gas pipeline, Western shall consult with the Santa Barbara County Transportation Department and with Kern County and San Luis Obispo County to assure coordination with existing and future road facilities.

(31) The proposed pipeline route and access roads avoid springs and water catchment basins which are known or suspected to be of value to wildlife. Where the proposed route would pass near those types of water bodies, plans to prevent siltation of those areas shall be implemented.

(32) Streams and other drainage channels be restored to their original gradients immediately following construction.

(33) Western consider possible future conflicts which could develop between the proposed pipeline and either the construction of the Lompoc Dam and Reservoir or the construction of local water conveyance facilities which would result from extensions of the Coastal Branch of the California Aqueduct and take whatever mitigating steps are reasonable to reduce or eliminate such conflicts.

(34) Prior to construction, a qualified biologist survey the proposed LNG site, pipeline and utilities rights-of-way, and access roads for rare and endangered species. Adverse impacts on rare and endangered species should be minimized to the greatest extent practical by realignment of the route, construction scheduling to avoid breeding seasons, and other necessary measures.

(35) Prior to construction, rare and endangered plant species located within all areas to be disturbed be identified to the extent practical. Areas of concentrations of such plants should be avoided.

(36) Existing vegetation on the right-of-way, with the exception of that over the trenched area, be disturbed to the least extent possible during construction. Both above- and belowground portions of vegetation remaining intact on the right-of-way would help stabilize the soil, reduce erosion, and aid revegetation.

(37) Construction in naturally vegetated areas be timed to avoid peak wildlife nesting periods. In general, midsummer through winter would be the preferred time for construction. Streams near the coast shall be crossed in midsummer to avoid both spring spawning and fall and winter fish migration.

(38) Maintenance of access roads to pipeline and powerline rights-of-way should be minimized in areas of valuable wildlife habitat, such as shrubland and woodland. Public access to maintenance roads and the rights-of-way should be controlled to prevent abuse by offroad vehicles.

(39) The beach area in front of the terminal be restored as nearly as possible to its original condition.

(40) The use of herbicides be coordinated with the California Department of Fish and Game; however, herbicides should be used only when absolutely necessary.

(41) Every attempt be made during final right-of-way alignment to avoid vineyards and orchards. Where this would not be feasible, the temporary right-of-way shall be kept to a minimum.

(42) In croplands and upland areas where soils are shallow to bedrock, surface soils over the trenched area be segregated and stored prior to trenching and returned to the surface after the trench is backfilled with subsurface material. Surface soils on the proposed LNG site having a suitable rating for use as topsoil be removed, stored and vegetated to prevent erosion, prior to construction activities and be placed on those areas of the site to be revegetated after construction is completed. The applicant shall contact the county offices of the Soil Conservation Service in each county through which the proposed pipeline would pass for assistance in locating other areas, if any, where this practice should be utilized.

(43) In areas where right-of-way construction produces sizeable surplus of soil material, such as in cut-and-fill operations and where these areas are reasonably close to sections of the pipeline where soils are extremely thin, such as on ridgetops, the surplus soil be transported to these areas of thin soils to be used as additional soil cover to aid in the establishment of vegetation.

(44) The applicant contact the Soil Conservation Service State Office in Davis, California, for assistance in determining in what areas of the proposed route the trench backfill should be compacted, the most desirable method of compaction to be utilized, and the degree of compaction that should be achieved.

(45) Where right-of-way preparation involves ridgecutting, excess soil and rock material shall not be placed on the downslopes adjacent to the right-of-way. Side-casting of soil material of the right-of-way be confined to areas where it can adequately compacted, stabilized and revegetated and where it is approved in landowner right-of-way agreements. All excess rock material resulting from trenching and right-of-way preparation be disposed of in approved disposal sites. All backfill used along the proposed pipeline route be free of excessive vegetation and organic debris which could decay and cause additional subsidence.

(46) The applicant contact the county offices of the USDA Soil Conservation Service, the USDA Forest Service, and the California Department of Fish and Game prior to construction for assistance in designing erosion control structures and formulating erosion control and revegetation plans. The Bureau of Land Management should also be contacted for its assistance where the proposed route crosses land under its administration. Special attention shall be given to constructing access roads in the upland areas which have in the past been the site of severe erosion and slope stability problems.

(47) All areas of the right-of-way where construction has been completed by the end of the summer should be seeded before October, whether the entire pipeline has been completed or not, to allow vegetation to establish during the most desirable period of the year.

(48) After construction and revegetation has been completed, the applicant frequently patrol the right-of-way, repairing all areas where trench subsidence has been excessive, where vegetation has failed to establish with the first seeding attempt, and also where erosion is active.

(49) Western instruct its employees in recognizing the disease known as coccidioidomycosis (San Joaquin Valley Fever, Valley Fever, etc.), which is endemic along the proposed pipeline route in Santa Barbara, San Luis Obispo, and Kern Counties. Construction workers exposed to dust from the pipeline trench could contract this highly infectious, sometimes fatal disease. Employees shall wear dust masks and protective gloves while working, and a program of medical screening utilizing skin tests and chest x-rays to detect the disease as early as possible shall be provided by the applicant.

(50) The terminal facilities, including the storage tanks, be painted in an environmentally harmonious color (e.g., buff or light blue). The California Coastal Commission or other appropriate state or local authorities and local landowners shall be consulted in selecting the final color.

(51) In accordance with the National Historic Preservation Act of 1966, as amended, and the Archaeological and Historic Preservation Act of 1974, the applicant be required to:

(a) Develop alternate plans which would avoid direct and indirect impact to cultural resources and to adopt these alternatives whenever feasible; e.g., moving the LNG facility at least 1,500 feet to the east to reduce impact to the archaeological sites on the proposed site.

(b) Protect known, unimpacted sites on property owned or leased at the proposed terminal site by isolating these with fencing from accidental disturbance during construction.

(c) Consult with local Native American groups to determine any concerns or cultural values which may be affected by this project.

(d) Undertake such further investigations before construction begins (e.g., subsurface site identification, deeds record search, survey by an architectural historian) determined to be necessary by the California State Historic Preservation Offices (SHPO), Interagency Archaeological Services (IAS), and appropriate agencies, following standards and procedures developed by these entities.

(e) Nominate to the National Register of Historic Places all properties potentially affected by the project which meet the National Register criteria of eligibility.

(f) Have qualified archaeologists monitor construction (including land clearing) following procedures developed and approved by the SHPO and appropriate agencies to assure compliance with these conditions and to prevent accidental damage to avoidable cultural resources.

(g) Follow procedures, standards, scope of work, and research design developed or approved by the SHPO, IAS, and appropriate organizations, and in consultation with Native American groups, excavate all impacted properties eligible for inclusion in the National Register of Historic Places and other cultural properties containing significant data as determined necessary by the appropriate agencies.

(h) Stop further disturbance if any historic or prehistoric remains should be discovered during construction until the scientific value of the property can be determined or the property avoided.

(52) The applicant should provide some means of measuring the density of LNG within each storage tank, so that an accurate density measurement may be made prior to introducing any "new" LNG into the tank.

(53) Signals should be placed on the Southern Pacific Railroad tracks to warn trains approaching the terminal site from either direction in the event of a plant emergency, so that the train (a potential ignition source) does not pass the terminal during the emergency.

(54) The applicant shall limit truck deliveries of materials and equipment to the site to emergency and or special or priority items or supplies for which there is an immediate need and cannot be shipped by rail or when rail shipment would be demonstrably impractical. Rail shipments should be the primary transport mode for all other deliveries of material and equipment.

(55) Improvements to the Hollister Ranch Road for access to the site should be strictly limited and regrading and realignment should be performed to the minimum level required for safe, reliable, and environmentally sound transit of construction worker, buses, emergency vehicles and automobile traffic. This may lower the average design speed of the road well below 25 miles per hour; however, considering the reduced usage of the road as recommended by the staff, design speed of the road is a less important factor than safety and environmental preservation.

(56) The applicant comply with all of the mitigation measures concerning geotechnical, air quality, terrestrial biology, aesthetics, traffic and archaeology which have been recommended by its consultants, Dames and Moore, in Exhibit No. 282, entitled Preliminary Environmental Impact Assessment Proposed Access Road Route (March 1978) on pages 83 to 86.

(57) In addition, to encouraging carpooling of the workers to the staging area as recommended by Dames and Moore in Exhibit No. 282, the applicant should establish an experimental bus program that would offer direct bus transport to the site from Santa Barbara, Santa Maria and other candidate cities where a number of construction workers for the project reside. The direct bus transport service should be expanded or curtailed to these or other cities upon demand by the workers. If demand from any one city is shown to be low (i.e., usually less than one-half of a busload), the service to that city may be abandoned.

(58) The applicant shall reroute the proposed 66 KV electric transmission line to replace the existing SCE 16 KV transmission line along the Hollister Ranch property. The existing single and double wooden pole on the 16 KV line should be replaced with the 20 foot higher poles needed for the 66 KV line.

(59) The applicant shall consider establishing a gate house or having a representative at or near the Hollister Ranch gate house for controlling access to the LNG terminal site.

(60) The County of Santa Barbara recommended and staff agrees that if the access route to the plant is via the Hollister Ranch and Gaviota, the applicant shall satisfy the California Department of Transportation regarding providing a safe entrance and safe exit between U.S. 101 and Gaviota Beach Road during the construction period of the LNG plant. Conditions may require closure of the center divider, thus requiring traffic from the south to use the U.S. 101-State Highway 1 Interchange, construction of an interchange, relocation of the connection of Gaviota Beach Road, or some other improvement.

(61 The County of Santa Barbara recommended and the staff agrees that the applicant submit to the Santa Barbara County Department of Public Works a grading plan and complete surface drainage plan of all roads and building areas. The grading plan should show the method and degree of compaction and proposed method of stabilization of exposed slopes. The owner/operator should plant and maintain all cut-and-fill slopes, with maintenance to be continued until the project is completed.

(62) The County of Santa Barbara recommended and the staff agrees that a potable water supply be developed on the property to serve the project with domestic water and a domestic water supply permit obtained by the owner/operator pursuant to California Health and Safety Code, Section 4011. A well drilling permit shall be obtained from the County of Santa Barbara pursuant to local ordinances.

(a) Domestic water shall be available on the site during the construction phase as well as after the project is completed and in operation.

(b) Domestic water well(s) construction shall be in accordance with standards set forth by the Department of Water Resources Bulletin No. 74, "Water Well Standards": State of California.

(c) Domestic water well development and test pumping to determine capacity of water source(s) shall be performed by a California Registered Civil Engineer, Registered Geologist, Registered Engineering Geologist, or licensed well drilling contractor. He shall also certify that the results of this testing show the supply to be adequate to serve the proposed development.

(d) Domestic water well system facilities shall be designed by a licensed engineer in accordance with "California Safe Drinking Water Act" (Health and Safety Code, Section 4010, et. seq.), relating to Domestic Water Supply, and all administrative regulations adopted pursuant to this act. Detailed engineering plans and specifications shall address the adequacy and appropriateness of the source(s), system capacity, storage treatment, distribution, and cross connections protection. The system plans and specifications shall be reviewed and approved by Santa Barbara County Public Works and Health Department officials when appropriate.

(e) Installation of the system for approved plans shall be under the design supervision of a licensed engineer.

(f) Chemical and bacteriological testing shall be done by a tate approved domestic water testing laboratory to insure that the water supply developed is suitable for drinking.

(g) If water is to be hauled in for domestic use during construction, procedures and equipment shall be reviewed and approved by Santa Barbara County health officials.

(h) Prior to construction, a complete hydrological evaluation of domestic groundwater availability shall be made by an independent consultant, and submitted to the California Public Utility Commission and the County of Santa Barbara. Investigation shall include evaluation of impacts upon surrounding existing groundwater usage and the effect upon this supply with continual pumping for this project.

(i) Prior to construction, a long-term pump test in excess of 2 to 3 months shall be conducted by a registered civil engineer or licensed well drilling contractor to determine long-term availability of groundwater to the proposed project.

(j) Prior to construction, a detailed analysis of project water demands both for construction and operation shall be completed. Analysis shall itemize specific types of water use proposed for the domestic supply throughout the plant. (Current preliminary evaluation of potable water usage is felt to be seriously inaccurate.)

(63) The County of Santa Barbara recommended that cut slopes shall not be steeper than 1 1/2:1 nor fill slopes steeper than 2:1 unless certified to their stability by the project soils engineer and engineering geologist. Whenever possible, the top and toe of slopes shall be rounded to produce a contoured transition with the natural ground, and all slopes shall be sprayed with hydro-mulch to provide fast growth and reduce erosion. Staff agrees since limits for cut-and-fill slopes proposed in this condition are in general agreement with Bureau of Reclamation specifications.

(64) The CPUC recommended and staff agrees that Western Terminal continue its meteorologic and oceanographic monitoring program to further evaluate actual sea conditions at the Point Conception marine terminal area. A minimum of 2 years of continuous onsite measurement of sea conditions including wind, wave, swell, current, and fog shall be recorded. After review and analysis of this data, the CPUC will make a further determination as to the safety and reliability of the project's maritime operations. If deemed necessary, further conditions may be placed upon the permit in order to assure the safety and reliability of the marine operations. This data shall be submitted to the FERC and CPUC not later than January 15, 1980, and shall encompass the period December 1977 through December 1979.

REFERENCES

Agbabian Associates. Evaluation of Seismic Criteria and Design Concepts for Point Conception LNG Terminal Environmental Impact Report. December 7, 1977.

American Heritage Research. Archaeological and Historical Evaluation of California LNG Terminal Sites and Associated Gas Transmission Pipelines. 1975.

Arthur D. Little, Inc. Alternative Site Analysis: Technical Report No. 23 In Support of the Point Conception LNG Facility Draft Environmental Impact Report. San Francisco, 1977.

---- Berth Availability: Technical Report No. 15 in Support of Point Conception Draft Environmental Impact Report. San Francisco, 1977.

---- Draft Environmental Impact Report for Proposed Point Conception LNG Project. San Francisco, 1978.

---- Meteorology/Air Quality: Technical Report No. 4 for the Draft Environmental Impact Report, Point Conception LNG Project. San Francisco, 1978.

---- Noise Assessment: Technical Report No. 6 for the Draft Environmental Impact Report, Point Conception LNG Project. San Francisco, 1978.

---- Terrestrial Biology: Technical Report No. 5B In Support of Point Conception LNG Project. San Francisco, 1978.

---- Water Quality/Marine Biology: Technical Report No. 5A In Support of Point Conception LNG Project. San Francisco, 1978.

Asquith, D. O. Summary of Seismic Hazards, Proposed LNG Terminal Site, Cojo Bay, Santa Barbara County, California. Sherman Oaks, California, 1978.

Baldwin, John L. Climates of the United States. Environmental Data Service, U.S. Department of Commerce. Washington, D.C., 1974.

Biswell, H. H. "Ecology of California Grasslands," Journal of Range Management (Vol. 9, 1956), pp. 19-24.

Bullock, T. H. "Compensation for Temperature in the Metabolism and Activity of Poikilotherms," Biological Review (Vol. 30, 1955), pp. 311-342.

California Air Resources Board. California Air Quality Data: January, February, March 1976. Vol. 3, No. 1. Sacramento, 1976.

California Coastal Commission. Offshore Oil and Gas Development: Southern California. 2 vols. Sacramento, 1977.

---- Staff Draft for Public Comment - Offshore LNG Terminal Study. 1978.

California Department of Fish and Game. At the Crossroads. 1976.

---- California Least Tern Census and Nesting Survey. 1977.

---- Status Designations of California Vertebrates. 1976.

California Department of Parks and Recreation. The California State Park System Guide. Sacramento, 1976.

California Energy Resources and Development Commission. Natural Gas Supply and Demand for California, 1978-1995. 1978.

California Native Plant Society. Inventory of Rare and Endangered Vascular Plants of California. Berkeley, 1974.

California Public Utilities Commission. Draft Environmental Impact Report for Point Conception Pipeline. Technical Report No. 1308-Z. 1977.

---- Staff Report on the Decline in Natural Gas Available to the California Distribution Utilities from Traditional Supply Sources and the Need for and Timing of Supplemental Supply Sources. 1978.

California Region Framework Study Committee. Comprehensive Framework Study, California Region, Fish and Wildlife, Appendix XIII. 1971.

California State Water Quality Control Board. An Oceanographic and Biological Survey of the Southern California Coastland Shelf. Publication No. 27. 1965.

Clarke, William D. and Michael Neushul. "Subtidal Ecology of the Southern California Coast" in Pollution and Marine Ecology, T. A. Olson and F. J. Burgess, Eds. Interscience, N.Y., 1967.

Cooke, Z. F. "Conflict Between the California Indian and White Civilization" in The California Indians, R. C. Heizer and M. A. Whipple. Berkeley, 1971, pp. 562-571.

Dames and Moore. Detailed Environmental Analysis Concerning a Proposed Gas Transmission Pipeline for Pacific Gas and Electric Company and Pacific Lighting Company Associated with Proposed Liquefied Natural Gas Facilities for Western LNG Terminal Associates. Los Angeles, 1977.

---- Detailed Environmental Analysis Concerning a Proposed Liquefied Natural Gas Facility, Point Conception, California, for Western LNG Terminal Associates. Los Angeles, 1977.

Volume I LNG Facilities, Point Conception, California
Volume III Technical Appendix A. Supplement. 1978.
Volume IV Technical Appendices B through H.

---- Detailed Environmental Analysis Concerning Proposed Liquefied Natural Gas Facilities and Associated Gas Transmission Pipelines for Western LNG Terminal Company. Vol. III. Los Angeles, 1974.

---- Draft Environmental Impact Report: Proposed Dos Pueblos Marine Terminal, Naples, California. Los Angeles, 1975.

---- Effects on Marine Biota, Effluent Seawater Discharge, Oxnard LNG Terminal, For Western LNG Terminal Company. Los Angeles, 1977.

---- Meteorological-Oceanographic Conditions Affecting Tanker Terminal Design and Operation at Site C-1, Southern California Edison Property at Point Conception, California. Los Angeles, 1973.

---- Preliminary Evaluation of Groundwater Potential for the LNG Gasification Plant, Point Conception, California. Los Angeles, 1977.

---- Supplemental Data Report: Emissions Inventory, Proposed LNG Facilities and Associated Gas Transmission Pipeline, Point Conception, California, for Western LNG Terminal Company. Los Angeles, 1977.

Dawson, Yale E., Michael Neushul, and Robert D. Wildman. "Seaweeds Associated with Kelp Beds Along Southern California and Northwestern Mexico," Pacific Naturalist (Vol. 1, No. 16).

Dehnel, P. A. "Rates of Growth of Gastropodsasa Functions of Latitude," Physiological Zoology (Vol. 28, 1955), pp. 115-144.

Dibblee, Jr., T. W. Regional Geologic Maps of San Andreas and Related Faults in Carrizo Plain, Temblor, Caliente, and La Panga Ranges and Vicinity, California. USGS Miscellaneous Geologic Investigations Map I-757. 1973.

Environmental Data Service, U.S. Department of Commerce. Climatological Data, Annual Summary: 1976. Asheville, N.C., 1977.

Fairchild Industries. Offshore LNG Receiving Terminal Project. Vol. II. 1977.

Federal Power Commission. Alaska Natural Gas Transportation Systems: Final Environmental Impact Statement. Vol. III. Washington, D.C., 1976.

---- Pacific Indonesia Project: Final Environmental Impact Statement. Washington, D.C. 1976.

---- Santa Barbara Channel Pipeline Project: Final Environmental Impact Statement. Washington, D.C., 1975.

Fitch, John E. "Fish Remains, Primarily Otoliths, From a Ventura, California, Chumash Village Site (Ven-3)" in A Coastal Chumash Village: Excavations of Shisholop, Ventura County, California, Roberta S. Greenwood and R. O. Browne. Memoirs of the Southern California Academy of Sciences (Vol. 8, 1969), pp. 56-71.

Fluor Engineers and Constructors, Inc. "Construction Site Access and Transportation Plan," 1978.

Fox, H. M. "The Activity and Metabolism of Poikilothermal Animals in Different Latitudes," Proceedings of the Zoological Society of London, Series A (Vol. 109, 1939), pp. 141-156.

Goldman, Joel C. and John A. Davidson. "Physical Model of Marine Phytoplankton Chlorination at Coastal Power Plants," Environmental Science (Vol. II, No. 9), pp. 908-913.

Grant, Campbell. The Rock Paintings of the Chumash. Los Angeles, 1965.

Greenwood, Roberta S. and R. O. Browne. A Coastal Chumash Village: Excavation of Shisholop, Ventura County, California. Memoirs of the Southern California Academy of Sciences. Vol. 8. 1969.

Griffin, James R. and W. B. Critchfield. "The Distribution of Forest Trees in California," USDA Forest Research Paper PSW-82/1972. Berkeley, 1976.

Hales, Lyndell Z. Preliminary Evaluation of Wind and Wave Effects at Potential LNG Terminal Sites, State of California. U.S. Army Engineer Waterways Experiment Station Hydraulic Laboratory. Vicksburg, Miss., 1978.

Hanes, Ted L. "Succession After Fire in the Chaparral of Southern California," Ecological Monographs (Vol. 41), pp. 27-52.

Harrison, A. T., E. Small, and H. A. Mooney. "Drought Relationships and Distribution of Two Mediterranean-Climate California Plant Communities," Ecology (Vol. 52), pp. 869-875.

Heizer, Robert F. "The Western Coast of North America" in Prehistoric Man in North America, Jesse D. Jennings and Edward Norbeck. Chicago, 1969, pp. 117-148.

Hoover, Robert F. The Vascular Plants of San Luis Obispo County, California. Berkeley, 1970.

Houston, J. R. and A. W. Garcia. Type 16 Flood Insurance Study: Tsunami Predictions for Pacific Coastal Communities. U.S. Army Engineer Waterways Experiment Station Hydraulic Laboratory. Vicksburg, Miss., 1973.

Hunt, Charles B. Natural Regions of the United States and Canada. San Francisco, 1974.

Huss, P. O. Relation Between Gusts and Average Wind Speeds, Report No. 140. David Guggenheim Airship Institute. Akron, 1946.

Intersea Research Corporation. Alternative Sites for Related LNG Facilities on the West Coast of the Contiguous United States. La Jolla, Ca., 1975.

---- Thermal Effect Study for the Ormond Beach Generating Station: Summary Report. La Jolla, Ca., 1973.

J. H. Wiggins Company. Seismic Hazards Analysis of the Point Conception Pipeline. Technical Report No. 1308-Z. 1977.

Jen, Yuan. "Wave Refraction Near San Pedro Bay, California," Proceedings of the American Society of Civil Engineers, Waterways and Harbors Division (August 1969).

Jennings, C. W. Fault Map of California. California Division of Mines and Geology. Geologic Data Map No. 1. 1975.

John J. McMullen Associates, Inc. Breakwater Design Characteristics for Rattlesnake Canyon Site. 1978.

---- Initial LNG Facility Site Evaluation: Maritime Factors Relating to Onshore Mainland Sites. 1978.

Johnson, Barbara. Kern County Parks and Recreation Department. Telephone Conversation with FERC Staff, February 8, 1978.

Jones, J. H. General Circulation and Water Characteristics in the Southern California Bight, Southern California. Coastal Water Research Project. Los Angeles, 1971.

King, Chester and Steve Craig. Cultural Resources: Technical Report No. 8 in Support of Point Conception LNG Project Environmental Impact Report. San Francisco, 1978.

MacLaren, I. A. "Some Relationships Between Temperatures and Egg Size, Development Rate, and Fecundity of the Copepad Pseudocalamus," Limnology and Oceanography (Vol. 10, 1965), pp. 528-538.

Marcus, Henry S. and John Larson. Offshore Liquefied Natural Gas Terminals. Center for Transportation Studies, Massachusetts Institute of Technology. 1977.

McConnaughey, Baynard H. Marine Biology. St. Louis, 1970.

McClean, James H. "Sublittoral Ecology of Kelp Beds of the Open Coast Near Carmel, California, "The Biological Bulletin (Vol. 122), pp. 95-114.

Moriarity, James R. "Report of James Robert Moriarity III" in Archaeological and Historical Evaluation of California LNG Terminal Sites and Associated Gas Transmission Pipelines, American Heritage Research. 1975.

Morrell, S. H. San Joaquin Kit Fox Distribution and Abundance in 1975. California Department of Fish and Game. 1975.

Muny, Philip A. and D. D. Keck. A California Flora. Berkeley, 1959. Supplement. 1968.

National Climatic Center. Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1941-1970. Asheville, N.C., 1973.

Passano, L. M. "Low Temperature Blockage of Molting in Uca Pugnax," Biological Bulletin (Vol. 118, 1960), pp. 129-136.

Patel, B. and D. J. Crisp. "The Influence of Temperature on the Breeding and Molting Activities of Some Warm Water Species of Operculate Barnacles," Journal of Marine Biological Association (Vol. 39, 1960), pp. 667-680.

Phillips, Ronald C. "Kelp Beds" in Coastal Ecological Systems of the United States, H. T. Odum, B. J. Copeland, E. A. McMahan, Eds. Washington, D.C., 1974.

Port of Long Beach and the California Public Utilities Commission. Final Environmental Impact Report: SOHIO West Coast to Mid-Continent Pipeline Project. Vol. 4, Part 3. 1977.

Ried, J. L. Physical Oceanography of the Region Near Point Arguello. Institute of Marine Resources, University of California. 1965.

Resource Planning Associates, Inc. Alternative Site Study--Gulf Coast LNG Conversion Facility. Cambridge, Mass., 1977.

---- California Natural Gas Supply and Demand. Cambridge, Mass., 1978.

Richetts, Edward F. and Jack Calvin. Between Pacific Coast Tides. 4th ed. Stanford, 1968.

Robbins, C. S., B. Bruun, and H. Zim. Birds of North America. New York, 1966.

Santa Barbara County Board of Supervisors. Santa Barbara County Population Statistics with Annual and Ten-Year Growth Percentages. 1974.

Santa Barbara County General Plan Report. 1966.

Scheltema, R. S. "The Relationship of Temperature of the Larval Development of Nassorins Olsdetus," Biological Bulletin (Vol. 132, 1967).

Slosson and Associates. Environmental Geology and Seismic Analysis: Point Conception and Alternate Sites. N. D.

Volume I Point Conception and Alternate Sites
Volume I-A Alternate Sites
Volume II Point Conception Pipeline Route
Volume II-A Point Conception Pipeline Addition Gosford Route

Snow, C. "Blunt-Nosed Leopard Lizard," U.S. Bureau of Land Management Habitat Management Series for Endangered Species, Report No. 5, 1973.

Soil Conservation Society of America. Soil Erosion: Prediction and Control. Ankeny, Iowa, 1977.

South Coast Air Quality Management District. Air Quality Handbook for Environmental Impact Reports. El Monte, Ca., 1977.

Southern California Air Pollution Control District. Fuel Use and Emissions From Stationary Combustion Processes. El Monte, Ca., 1976.

Spaeth, M. G. and S. C. Berkman. The Tsunami of March 28, 1964, as Recorded at Tide Stations. U.S. Department of Commerce ESSA Technical Reports C and 6.5.33. 1967.

State of California. An Oceanographic and Biological Survey of the Southern California Mainland Shelf, California. State Water Quality Control Board Publication No. 27. 1965.

State of California, Employment Development Department. Santa Barbara County Labor Market Bulletin. Los Angeles, 1976.

Strange III, R. Rea. "A Hindcast of Wind and Wave Conditions at the Proposed LNG Site Near Point Conception, California," 1977.

Thom, H. C. S. "New Distributions of Extreme Winds in the United States," Journal of the Structural Division, Proceedings of the American Society of Civil Engineers (1968), pp. 1,787-1,801.

Upson, J. E. Geology and Groundwater, South Coast Basins, Santa Barbara County, California. USGS Water Supply Paper 1108. 1951.

U. S. Atomic Energy Commission. Final Environmental Impact Statement Related to the Nuclear Generating Station, Diablo Canyon. 1973.

U.S. Department of Agriculture, Soil Conservation Service. "Official Series Descriptions and Interpretations." Washington, D.C.

---- Report and General Soil Maps: Kern County, California, 1967; San Luis Obispo County, California, 1968; Santa Barbara County, California, 1968.

---- Soil Survey of Northern Santa Barbara Area, California. Washington, D.C., 1972.

---- Soil Survey of Santa Barbara County, California, South Coastal Part, Interim Report. Washington, D.C., 1977.

---- Soil Survey of Ventura Area, California. Washington, D. C., 1970.

---- The Yearbook of Agriculture. Washington, D.C., 1957.

U.S. Department of the Air Force. Final Environmental Impact Statement: Space Shuttle Program, Vandenberg Air Force Base, California. 1978.

U.S. Department of Commerce. State of California Coastal Management Program and Final Environmental Impact Statement. Washington, D.C., 1977.

U.S. Department of Commerce, Bureau of the Census. Number of Inhabitants: California. PC(1)A6. 1971.

U.S. Environmental Protection Agency. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/2-78-019. Research Triangle Park, N.C., 1978.

---- Compilation of Air Pollutant Emission Factors. 2nd Ed. Research Triangle Park, N.C., 1975. Supplement No. 7, 1977.

---- Effectiveness of Organic Emission Control Programs as a Function of Geographic Location. Research Triangle Park, N.C., 1977.

---- Guidelines for Air Quality Maintenance Planning and Analysis: Procedures for Evaluating Air Quality Impact of New Stationary Sources. Vol. 10, revised. Research Triangle Park, N.C., 1977.

---- Power Plant Stack Plumes in Complex Terrain: An Analysis of Current Research. Research Triangle Park, N.C., 1977.

---- Workbook of Atmospheric Dispersion Estimates. Research Triangle Park, N.C., 1970.

U.S. Department of the Interior. Natural Resources of California. Washington, D.C., 1965.

U.S. Fish and Wildlife Service. "Endangered and Threatened Wildlife and Plants," Federal Register (October 27, 1976), pp. 47,181-47,198.

---- "Endangered and Threatened Species: Plants," Federal Register (June 16, 1976), pp. 24,524-24,572.

---- "Review of Endangered Species Status of U.S. Plants," Federal Register (July 1, 1975), pp. 27,833-27,924.

---- Threatened Wildlife of the United States. Washington, D.C., 1973.

Warren, Claude N. "California" in The Development of North American Archaeology, James E. Fitting, Ed. Garden City, N.Y., 1973, pp. 212-249.

Wells, Philip V. "Vegetation in Relation to Geological Substratum and Fire in the San Luis Obispo Quadrangle, California," Ecological Monographs (Vol. 32), pp. 79-103.

West, James, California Department of Transportation. Telephone Conversation with FERC Staff, February 7, 1978.

White, Keith L. "Structure and Composition of Foothill Woodland in Central Coastal California," Ecology (Vol. 47), pp. 229-237.

Willey, Gordon R. An Introduction to American Archaeology: North and Middle America. Englewood Cliffs, N.J., 1966.

Woodward-Clyde Consultants. Geotechnical Evaluation of Five Potential Mainland California LNG Import Terminal Sites. Orange, California, 1978.