OPPORTUNITIES FOR NEW COASTAL POWER PLANTS IN CALIFORNIA

STAFF REPORT

JUNE 1981

CALIFORNIA
ENERGY
COMMISSION

P700-81-006

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

CALIFORNIA ENERGY COMMISSION
1111 HOWE AVENUE
SACRAMENTO, CALIFORNIA 95825

TO: All Interested Parties

The staff of the California Energy Commission (CEC) has completed its study examining opportunities for new coastal power plants in California. The study was prepared for the California Coastal Commission (CCC) and the San Francisco Bay Conservation and Development Commission (BCDC). Its purpose was to determine if energy development objectives could be met while maintaining coastal protection. From the study it was concluded that minimal changes to CCC and BCDC designated areas would be required to allow development of coastal power plants at the locations identified.

A draft of this report was widely circulated for comment to governmental agencies, utilities and interested members of the public. Public workshops on the draft report were conducted by CEC staff in early 1981, and many comments, both written and verbal, were received and incorporated as changes to the final report. Public participation significantly assisted in improving the quality of the study.

If you have any questions regarding the final report or future studies, please contact David Maul of the CEC's Special Projects and Planning Office at (916) 920-7525. Written comments should be directed to:

California Energy Commission
1111 Howe Avenue, MS-43
Sacramento, CA 95825
Attention: David Maul

We welcome your continued participation in the activities of the California Energy Commission.

Sincerely,

JOHN L. GEESMAN
Executive Director

OPPORTUNITIES FOR NEW COASTAL POWER PLANTS IN CALIFORNIA

STAFF REPORT

PREPARED BY

CALIFORNIA ENERGY COMMISSION
1111 HOWE AVENUE
SACRAMENTO, CA 95825

JUNE 1981

This publication was prepared with financial assistance from the U.S. Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, under the provisions of the Federal Coastal Zone Management Act of 1972, as amended, and from the California Coastal Commission, under the provisions of the California Coastal Act of 1976.

DISCLAIMER

ACKNOWLEDGEMENTS

CALIFORNIA ENERGY COMMISSION
JOHN GEESMAN
EXECUTIVE DIRECTOR

ENGINEERING AND ENVIRONMENTAL DIVISION

CLIFF WEBB	Division Chief Engineering & Environmental Division
BILL DURKEE	Deputy Division Chief
BOB THERKELSEN	Office Manager Environmental & Health Office
KEITH SCHWARTZTRAUBER	Office Manager Engineering Evaluation Office
DAVE MAUL	Office Manager Special Projects Office
BRYCE CAUGHEY ROBERT WOODS	Project Managers Special Projects Office

CONTRIBUTING CEC STAFF

Zene Bohrer
Bob Brand
Jim Dickson
Judy Gaumon
Rod Gottschalk
Bob Haussler
Gary Heath
Joel Klein
Ken Koyama
Al McCuen
Greg Newhouse
Richard Peter
Luke Shurley
Brian Smith
Steve Smith
Bob Strand
Bob Therkelsen

California Coastal Commission

Brian Baird
Jody Loeffler
Joe Nicholson

Bay Conservation and Development Commission

Frank Broadhead
Margit Nickell

SECRETARIAL STAFF

Cindy Johnson
Lois Mouriski
Barbara Romanini
Word Processing staff

CONTRACTORS:

California Division of Mines and Geology

Richard Kilbourne

Department of Water Resources

John Bever
Richard DeCoe
Ernest Stone

Associated Electrical Engineers

Jerry Bagley
Don Keef

EE-6 CPP dh

ABSTRACT

This final report presents the results of a staff study examining power plant siting issues in California. The study was conducted to determine the effects of the California Coastal Commission (CCC) and the San Francisco Bay Conservation and Development Commission (BCDC) coastal protection policies on opportunities to develop new coastal power plants. The study concludes that minimal changes to CCC and BCDC policies are required to allow development of base load and peaking power plant capacity additions at the locations identified in the report.

The study examined four types of conventional power plants, six fuel types, and three sizes of plants. Approximately 200 areas on the coast were evaluated using 27 environmental and technical factors. Three institutional factors are examined to consider their effects on the opportunities identified. Finally, public opinion was considered in the evaluation of the results.

Opporunities for the location of new power plants are identified at nine areas along the coast and San Francisco Bay. The opporunities identified potentially allow the construction of 3700-4400 MW of generation capacity. The staff recommends that the CEC, CCC, and BCDC adopt a joint policy statement identifying the priorities for future development of coastally located power plants. Development should conform to the following priorities:

- Expansion of existing power plant sites,
- Development of new sites adjacent to existing sites,
- Development of new sites in other undesignated areas,
- Development of new sites in designated areas.

SUMMARY

Conclusion

Opportunities for the location of new power plants are identified at nine of approximately 200 California Coastal Commission (CCC) and San Francisco Bay Conservation and Development Commission (BCDC) undesignated areas (UAs). The opportunities identified potentially allow the construction of 3,700 - 4,400 MW of generation capacity to support the state's projected need for development of electrical supplies. Violation of ambient air quality standards in areas of rugged terrain was the most common prohibition to development. A common but mitigatable constraint to development at the nine remaining undesignated areas described herein is the effect of cooling water system entrainment and thermal discharges on marine and estuarine biological resources. Although other minor constraints exist at the nine UAs, they can be adequately mitigated. CEC staff has identified reasonable opportunities as a result of this study and an earlier CEC staff study which examined opportunities to expand existing coastal power plants. The CEC staff concludes that minimal changes to CCC and BCDC designated areas are required to allow development of base load and peaking power plant capacity additions at the locations identified in these reports.

Project Description

This study examines opportunities to locate new power plants in California's coastal zone. It has been conducted by the California Energy Commission (CEC) in conjunction with the California Coastal Commission (CCC) and the San Francisco Bay Conservation and Development Commission (BCDC). The purpose of this study is to determine the effects of CCC and BCDC designated areas on opportunities to develop electrical generating capacity in the state's coastal areas. The CCC and the BCDC are legally required to "designate" areas of their respective coastal zone jurisdictions where the location of a thermal power plant of 50 megawatts (MW) or greater would prevent achievement of coastal resource protection objectives. This study assists the CCC and the BCDC in determining the effects of the designations. Information from this study is being used by the CCC and the BCDC in their biennial revisions of their designations, and by the CEC in its continuing planning for the state's electrical generating supply needs.*

*THIS STUDY IS A PRELIMINARY ANALYSIS OF OPPORTUNITIES TO LOCATE NEW COASTAL POWER PLANTS; IT DOES NOT IDENTIFY OR SELECT SITES FOR CONSTRUCTION OF NEW POWER PLANTS. ACTUAL CONSTRUCTION OF ELECTRICAL GENERATING CAPACITY AT ANY COASTAL LOCATION EXAMINED IN THIS STUDY WOULD REQUIRE ADDITIONAL STUDY AND REVIEW BEFORE CERTIFICATION. THIS REPORT IS INTENDED FOR USE AS A PLANNING DOCUMENT AND IS NOT PART OF CEC'S REGULATORY PROCESS.

This study initially examined approximately 200 individual undesignated areas (UAs) for potential power plant opportunities. These areas were analyzed using 27 environmental and technical screening factors. The effects of three institutional factors--the Powerplant and Industrial Fuel Use Act (PIFUA), the CEC 1981 Biennial Report (BR) supply criteria (also 1981 Preliminary Report), and state nuclear waste disposal laws (PRC Section 25524.2)--are examined to consider their effects on the opportunities identified. Finally, public opinion was considered in the evaluation of the study results (see Appendix I).

The study examines opportunities for four types of conventional power plants: nuclear, direct-fired coal, oil- or gas-fired steam turbine, and combined cycle. Six fuel types--uranium, coal, oil, natural gas, methanol, and coal gas--are considered in conjunction with the various plant types. Finally, three plant sizes in terms of MW capacity--small (100 - 400 MW), medium (500 - 800 MW), and large (1,200 - 1,300 MW)--are used for each type of plant. The study includes an evaluation of cost factors for cooling water pumping penalties and transmission corridor analyses. No other economic analysis is performed in the study. Waterfront location opportunities are compared with setback opportunities to provide information for developing a range of coastal locations.

Results

Opportunities for the location of new power plants are identified at nine CCC and BCDC undesignated areas (5 - CCC; 4 - BCDC). Nearly all opportunities identified will require trade-offs or mitigation to offset the effects of adverse impacts on natural resources. Results are tabulated in Table i and Figure i and summarized in Chapter 5 - Results.

Air quality factors eliminated the majority of UAs examined (see Appendix H). In rural areas, this is due primarily to the interaction of air quality impacts from power plant stack emissions on the nearby hills. In urban areas, the lack of trade-offs for air quality impacts eliminates opportunities.

The most severe constraint to development at the nine undesignated areas described in this study is the impact of plant cooling water systems on marine biological resources. History, however, has shown that this impact can be mitigated and should not prohibit development. At the five CCC UAs, the impact of once-through cooling entrainment and thermal discharges on marine biological resources limits most opportunities to medium-size facilities. The use of cooling towers may increase these opportunities. At three BCDC UAs (with the exception of Oleum), the use of once-through cooling is not recommended due to thermal discharge restrictions. Thermal discharge effects associated with the use of alternative water supplies (waste water) on sensitive estuarine ecosystems at these sites would limit opportunities to small-size facilities. If cooling towers are used, they should use available waste water to reduce demand for limited freshwater supplies.

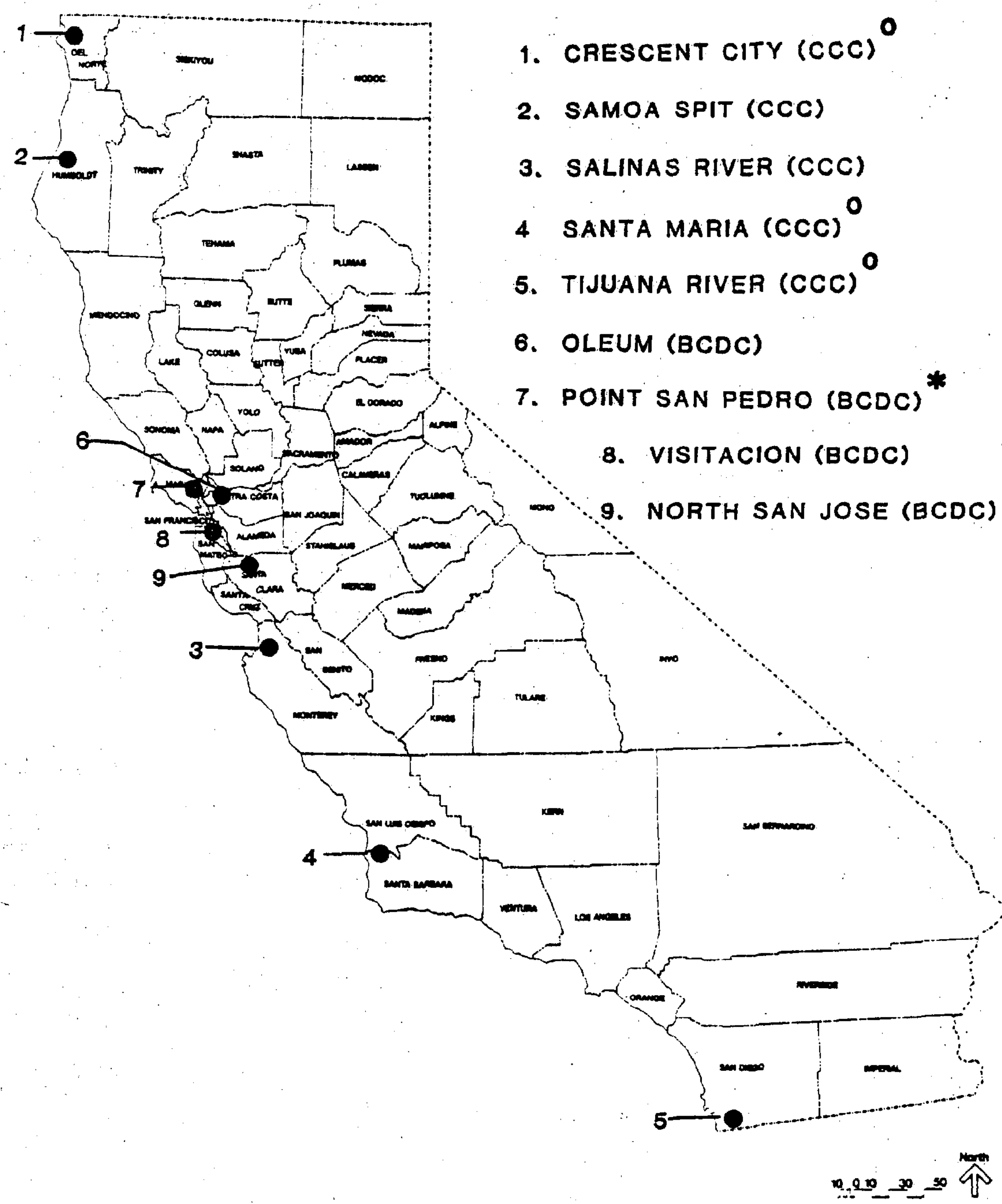
TABLE i: OPPORTUNITIES SUMMARY (MW)

Technology / SITE (Fuel)	NUCLEAR	COAL	CONVENTIONAL STEAM TURBINE	COMBINED CYCLE
	UO_2	COAL	OIL, NATURAL GAS, COAL GAS, METHANOL	OIL, NATURAL GAS, COAL GAS, METHANOL
CRESCENT CITY #<	-0-	-0-	150 - 500	400 - 500*
SAMOA SPIT	-0-	-0-	150 - 500	400 - 500*
SALINAS RIVER #	-0-	100	150 - 500	400 - 500*
SANTA MARIA RIVER #<	-0-	100	150 - 500	400 - 500*
TIJUANA RIVER # <	-0-	-0-	150 - 800	400 - 500*
OLEUM	-0-	100	150	400*
PT. SAN PEDRO +	-0-	-0-	150	400*
VISITACION	-0-	100	150	400*
NORTH SAN JOSE # +	-0-	100	150	400*

- SETBACK AREA
* - MOST PRACTICAL CAPACITY DISTRIBUTION: BASED ON SELECTION OF MOST EFFICIENT TECHNOLOGY AT AREAS WITH REASONABLE DEVELOPMENT OPPORTUNITY
+ - SENSITIVE DEVELOPMENT LOCATION BUT MEETS OPPORTUNITY CRITERIA
< - REQUIRES PARTIAL DESIGNATION FOR DEVELOPMENT

FIGURE i

OPPORTUNITY LOCATIONS



1. CRESCENT CITY (CCC)°
2. SAMOA SPIT (CCC)
3. SALINAS RIVER (CCC)
4. SANTA MARIA (CCC)°
5. TIJUANA RIVER (CCC)°
6. OLEUM (BCDC)
7. POINT SAN PEDRO (BCDC)*
8. VISITACION (BCDC)
9. NORTH SAN JOSE (BCDC)*

° - PARTIAL DESIGNATIONS ARE REQUIRED TO DEVELOP OPPORTUNITIES

* - SENSITIVE LOCATION FOR DEVELOPMENT BUT MEETS LOCATION OPPORTUNITY CRITERIA

The availability of land is not considered a serious constraint at most of the nine UAs due to their generally rural location or less developed status. However, land availability is limited at two BCDC UAs (Pt. San Pedro and Visitacion), thereby restricting opportunities at the two UAs to small-size facilities. This study identifies five UAs (4 - CCC; 1 - BCDC) that are set back from the coast. Engineering analysis of the feasibility to pump cooling water to these areas confirms the availability of these opportunities. Locations set back from the immediate coastline provide more flexibility in locating power plants where designated areas may limit access to the immediate coastline. This provides opportunities which are not constrained by the impacts on biological resources.

This report identifies opportunities for conventional steam turbine and combined-cycle power plants. The report also identifies opportunities for 100 MW coal-fired facilities which economically may not be a practical opportunity. Opportunities for new nuclear power plants are determined not to be available at any of the 200 UAs initially considered in this study. This is due to the limiting effects of Quaternary faults, lack of ingredients to demonstrate positive geologic stability, and population density criteria. These specific results generally reflect the conservative nature of the siting criteria of the Nuclear Regulatory Commission (NRC).

The development of the opportunities identified in this report may be limited by certain institutional factors. The Powerplant and Industrial Fuels Use Act (PIFUA) would limit the use of oil and gas fuels in new steam turbine and combined-cycle power plants until either synthetic fuels are available on a reliable basis or exemptions to PIFUA are established. The 1981 CEC Biennial Report forecasts the demand for electricity and identifies California's preferred energy options. Both aspects discourage the development of new conventional power plants except those using synthetic fuels.

The results of this study indicate moderate opportunities (3,700 MW - 4,400 MW) for new electrical generating capacity exist at nine coastal locations. Additionally, staff has previously identified* 7,600 MW -10,000 MW of capacity available through expansion at 20 existing coastal power plant sites. These expansion opportunities were for both base load and peaking power plant types. Staff concluded that the CCC and BCDC designated areas did not preclude opportunities for the reasonable expansion of existing coastal zone power plants. Again, PIFUA would be a limiting factor unless an exemption was obtained or a reliable source of synthetic fuels was available.

Based on the results of these two studies, CEC staff concludes that there are reasonable opportunities (assuming exemptions to PIFUA or a reliable supply of synfuels) for both base load and peaking capacity additions on the coast. Minimal changes to CCC and BCDC designated areas are required to allow development of these opportunities. While the major utilities have not identified the necessity to develop any of the nine opportunities in this report during the period 1980-92, future change in the CEC Demand Forecast may require development of one of these opportunities.

---

*Opportunities to Expand Existing Coastal Power Plants in California (see Appendix G).

Recommendations

The CEC staff recommends the following actions to support the results and conclusions of this study:

1. The CEC, the CCC, and the BCDC should adopt and issue a joint policy statement identifying the priorities for future development of coastally located electrical generating capacity. This statement should be based on opportunities and constraints identified in this study and in the previous coastal power plant expansion study. Such a statement should provide for continuing safeguards of coastal resources as required by law and provide for developmental capacity with the following priorities:

   o Expansion of existing power plant sites,

   o Development of new sites adjacent to existing sites,

   o Development of new sites in other undesignated areas, and

   o Development of new sites in designated areas only as a last resort.

2. The CCC should allow development of cooling water conduits at Crescent City (CCC Map 2), Santa Maria River (CCC Maps 109, 110, and 111), and Tijuana River (CCC Map 161) to accommodate opportunities identified in this report. This would allow for necessary power plant ancillary support facilities. Proposals for development at these areas should consider the priorities identified in recommendation number one. Prior to such designation, the applicant should submit a detailed site-specific evaluation of the proposed area to the CCC to ensure that no substantial adverse impact on the environment occurs as a result of site development and operation. This submittal should occur prior to or concurrently with the CEC Notice of Intent regulatory proceedings. The CCC can allow this development by either adopting a partial designation or by making a finding under Public Resources Code Section 25526.

3. The CCC should adopt regulations on procedures for approval of ancillary power plant support facilities in designated areas pursuant to Section 25526 of the Public Resources Code. The regulations should provide a procedure for CCC review of utility proposals to locate underground cooling water intake and outfall pipelines through designated areas to determine if the facilities can be sited consistent with the primary uses of the land and if any substantial adverse environmental effects of the proposal can be mitigated.

4. The CCC and the BCDC should ensure that study results are incorporated into coastal planning studies at the local level to assist in maintaining options for any opportunities identified. The agencies should cooperatively participate in local planning efforts to promulgate the necessary information and interpretation. The CCC and BCDC staffs should participate in the development of local coastal plans to ensure that such plans are not inconsistent with the results of this study and the previous site expansion study.

TABLE OF CONTENTS

	Page
SUMMARY	i
TABLE OF CONTENTS	vii
LIST OF TABLES AND FIGURES	viii
CHAPTER 1 - INTRODUCTION	1
CHAPTER 2 - PROJECT DESCRIPTION	2
Objective	2
Methodology	3
CHAPTER 3 - EVALUATION ANALYSES	14
Air Quality	15
Geology	27
Public Facilities	36
Biological Resources	48
Water Resources	69
Setback Ranges	78
CHAPTER 4 - INSTITUTIONAL FACTORS	76
CHAPTER 5 - RESULTS	90
Area Profiles	92
Matrix by Location and Plant Type: Table 15.	98
Plant-Type Profiles	99
Screening Factor Profiles	102
Institutional Constraints	105
Undesignated Area Opportunities: Conclusions	109
CHAPTER 6 - RECOMMENDATIONS	111
REFERENCES	113
APPENDICES	120
A. CEC, CCC, BCDC SITING MANDATES	121
B. PLANT TECHNOLOGY DESCRIPTIONS	123
C. SCREENING FACTOR DEFINITIONS	129
D. AIR QUALITY CRITERIA	144
E. SETBACK CRITERIA	145
F. TRANSMISSION CORRIDORS	175
G. EXPANSION STUDY RESULTS	183
H. AREA PROHIBITION CRITERIA	187
I. PUBLIC PARTICIPATION	188
J. AREAS MAPS (UAs 1-19 only)	209

LIST OF TABLES

Page

Table i - Opportunities Summary iv
Table 1 - Plant Technology 11
Table 2 - Evaluation Factors 13
Table 3 - Ambient Air Quality Standards 16
Table 4 - Trade-offs Required For AAQS Violations 19
Table 5 - Status of Compliance with State and Federal AAQS 20
Table 6 - Percent of Average Annual TSP Concentrations Comprised of Organics, Sulfates, and Nitrates 21
Table 7 - Allowable PSD Deterioration Increments 24
Table 8 - Cultural Resources (CCC) 41
Table 9 - Cooling Water Demand 72
Table 10 - Acreage Assumptions For Cooling Processes 74
Table 11 - Flood Hazard and Alternate Water Supply Analysis (BCDC) 76
Table 12 - Water Quality and Waste Disposal 77
Table 13 - Setback Pumping Costs 80
Table 14 - Setback Opportunities 85
Table 15 - Summary of Opportunities 98
Table 16 - Capacity Distribution 108
Table D1 - Emission Limitations 138
Table D2 - Plant Specifications 142
Table D3 - Trade-off Requirements 143
Table E1 - Cooling Water Requirements 146
Table E2 - Summary of Design Criteria 154
Table E3 - Design Criteria and Capacity Factors 155
Table E4 - Fuel Cost 156
Table E5 - Design and Cost Criteria 159

LIST OF FIGURES

Figure i - Opportunity Locations iii
Figure 1 - Opportunity Locations 5
Figure 2 - Coastal Designated Areas 6
Figure 3 - Quaternary Fault Restriction Zones 30
Figure 4 - Breakeven Costs (Setback Siting) 81
Figure 5 - Setback Facility 82
Figure E1 - Megawatts versus Plant Size 161
Figure E2 - Megawatts versus Plant Size 162
Figure E3 - Installed Capital Cost versus Plant Size 163
Figure E4 - Installed Capital Cost versus Plant Size 164
Figure E5 - Annual Operating and Maintenance Cost versus Plant Size 165
Figure E6 - Total Annual Cost versus Plant Size 166
Figure E7 - Installed Capital Cost versus Plant Size (Hydroelectric Generation) 167
Figure E8 - Annual kWh x 10^6 versus Plant Size (Hydroelectric Generation) 168

Figure E9 - Breakeven Price of Power versus Plant Size 169
Figure E10 - Once-Through Saltwater Cooling System (Net Cost Penalty) 170
Figure E11 - Once-Through Saltwater Cooling System (Net Cost Penalty) 171
Figure E12 - Breakeven Cost of Once-Through Cooling versus Cooling Towers (A Function of Plant Elevation and Setback Distance) 172
Figure E13 - Annual Cost Penalties for A 1,200 MW Nuclear and 500 MW Combined Cycle Power Plants Using Once-Through Cooling 173
Figure E14 - Construction Cost Penalties for A 1,200 MW Nuclear and 500 MW Combined Cycle Power Plants Using Cooling Towers 174

OPPORTUNITY MAPS

Map 1A - Crescent City 211
Map 1B - Crescent City 212
Map 2 - Samoa Spit 213
Map 3A - Salinas River 214
Map 3B - Salinas River 215
Map 4A - Santa Maria River 216
Map 4B - Santa Maria River 217
Map 5 - Tijuana River 218
Map 6 - Oleum 219
Map 7 - Pt. San Pedro 220
Map 8 - Visitacion 221
Map 9 - North San Jose 222

CHAPTER 1: INTRODUCTION

This study, conducted by the California Energy Commission (CEC), examines opportunities to locate new power plants in undesignated areas of the California Coastal Commission (CCC) and the San Francisco Bay Conservation and Development Commission (BCDC) coastal zones. Specifically, the study examines the availability of opportunities for locating new power plants after the application of coastal resource protection designations by the CCC and the BCDC have initially restricted those opportunities in certain areas of the coast. The potential for additional electrical-generating capacity from new coastal power plants is an important consideration in the development of California's energy supply strategy, and the potential effect of restrictions on new power plant sites, such as designated areas, must be adequately analyzed if electricity supply projections are to be accurately matched with electricity demand projections. This study limits its analyses to screening existing undesignated areas with a variety of technical and institutional factors for opportunities for new power plants. It follows a similar CEC staff study which produced the report "Opportunities to Expand Coastal Power Plants in California."

The CEC, within its role as the state's energy resources conservation and development agency, has been assigned the exclusive responsibility for certifying statewide sites--including the coastal zone--for new thermal power plants of 50 MW or greater (see Appendix A). The CCC and the BCDC, within their roles as the state's coastal zone land use planning agencies, have been assigned the responsibilities for "designating" specific areas of their respective jurisdictions where the location of a thermal electric power plant of 50 MW or more would prevent the achievement of coastal resource protection objectives.

These three state agencies, by reason of their separate legislative mandates share responsibilities for the location of new power plants in California's coastal zone areas. To be most effective, these responsibilities must be carried out cooperatively. This study is such a cooperative effort, conducted jointly by the CEC, the CCC, and the BCDC to examine opportunities to locate new power plants in undesignated coastal zone areas.

THIS STUDY IS NOT INTENDED OR DESIGNED TO BE A SITE-SELECTION STUDY OR A DETAILED RESOURCE, OR IMPACT ANALYSIS. Its format and depth of analysis are intentionally limited to a preliminary level that is sufficient only to examine general opportunities for locating power plants. It should not be used, or in any other way interpreted, as a site-selection study.

This study is a continuation of previous CEC locational analysis projects: the 1977 CEC Biennial Report, Volume 7, Power Plant Siting; the 1979 CEC Constraint Mapping Study; the 1979 CEC Constraints and Opportunities for Power Plant Siting: Technical Issues; the 1979 CEC Biennial Report; the 1980 CEC Opportunities to Expand Coastal Power Plants In California; and the 1981 CEC Biennial Report and Electricity Tommorrow. This final report is the subject of four workshops in February and March 1981. Additional coastal area studies are not scheduled at this time.

CHAPTER 2: PROJECT DESCRIPTION

OBJECTIVE

This study examines opportunities to locate new power plants in undesignated* areas (UAs) of the California coastal zone. Its objective is to determine the effects of CCC and BCDC coastal resource protection designations** on opportunities to locate electrical-generating facilities on the state's coast. To that end, the study is conducted by the CEC to assist the CCC and the BCDC with the legislatively mandated revisions to their designation processes. The study is intended to provide information for the second set of revisions of the designations of both agencies.***

This is a preliminary study which is intended only to accomplish a general examination of opportunities to locate new power plants in CCC and BCDC undesignated areas. THE STUDY IS NOT AN ATTEMPT BY THE CEC TO SITE POWER PLANTS, AND SHOULD NOT BE INTERPRETED IN THAT MANNER.

CEC staff studies and analysis of the California Coastal Act and the McAteer-Petris Act suggest that new coastal electrical-generating capacity be considered in the following priority:

- Expansion of existing power plant sites,
- Development of new sites adjacent to existing sites,
- Development of new sites in other undesignated areas,
- Development of new sites in designated areas only as a last resort.

A study examining expansion opportunities, "Opportunities to Expand Coastal Power Plants in California," was completed by the CEC staff in 1980. This new study is the continuation of a planning procedure intended to correlate the need for electrical generating capacity with opportunities to locate such

---

*Areas of the coast not "designated" as noted below are available for the location of new and/or expanded powerplants. In planning vernacular these areas are termed "undesignated" areas. These undesignated areas are the subject of this study.

**State law (see Appendix A) requires both the CCC and the BCDC to "designate" areas of their respective coastal zone jurisdictions where the location of any thermal power plant with an electrical generating capacity of 50 MW or greater, or any electric transmission line, would prevent the achievement of coastal resource protection objectives noted in the agencies' enabling legislation [PRC Section 30413b and GC Section 66645(b)].

***Revisions of the CCC and BCDC designations are required biennially, and are scheduled to occur in alternate years. The CCC designates were begun in 1978, and first revised in 1980; the next revision is due in 1982, etc. The BCDC designation revision are scheduled for 1981 and 1983, etc.

capacity in the coastal zone where important opportunities, such as major load centers and once-through cooling water supplies, exist. If the combined expansion and new plant opportunities do not provide adequate electric generating supply capacity, designated areas could then be studied to determine if specific revisions would help to provide the necessary capacity siting opportunities.

A second objective of this study is to generate information for use in developing and revising CCC local coastal programs (LCPs), and for other land use planning efforts by both the CCC and the BCDC. In this respect, the study is intended to further the coordination of the three agencies involved--the CEC, the CCC, and the BCDC. This cooperation in discharging separate, as well as joint, responsibilities in coastal zone land use planning and power plant locational analysis is intended to avoid duplication of effort and products, and to reduce the staff time and expenditures involved.

The third objective is to generate information and identify the need for additional studies which could help guide utility supply planners in the development of more detailed siting or expansion analyses. This study considers opportunities on a coastwide basis and provides information of a more comprehensive nature than the utilities might ordinarily develop individually. The study's comprehensive design is intended to reduce duplication effort in future planning studies by the utilities.

This study will also contribute to satisfying the mandate of Public Resources Code 25309(e) and to a number of current and future CEC planning programs. Through the provision of information on plant locational opportunities, the study will contribute to the long-term resolution of regional equities such as coastal/inland cooling water conflicts, and urban/rural air quality impacts. Information from the study will also be used in the CEC's synthetic-fuel planning program.

METHODOLOGY

Design

This study uses the process of geographic focusing or screening to introduce a practical element into the examination of opportunities for new power plants. These opportunities are identified by determining the effects of a variety of power plant location characteristics (or factors) on each undesignated area. Through this process, certain undesignated areas may be identified as providing opportunities for a range of plant types and generating capacities, while other areas may be eliminated. The results (opportunities) are then compared against the projected need for supplies of electrical generating capacity.

The study is limited to a preliminary level of examination and analysis. Determinations of availability of power plant location opportunities are of necessity, based on the "Null Hypothesis" principle. If a clear prohibition to location has not developed on completion of the screening process, an opportunity for location is assumed to exist <u>within the limits of the study's level of analysis</u>. This level of analysis as previously noted, is not intended to result in site selection. The results of the study are, therefore, not conclusive but are sufficiently detailed to adequately meet the technical and institutional factors used in this study, and to provide direction for additional planning.

Evaluation Process

The evaluation process used in this study is a common and generally accepted screening method. It involves the progressive reduction (focusing) of the geographic scope of review as the level of detail of the screening factors being applied is increased. That is, large land areas are first examined with factors whose effects occur on a gross level to eliminate (screen) areas where opportunities do not exist. The remaining smaller areas are then, in turn, examined with factors whose effects occur on a more site-specific level. The result is a limited number of relatively small areas which have not been screened out or eliminated on either a gross or site-specific level. These areas are identified as opportunity areas for the purpose of the study.

This study uses air quality and geology factors to examine regional areas for opportunities on a gross basis; public facility and natural resource factors are used to examine the results of that gross screening process for opportunities on a more detailed or site-specific basis. At both levels of screening, the factors are applied to determine both effects which might be prohibitive or constraining to an unacceptable degree, or which might be positive opportunities for location of a new power plant (see also Evaluation Factors section following in this chapter).

Scope

This study examines opportunities for locating new power plants in, or adjacent to, California's coastal zone areas. The study is limited in geographic scope to the state's coastal areas due to the jurisdictions of the CCC and the BCDC. The CCC jurisdiction incorporates the 1,100 mile Pacific Ocean coastline, and the BCDC jurisdiction covers the 300 mile shoreline of the San Francisco and Suisun Bays (see Figure 1).

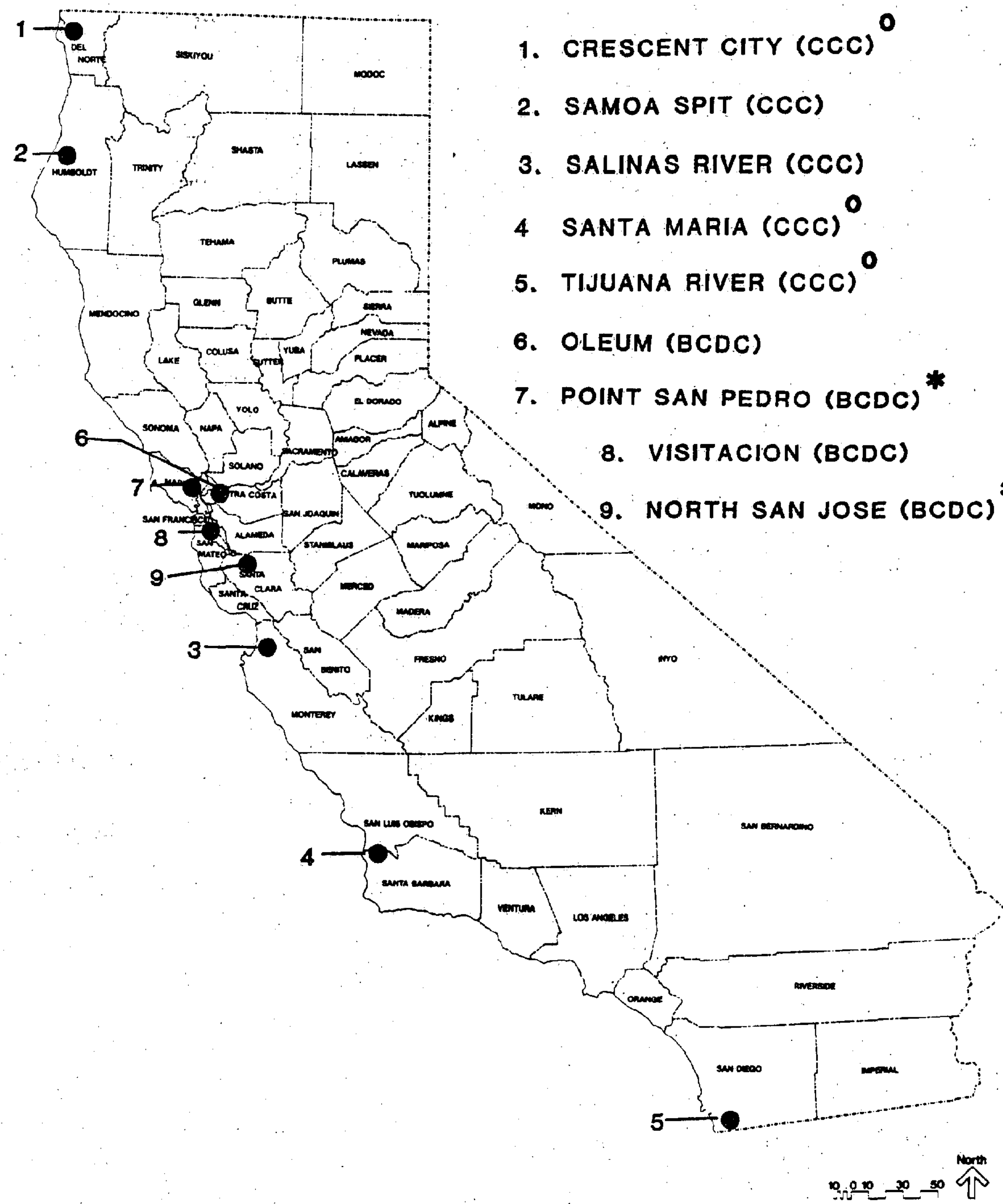
While this study initially examined approximately 200 UAs, this report discusses only the opportunities of nine UAs which met the evaluation criteria. These nine UAs are described with general place names and numbers by staff for ease of reference throughout this report. These nine UA locations and numbers are:

Crescent City	- UA 1
Samoa Spit	- UA 2
Salinas River	- UA 3
Santa Maria River	- UA 4
Tijuana River	- UA 5
Oleum	- UA 6
Point San Pedro	- UA 7
Visitacion	- UA 8
North San Jose	- UA 9

The study's examination of opportunities for new power plants is limited primarily to the undesignated areas of both the CCC and the BCDC. In general, these undesignated areas are defined by the boundaries of the "designations" assigned by the CCC and the BCDC to prevent power plant impacts on coastal

FIGURE 1

OPPORTUNITY LOCATIONS



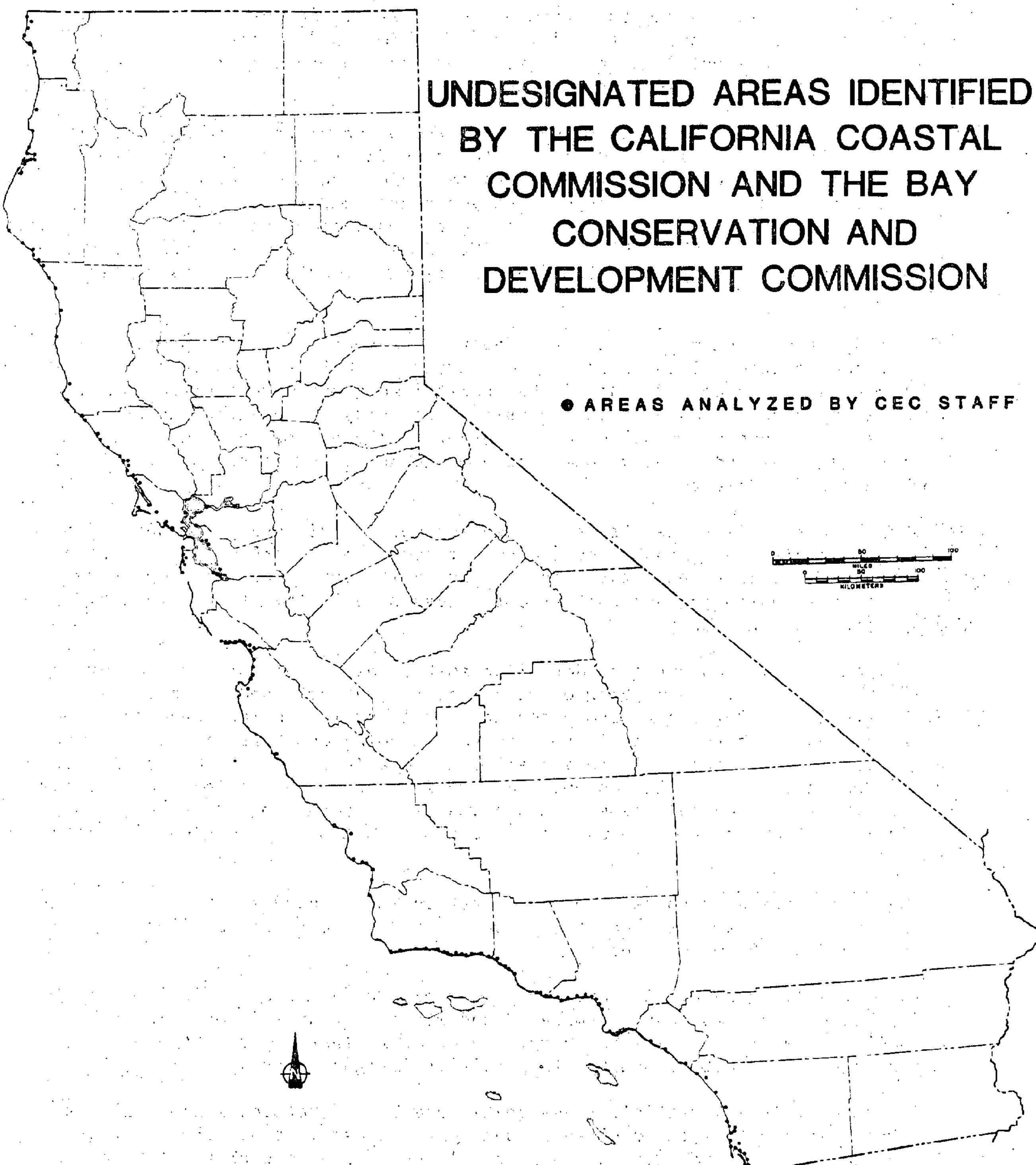
1. CRESCENT CITY (CCC) o
2. SAMOA SPIT (CCC)
3. SALINAS RIVER (CCC)
4. SANTA MARIA (CCC) o
5. TIJUANA RIVER (CCC) o
6. OLEUM (BCDC)
7. POINT SAN PEDRO (BCDC) *
8. VISITACION (BCDC)
9. NORTH SAN JOSE (BCDC) *

o - PARTIAL DESIGNATIONS ARE REQUIRED TO DEVELOP OPPORTUNITIES

* - SENSITIVE LOCATION FOR DEVELOPMENT BUT MEETS LOCATION OPPORTUNITY CRITERIA

FIGURE 2

UNDESIGNATED AREAS IDENTIFIED BY THE CALIFORNIA COASTAL COMMISSION AND THE BAY CONSERVATION AND DEVELOPMENT COMMISSION



CALIFORNIA ENERGY COMMISSION

1981

resources (see Appendix A). The study does not examine opportunities in any of these designated areas (see Figure 2). However, analyses of some of the undesignated areas require that logical, yet limited, peripheral portions of the adjacent designated areas be screened to provide information to help resolve a particular issue within a UA.

In addition to UAs with direct access to the ocean or bay waters, the study also examines opportunities to locate plants in UAs that are set back from the water's edge. Such "setback"* locations would require that cooling water conduits traverse longer distances between plant and water supply but could also provide more opportunities to locate plants since more land areas would be available. Both the CCC and the BCDC have provided for such "setback" siting opportunities by assigning "partial designations"** to certain areas of the coast.

The study, then, examines both waterfront and setback location opportunities. The setback portion of the study screens areas up to five miles inland. Most of these inland areas are out of the coastal zone but were included in this preliminary study because of the possible necessity to use the coastal zone for ancillary systems (cooling water, etc.). The effects of these partially designated areas and setback locations are discussed in Chapter 3: Analyses, and Chapter 5: Results.

Several other limitations affect the development of this study. They reflect the many complex technical, legal, and institutional factors which affect the location of power plants statewide. They limit the scope and complexity of the study's design but not the effectiveness or validity of the results and conclusions of the study.

First, the study does not consider all possible power plant siting factors or all possible relationships between the factors that are used. It relies on factors selected for their prominence and efficacy in the land use aspect of locating power plants. The factor selection coincides with the intent and necessity to limit the study to a preliminary examination. Specifically, the study does not examine all economic factors involved with the location of new power plants in coastal areas. Economics are clearly important to ultimate siting decisions and are included in the CEC's Notice of intention (NOI) and

---

*"Setback" siting permits a power plant to be located slightly inland so that the plant is still "on" the coast or in the near coastal area yet not exactly "on" the water's edge.

**A "partially designated" area may contain only power plant ancillary facilities such as cooling water conduits and transmission lines; these facilities must be located underground; power plants per se (power block, fuel tanks) may not be located in partially designated areas.

The combination of partially designated areas and setback siting allows a power plant to be located close enough to the coast (through the location of ancillary support facilities in partially designated areas) to take advantage of the positive attributes of coastal locations. At the same time, the effects on the sensitive coastal resources of the transition zone between water and land habitats are minimized.

Application for Certification (AFC) regulatory process. This study examines only cost penalties associated with setback location and cost estimates of the development of transmission line corridors. ADDITIONAL ANALYSIS BEYOND THE SCOPE OF THIS STUDY WOULD BE NECESSARY TO ACTUALLY SELECT LOCATIONS FOR SITING. THIS PLANNING STUDY IS NOT DESIGNED TO BE A TOOL FOR SUCH FINAL SELECTION. IT DOES NOT REPLACE THE CEC'S REGULATORY PROCESS.

Second, the factors used for the study are not weighted. Rather they are applied sequentially. Only to the extent that they are sequentially applied, are the factors considered cumulatively. The effects of individual factors are considered individually, and are not added to determine a specific level of opportunity.

Third, some power plant technology characteristics considered in this study are known to be relatively impractical in the current commercial and technical frameworks. For instance, 100 MW nuclear and coal plants are utilized as examples of small plant sizes for those technologies in this study, but, for all practical purposes, nuclear and coal plants of this size are no longer constructed. They are included in this study, however, to provide as broad a range of technical characteristics as possible so that the analysis of opportunities would be as complete as possible. Inclusion of the smaller plant sizes is also intended to provide elementary information for consideration in energy supply plans that emphasize decentralization of power plants.

The technologies considered in this study are essentially limited to those which are commercially available, or which are projected to be available, through 1985. The study does not consider potential effects of technologies which may be available after 1985. Potential effects of proposed future land land development patterns on land use, or air and water quality are not considered.

Fourth, since the scope of the study is limited to coastal zone areas only, an extensive examination of regional equities (for example, coastal vs. inland siting and water use constraints and opportunities) are not involved. The study does examine the relation of projected statewide end-use demand to potential new site capacity. This is based on the 12-year planning period that coincides with CEC Biennial Report (BR) forecast figures. This information is intended to contribute to a broader discussion of regional equities involving other concepts in addition to potential new coastal sites.

This study is based on readily available data (see References). With the exception of site visits and computer modeling (air quality and pumping penalties), original research is not conducted, nor is existing original research extensively interpreted.

Undesignated Areas

This study examines opportunities to locate new power plants in the jurisdictions of both the CCC and BCDC. Of necessity, it also considers partially designated areas where the underground placement of ancillary power plant facilities (for example, cooling water conduits and transmission lines) would support setback opportunities. Opportunities in designated areas of either jurisdiction are not considered.

CEC staff have identified, in the CCC jurisdiction, 141 undesignated areas, determined on the basis of complete and discrete boundary lines for each individual area. This system follows the designations of the CCC, and results in some undesignated and partially designated areas which are quite large and some which are quite small. However, for this reason, the individual areas also tend to incorporate coastal resources of a discrete or similar type so that while the sizes of the areas are varied, the analyses of the resources involved are more orderly and logical.

Undesignated areas located behind, or adjacent to, partially designated areas, are considered for setback opportunities along the entire length of the coast. Undesignated areas with immediate access to open ocean waters are not considered for setback locations. Space does not allow a graphic representation of all the areas--only those not eliminated by the screening process (see Appendix G). Map sets of the designated and undesignated areas are available for review at CCC and CEC offices.

CEC staff have identified, in the BCDC jurisdiction, 51 undesignated areas, 45 partially designated areas and 60 designated areas. The method of identification for these areas follows that described above.

The jurisdictions, and hence the noted undesignated areas of both the CCC and the BCDC are variously distributed among the service areas of the state's four largest electrical utilities--Pacific Gas and Electric Company (PGandE), Southern California Edison (SCE), San Diego Gas and Electric Company (SDGandE), and City of Los Angeles Department of Water and Power (LADWP).

Plant Types and Sizes (see Appendix B)

This examination of new power plant opportunities considers 30 different combinations of plant types, plant sizes, fuel types, and facility components. As indicated in Table 1, these combinations include four types of conventional electricity generating power plants: nuclear, coal direct-fired, oil- or gas-fired steam turbine (hereafter referred to as steam turbine) and combined cycle. A pressurized water reactor (PWR) is used as the nuclear plant type. Direct-fired coal plants are considered as a separate plant type due to the unique fuel and waste storage and handling capabilities required, even though the thermal generation process involved is a conventional steam turbine (Rankine-cycle) type.

Combustion (gas) turbine plant types are not considered in this study since the CEC 1979 Biennial Report (BR) indicated that the demand for this peaking capacity through 2000 can probably be met without a major new coastal site.

For example, 1,290 MW of combustion turbine capacity is proposed for development by SCE at the inland Lucerne Valley site. Cogeneration and repowering are not included as plant types since these technologies are options for expanding existing capacity.

Power plant technology is also considered in terms of three basic plant sizes--small, medium, and large. The capacity rating in megawatts (MW) for each plant size is related to the capacity for each of the four respective plant types as commonly constructed. Thus, a small steam turbine is rated for use in this study at 150 MW, while a small combined cycle is rated at 400 MW to reflect current construction practices.

Plants with a capacity of 50 MW or less are not examined in this study due to the legal restrictions on the CEC's review procedures. The Warren-Alquist Act limits the CEC power facility certification authority to "thermal power plant" (Public Resources Code [PRC] Sections 25500 and 25110). The Act further defines "thermal power plant" as "any stationary or floating electrical generating facility using any source of thermal energy, with a generating capacity of 50 MW or more (emphasis added), and any facilities appurtenant thereto" (PRC Section 25120). (See also Appendix A.)

Fuel Types

Table 1 also lists the various fuel types that are considered in conjunction with each plant type. Uranium dioxide pellets are the only fuel considered for nuclear plants, and only pulverized raw coal is considered for direct-fired coal plants. Four fuel types--oil, natural gas, coal gas, and methanol--are all considered as fuels for both the steam turbine and combined-cycle plant types. The effect of the availability of oil and natural gas as power plant fuels is discussed further in Chapter 4, Institutional Factors. Plant size is not a factor in the consideration of fuel type. The effects of fuel type are discussed in greater detail in Chapter 3--Analyses.

Screening Factors (see Appendix C)

The 30 combinations of plant and fuel type and plant size are further considered in terms of the 27 screening factors listed in Table 2. These factors are selected by CEC staff for their applicability to screening general opportunities for new power plant locations. They are not intended to represent all possible plant location considerations.

The 27 factors are grouped for discussion of analyses into several major groups on the basis of their application in the study: general land use, air quality, geology, public facilities, biology and water resources. The general land use and air quality factors are used in the analyses of plant effects on a regional basis. The geology, public facilities, and biology and water resources factors are applied on a more site-specific basis. Some of the factors are naturally occurring (for example, Wetlands and Estuaries), and some are man-made (Rail Lines and Public Parks).

The 27 factors are applied to determine the effects of the 30 different plant and fuel type and plant size combinations at various coastal locations. Potential locations are thus screened for 30 types of plant technology by 27 locational factors. This permits specific technology characteristics to be matched with compatible characteristics of specific, unique locations.

In this screening process, the factors are not considered to be either strictly constraints or strictly opportunities. Instead, each factor is analyzed in terms of its effects at various locations and is assigned one of five relative effect criteria ranging from opportunity to prohibition.

TABLE 1--PLANT TECHNOLOGY

Plant Type	Plant Size (MW) S	M	L	Fuel Type
Nuclear (PWR)	100	500	1,200	Uranium Dioxide
Coal (Direct-fired)	100	500	1,300	Coal
SteamTurbine (Oil/Gas)	150	500	800	Oil, NaturalGas, Coal Gas, Methanol
Combined Cycle	400	500	1,300	Oil, Natural Gas, Coal Gas, Methanol

The five levels of opportunity criteria are defined as follows:

1. Opportunity--desirable conditions or relationships exist that may aid in location, or otherwise promote or encourage opportunities to locate at specific areas.

2. Nominal--little or no constraint on location; little or no mitigation required for location; opportunity to locate exists.

3. Moderate--significant constraint on location; specific mitigation obviously and definitely required but location opportunities still exist.

4. Severe--most serious level of constraint not considered prohibitive; limited location possible only with costly design or mitigation required; limited location opportunities exist.

5. Prohibitive--location of any reasonable or practical plant size not possible due to this factor alone; eliminates location opportunities in spite of status of other factors.

With use of these criteria, each of the 27 evaluation factors may function either as an opportunity or constraint depending on its specific effect at different locations on the coast. The same factor, therefore, may have functioned as a prohibitive constraint at one location, as a nominal constraint at another location, and as an opportunity at still another location. For example, violation of emission limitations may be considered prohibitive at one location, while a lack of violation may be considered an opportunity at a different location.

These criteria are based primarily on practical rather than legal effects. Although certain of the factors (for example, air quality and seismicity standards) have a legal basis for existence, their application in this study, is based on technical knowledge and experience gained from previous staff analyses. Positive location opportunity is identified by three of the criteria: opportunity, nominal and moderate. The severe constraint criterion is considered as either opportunity or constraint depending on the extent of severity, and the degree to which the factor is critical to location of new facilities. The prohibitive criterion is used to indicate an elimination of location opportunities in all cases.

The factor and criterion application and analysis is done by CEC staff. The factor analyses are collated by individual location to develop an opportunity profile for each technology in terms of the opportunity criteria. Table 15 summarizes this information in a single matrix which identifies the general opportunities at various locations. The analyses supporting this study are described in Chapters 3 and 4 of this report. Results and conclusions are described in Chapter 5, and summarized beginning on page i. Recommendations are listed and explained in Chapter 6.

TABLE 2--EVALUATION FACTORS

GENERAL LAND USE

1. Parcel Size
2. Terrain Difficulty

AIR QUALITY

3. New Source Review
4. Emission Limitations
5. Prevention of Significant Deterioration

GEOLOGY

6. Slope Instability
    a. Active Sand Dunes
    b. Quaternary Landslides
    c. Steep Riverbank Slopes/Recognized Sea Cliff Instability
7. Faults and Related Seisic Hazards
    a. Ground Surface Rupture
    b. Seismic Shaking
    c. Seismically Induced Liquefaction
8. Selected Mineral and Geologic Resources
    a. Fossil Fuel Production
    b. Other Mineral Deposits

PUBLIC FACILITIES

9. Urban Areas
10. Cultivated Agricultural Lands
11. Recreational Activity Areas
12. Military Bases
13. View Protection
14. Rail Lines/Transportation
15. Available Land
16. Cultural Resources
17. Transmission

BIOLOGY RESOURCES

18. Legally Protected Species
19. Commerical/Recreational Species
20. Areas of Critical Concern
    a. Wetlands
    b. Estuaries
    c. Riparian Areas
    d. Refuges and Reserves
    e. Natural Areas
21. Species of Special Concern

WATER RESOURCES

22. Cooling Water Availability
23. Waste Water Availability
24. Once-Through Cooling Impacts
25. Waste Disposal Impacts
26. Water Quality Standards Conformance
27. Flood Hazards

CHAPTER 3: ANALYSES

This chapter describes the analyses associated with the application of the 27 screening factors in the screening process. The analyses discussions are organized into five general groupings of air quality, geology, public facilities, biology and water resources. Assumptions necessary to the analyses of each group of factors are described separately by group. The overall results of these analyses are discussed in Chapter 5: Results. Brief definitions for the 27 factors are contained in Appendix C.

AIR QUALITY

New Source Review (NSR)
Emission Limitations
Prevention of Significant Deterioration (PSD)

Three factors are used in analyzing air quality effects on opportunities for new coastal zone power plants. These factors are New Source Review (NSR) regulations, emission limitations, and Prevention of Significant Deterioration (PSD) regulations. These analyses are based on applicable air quality regulations and available ambient air quality data as of July 1, 1980.

New Source Review

NSR regulations are mandated by the United States Environmental Protection Agency (EPA) and have been promulgated at the state (model rules) and local level in California.

Basically, these regulations preclude a facility from being built if such a facility would prevent attainment or maintenance of an ambient air quality standard (AAQS). In California, there are state as well as national (EPA adopted) AAQSs, and for purposes of this study it is assumed that NSR regulations apply to both state and national AAQSs. These standards are included in Table 3. NSR regulations would preclude a new plant from being built if the plant would cause ground level AAQS violations where such violations do not already exist. This condition could occur where a plume from the plant stack would directly impact elevated terrain.

Earlier work by CEC staff in the Air Quality Statewide Coal Plant Area Screening Study (see References) indicated that a 500 MW coal plant would have to be located in an area in which net elevation increases are no more than 500 feet within a 10 kilometer (km) radius of the plant site to avoid excessive elevated terrain impacts. Since many of the undesignated coastal areas are located in or near complex terrain, a considerable number of areas were screened out at the onset of the study. Because some of the power plant types being considered in this study have considerably lower emissions than a 500 MW coal plant, the required "flat terrain" radius criterion was reduced to approximately 5 km. In other words, to be eligible for further consideration, an undesignated area would have to include at least one potential site at a minimum distance of 5 km (plus or minus) from the nearest point of terrain 500 feet higher than the potential site itself.

Following this initial screening process, site-specific impact analyses are performed to determine the maximum ground level impacts for various pollutants emitted by each power plant type and size. If these impacts are found to exceed the state or federal AAQSs, it is assumed that the plant type and size in question could not comply with NSR regulations. If ambient air quality data are available for the general site area, these data are used to establish background air quality. If the plant impacts plus the background air quality

TABLE 3--AMBIENT AIR QUALITY STANDARDS

Pollutant	Average Time	California Standards	National Standards	
		Concentration	Primary	Secondary
Oxidant	1 hour	0.10 ppm ($200\ ug/m^3$)	-	-
Ozone	1 hour	-	$240\ ug/m^3$ (0.12 ppm)	Same as Primary Standards
Carbon Monoxide	12 hour	10 ppm ($11\ mg/m^3$)	-	Same as Primary Standards
	8 hour	-	$10\ mg/m^3$ (9 ppm)	
	1 hour	40 ppm ($46\ mg/m^3$)	$40\ mg/m^3$ (35 ppm)	
Nitrogen Dioxide	Annual Average	-	$100\ ug/m^3$ (0.5 ppm)	Same as Primary Standards
	1 hour	0.05 ppm ($470\ ug/m^3$)	-	
Sulfur Dioxide	Annual Average	-	$80\ ug/m^3$ (0.03 ppm)	-
	24 hour	0.05 ppm ($131\ ug/m^3$)	$365\ ug/m^3$ (0.14 ppm)	-
	3 hour	-	-	$1300\ ug/m^3$ (0.5 ppm)
	1 hour	0.5 ppm ($1310\ ug/m^3$)	-	-
Suspended Particulate Matter	Annual Geometric Mean	$60\ ug/m^3$	$75\ ug/m^3$	$60\ ug/m^3$
	24 hour	$100\ ug/m^3$	$260\ ug/m^3$	$150\ ug/m^3$
Sulfates	24 hour	$25\ ug/m^3$	-	-
Lead	30 day Average	$1.5\ ug/m^3$	-	-
	Calendar Average	-	$1.5\ ug/m^3$	$1.5\ ug/m^3$
Hydrogen Sulfide	1 hour	0.03 ppm ($42\ ug/m^3$)	-	-
Hydrocarbons (Corrected for Methane)	3 hour (6-9 a.m.)	-	$160\ ug/m_3$ (0.24 ppm)	Same as Primary Standards
Vinyl Chloride (Chloroethene)	24 hour	0.010 ppm ($26\ ug/m^3$)		
Ethylene	8 hour	0.1 ppm	-	-
	1 hour	0.5 ppm		
Visibility Reducing Particles	1 observation	In sufficient amount to reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70%.		

concentration[1] are found to cause an ambient air quality standard violation where no violation previously existed, noncompliance with NSR is once again assumed.[2]

If there are inadequate existing air quality data, cumulative concentrations are assumed to be less than the standards. The pollutants for which impacts are calculated are oxides of nitrogen (NO_x), sulfur dioxide (SO_2) and particulates (TSP). Because of the complex mechanisms involved in their formation, and because of insufficient background data, the impacts of reactive pollutants [ozone and sulfate (SO_4)] are not determined.

Maximum local impacts are calculated with a numerical simulation model, SMOG. SMOG is a refined[3] version of IMPACT, a model developed by Science Applications, Inc. for the CEC and Air Resources Board (ARB).

The plant emissions characteristics are shown in Appendix D.[4] Those meteorological parameters (stability, wind speed, and direction) which resulted in the greatest impacts (over a one-hour averaging time) are selected as representative of "worst case" conditions. Further details on impact analysis are discussed under Air Quality Impact Analysis.

NSR regulations also require that if a new source would prevent the attainment of standards (i.e., ambient air quality standards are already exceeded) it cannot be built unless emission offsets, or trade-offs, are obtained. Trade-offs are reductions in emissions from existing sources in the same general

---

1. The greatest of the second highest values recorded in any of the most recent four years of ARB published air quality data (1976 - 1979).

2. It is theoretically possible that trade-offs (reduced emissions from existing sources) would reduce background pollutant levels at the worst case impact area sufficiently to prevent the plant from causing ambient standard violations. However, this possibility is rather unlikely, and was discounted as an option for this study.

3. Refined by the ARB Research Division.

4. These values do not include emissions associated with cooling towers, or fuel handling, transport and storage. Transport emissions could vary widely depending on the source of fuel. Handling and storage emissions may be very low if precautions are taken. Cooling tower particulate emissions (if cooing towers are employed) also vary widely depending on the quality of cooling water used and tower operating conditions. In addition, some local air regulatory agencies (e.g., the South Coast Air Quality Management District) are not concerned about cooling tower emissions.

area as the proposed new source.[5] These trade-offs must usually be obtained at a ratio of at least 1.2 to 1, that is, emission reductions must be a minimum of 20 percent greater than the added emissions from the new source. The AAQS being violated in the vicinity of the proposed new plant determines what trade-offs must be obtained. Table 4 indicates the emissions for which trade-offs must be obtained as a function of which AAQS are violated.

Based on earlier site screening, including elimination of sites located in or near complex terrain, only a portion of the coastal and Bay Area counties contained potential sites. The status of ambient air quality in each of these counties is shown in Table 5.

As explained in the footnotes in Table 4, additional particulates may be traded off in lieu of HC, NO_x, and/or SO_2 in the case of Total Suspended Particulate (TSP) AAQS violations. Unless HC, NO_x, and/or SO_2 had to be traded off for other reasons (e.g., ozone or SO_4 AAQS violations), it is assumed that extra particulate trade-offs would be cheaper, and therefore the preferred option. The average annual organic, sulfate, and nitrate fraction of TSP in each of the counties considered is shown in Table 6.

The trade-offs in each county which could potentially be applied to power plants are obtained from the CEC staff report, Statewide Emission Trade-off Inventory (see References). The required trade-offs, for each plant type and size at each potential site, are calculated based on Tables 4, 5, 6, and Appendix D. A trade-off ratio of 1.2:1 is assumed. The required trade-offs are then compared against the potential trade-offs shown in the CEC trade-off report for each county to determine whether the NSR trade-off requirements could be met for each plant type/size and each possible site. For reasons explained in the report, only 20 percent of the potentially available trade-offs in a single county (the Bay Area Air Basin is treated as a single "county" for these purposes)[6] are considered to be applicable to a specific energy facility.

Emission Limitations

Emission limitations established by the local air pollution control districts (APCDs) place specific limits on the quantities of pollutants which may be emitted by power plants and regulate the quality of fuel used in the plants. A summary of the APCD emission limitations applicable to power plants is in Appendix D. These limitations are compared with the plant emissions characteristics and fuel specifications also described in Appendix D to determine which facility/location combinations will comply with emissions

5. According to NSR regulations adopted by the ARB for local Air Pollution Control Districts (APCDs), trade-off sources should generally be within 15 miles of the new source or anywhere upwind (prevailing winds) in the same or adjoining counties within the same air basin.

6. All the potential site areas considered are adjacent to the bay itself, and hence relatively close to one another. In addition, trade-off availability in any individual county on the bay varied widely, even between adjacent counties. Therefore, it was considered reasonable to pool the potentially available trade-offs for the entire bay area.

TABLE 4--TRADE-OFFS REQUIRED FOR AAQS VIOLATIONS

AAQS[1] Violated	Emissions for which Trade-offs Must be Obtained[2]
Ozone	hydrocarbons (HC), oxides of nitrogen (NO_x)[5]
NO_2	NO_x
TSP	HC, NO_x , particulates, SO_2[3]
SO_2	SO_2
SO_4	SO_2
Carbon Monoxide (CO)	None[4]

1. State of federal AAQS.

2. Based on ARB policy.

3. Current ARB staff policy holds that either full trade-offs be obtained for each of these, or extra particulates be traded off to account for organics, nitrate, and sulfate particulates formed from HC, NO_x , and SO_2 emissions. The quantity of extra particulate trade-offs is determined by the existing fraction of ambient particulates comprised of organics, nitrates or sulfates. In other words, if sulfate accounts for 15 percent of the ambient TSP levels, and SO_2 trade-offs are not being obtained, particulate trade-offs would have to be increased by 15 percent.

4. ARB considers power plants to be a minor source of CO, and ordinarily does not require trade-offs for CO emissions from them.

5. Based on the ARB Model New Source Review Rule, it was assumed that NO_x trade-offs for ambient ozone standard violations would not be required except in the Bay Area, South Central Coast, and South Coast Air Basins.

TABLE 5--STATUS OF COMPLIANCE WITH STATE AND FEDERAL

AMBIENT AIR QUALITY STANDARDS[1]

COUNTY	TSP		O_3		NO_2		SO_2		SO_4
	STATE	FED	STATE	FED	STATE	FED	STATE	FED	STATE
Del Norte	X	0	?	?	?	?	?	?	?
Humboldt	X	0	?	?	?	?	?	?	?
Alameda	X	X	X	X	X	0	0	0	0
Contra Costa	X	X	X	X	0	0	X	0	0
Marin	X	0	X	X	0	0	0	0	0
San Francisco	X	0	X	X	X	0	0	0	0
San Mateo	X	X	X	X	X	0	0	0	0
Santa Clara	X	X	X	X	X	0	0	0	0
Salano	X	0	X	X	0	0	0	0	0
Monterey	X	X	X	0	0	0	0	0	X
San Luis Obispo	X	X	X	X	0	0	0	0	0
Santa Barbara	X	X[2]	X	X	0	0	0	0	0
Ventura	X	X	X	X	X	0	X	0	X
Los Angeles	X	X	X	X	X	X	X	X	X
San Diego	X	X	X	X	X	X	0	0	X

1. Source: California Air Quality Data, California Air Resources Board, Yearly Summaries from 1976-1979.

2. North county only.

X = Violations reported.

0 = No violations reported.

? = No data available; no violations assumed.

NOTE: Each of the above counties (or portions of these counties) is classified by EPA as attainment, nonattainment or unclassified, with respect to compliance with federal standards. However, these classifications change, based upon ambient air quality data. Since this report is investigating future siting opportunities, analysis was based on air quality data rather than EPA classification.

TABLE 6--PERCENT OF AVERAGE ANNUAL TSP CONCENTRATIONS COMPRISED OF ORGANICS, SULFATES AND NITRATES[1]

County	Organics	Sulfates	Nitrates
Del Norte, Humboldt	No Data - Assumed negligible		
Alameda	7.0%[3]	12.5%	15.4%
Contra Costa	7.0%[3]	12.7%	10.0%
Marin	7.0%[3]	10.%	5.8%
San Francisco	7.0%[3]	22.8%	10.7%
San Mateo	9.4%	8.3%	8.5%
Santa Clara	8.4%	6.9%	8.5%
Solano	7.7%	11.3%	8.7%
Monterey	2.5%	4.1%	4.8%
San Luis Obispo	5.4%	7.2%	5.9%
Santa Barbara	7.7%	9.3%	10.0%
Ventura	5.7%	7.9%	11.5%
Los Angeles	6.2%[2]	14.8%	13.5%
San Diego	7.7%	9.2%	10.9%

1. Source: Alan Tangren, Tech Services Division, ARB, June 1980.
2. Based on Riverside data; no L.A. organic data available.
3. Data for this county not available - used arithmetic mean of values for San Mateo, Santa Clara, and Solano counties.

limitations. It should be noted that these limitations are an anachronism when applied to sources subject to NSR regulations. NSR regulations already require the use of Best Available Control Technology (BACT) to minimize source emissions and may also require trade-offs to mitigate the impact of those emissions. Emission limitations which apply to major new sources are generally a holdover from the time when such limitations were the only way to regulate such sources. Nevertheless, these limitations are still in effect throughout California, and most have the weight of federal authority because they have been approved by EPA as part of the State Implementation Plan (SIP). Once approved, the local APCDs are mandated by EPA to implement and enforce them.

Some APCDs have made changes in their emission limitations without obtaining official approval from EPA to modify the SIP accordingly. In such cases, the emission limitations which appear in the APCD-published Rules and Regulations are not part of the SIP, and the old limitations are still in effect from EPA's perspective. An example is Rule 67, originally adopted by most Southern California counties but later replaced with other emission limitations. Rule 67 was an extremely stringent regulation developed specifically to preclude new power plants from being constructed in Los Angeles County prior to the development of NSR regulations. While this rule (and similar rules with different numbers) was repealed in Los Angeles, San Bernardino, Orange, Riverside and Imperial[7] counties, EPA never approved the changes, and hence these rules would still be enforced at the federal level. To the extent known, the emission limitations which are in effect only at the local level, at both the local and federal level, and only at the federal level have all been considered in assessing compliance.

Prevention of Significant Deterioration

PSD regulations, promulgated by EPA, are intended to prevent the air quality in areas which are cleaner than required by the AAQSs from deteriorating significantly. California is currently divided into two types of PSD areas: Class I and Class II. Class I areas consist of national parks and wilderness areas and other areas designated as Class I by EPA based upon ARB recommendations and proposals (includes large national monuments, etc.). The remainder of the state is Class II. At the present time, only significant deterioration of SO_2 and TSP is restricted. It is anticipated that other pollutants may be similarly restricted in the future. In addition, EPA is currently in the process of developing visibility impact regulations for Class I areas. For purposes of this study, however, only power plant impacts on ambient SO_2 and TSP concentration are considered.

If an area is nonattainment[8] for either SO_2 or TSP, it is considered a Class I or II area only for that pollutant which is in attainment. Since much of the state is nonattainment for TSP, many areas are Class I or Class II for SO_2 only. The San Joaquin Valley portion of Kern County and the South Coast Air

7. This rule was later readopted by Imperial County.

8. The terms "attainment" and "nonattainment" refer to national ambient air quality standards only--not state standards.

Basin are currently designated as nonattainment areas for both SO_2 and TSP, although ARB has proposed redesignation to attainment status for SO_2 in both areas. In these areas, PSD would not apply.

The specific limits of air quality deterioration allowed under PSD regulations for SO_2 and TSP are shown in Table 7.

Details on air quality impact analysis calculations are provided in the following section.

<u>Air Quality Impact Analysis</u>

Air quality impacts are determined by using SMOG, a three-dimensional, gridded, numerical model. SMOG is used because of this model's ability to realistically simulate the effects of complex terrain which alter the wind flow, and therefore, pollutant concentrations.

Because of the widely varying coastal terrain, impacts on each undesignated area are determined by separate applications of the model. Terrain elevations of areas surrounding each site are obtained from Lawrence Livermore Laboratory's digital reproduction of USGS 15 minute topographic maps. Cell sizes are 1 minute by 1 minute in the horizontal directions (approximately 1,400 by 1,850 meters). Vertical cell depth is between 100 and 200 meters, depending on the height of the surrounding terrain.

The condition which produces the worst case ground level impact is that of plume impaction on elevated terrain. In this case, the plume trajectory is intercepted by high ground, causing large ground level pollutant concentrations. The meteorological condition which produces this worst case impaction is very stable air (Pasquill Stability Class F) and a wind speed of two meters per second. The wind is directed from the source to the highest terrain point on the modeling grid within a 10 kilometer radius of the source. The assumption is made that this condition persisted without variation until a steady state concentration is predicted at the point of maximum impact. This insured that the worst case value would be obtained.

Three simulations are performed at each site, one for each power plant type (direct-fired coal, steam turbine, and combined cycle). Results from these simulations are adjusted using the emission characteristics of each plant type, fuel, and pollutant species to determine the worst case one hour impacts of SO_2, NO_x, and particulates.

Since the availability of actual meteorological data for most of the sites considered is limited, impacts over longer averaging periods are estimated from the one hour values. Three hour average impacts are determined based on the assumption that the meteorological condition responsible for the worst case impact could be reasonably be expected to persist for three hours. Therefore, three hour impacts are assumed equal to the one hour worst case values. Impacts for 24-hour periods are derived using an approximation method developed by the Tennessee Valley Authority.[9]

9. Montgomery, T.L. and Coleman, J., 1975; Empirical Relationships Between Time-Averaged SO_2 Concentrations; ES&T, Volume9, #10.

TABLE 7--ALLOWABLE PSD DETERIORATION INCREMENTS

Max. Allowable Increase (ug/3)

Pollutant	Averaging Time	Class I Areas	Class II Areas
TSP	Annual geometric mean	5	19
TSP	24-hour maximum	10	37
SO_2	Annual arithmetic mean	2	20
SO_2	24-hour maximum	5	91
SO_2	3-hour maximum	25	512

Using this method, the one-hour averages are multiplied by a factor of 1/7 to determine the 24-hour average values.

The PSD Class I and Class II increments are compared directly to the results in order to determine if violations of PSD regulations would result. However, calculated impacts cannot be compared directly with the ambient air quality standards (to determine compliance with NSR regulations) because specific background pollutant concentrations for given site locations must be added to the maximum ground level impact of the powerplant to determine the total pollutant concentration. For this report, background concentrations were obtained from ARB published air quality data[10] for the years 1976 through 1979. The greatest of the second highest concentrations for a calendar year, from a monitoring station within approximately 20 km of each site considered, are used as representative worst-case background concentrations. Where no background values are available (generally due to the absence of monitoring stations), it is assumed that background concentrations are negligible.

Summary

In an earlier CEC staff report, Air Quality Statewide Coal Plant Area Screening Study (Anderson, M., et al., February 1979), the conclusion was reached that trade-off availability was the limiting factor in siting a 500 MW coal power plant. In this later study, trade-offs are again the limiting factor in siting any of the power plant types considered. Terrain impacts for the nine UAs described in this report are not a large factor primarily because these sites were previously screened for nearby elevated terrain which would cause the worst case plume impaction. Each county containing an area considered in this study is in violation of at least one state or federal TSP standard, and all but Del Norte and Humboldt counties are in violation of state or federal ozone standards. Therefore, some trade-offs are required in each area considered. Trade-off data is obtained from the CEC staff report Statewide Emission Tradeoff Inventory (see References). Industrial centers, not surprisingly, have by far the greatest amount of potential trade-offs. Contra Costa and Los Angeles counties, for example, are two of the largest sources of potential trade-offs.

In general, large direct-fired coal (500 or 1,300 MW) or oil (800 or 1,300 MW) plants probably cannot be sited in most of the areas considered. However, except where no trade-offs at all were available, a methanol, natural gas, or coal gas plant, especially small (up to 500 MW) sizes, could probably be sited in most of the areas considered.

NOTE: Public Health

The air quality analyses also serve as the basis for the consideration of public health questions involving fossil-fueled power plant expansion. There are other pollutants of concern in addition to those included in the air quality analyses. These other pollutants (such as trace metals and polycyclic

10. Source: California Air Quality Data, California Air Resources Board. Yearly Summaries 1976 through 1979.

aromatic hydrocarbons) are currently unregulated with regard to emission or ambient air quality standards. Because of this, there is little information on ambient levels of these pollutants. In addition, the equity, or adequacy of air pollutant offsets to protect public health can only be determined by a detailed site-specific analysis which may involve air quality impact modeling. Since there is no practicable method to "map" constraints related to the health concerns involving nonregulated pollutants and trade-off adequacy, these factors were not included in this study.

NOTE: Cooling Tower Emissions

Cooling tower emissions are not specifically considered as an air quality screening factor in this study. Specific predictions about such emissions and their effects are difficult to make. In addition, regulatory agencies generally do not consider cooling tower emissions to be a serious air quality problem. The issue is noted here, however, because, while opportunities for "once-through" cooling are a primary reason for coastal power plant siting, if such once-through opportunities are prohibited or restricted by water quality regulations, cooling towers may have to be used at coastal sites.

Some coastal plants have access to as many as three types of cooling water: ocean water, fresh water, and waste water (of varying quality). The emissions from the cooling towers could vary widely depending upon the type and quality of cooling water used and the cooling tower design (e.g., number of cycles of concentration, wet, wet-dry, or dry designs, and drift controls). Cooling tower emissions are usually particulates dissolved or suspended in water-droplets called "drift" which escape from the towers during operation. Much of the drift settles on ground or on other surfaces within a relatively short distance of the towers before the liquid portion evaporates. Some of the drift, however, may remain airborne as it evaporates, leaving suspended (airborne) particulate matter.

Cooling tower transport models (which estimate airborne particulate matter concentration) and deposition models (which approximate drift settling) have been developed and are in the final stages of validation. However, to date these models have not been used to determine the concentrations of suspended particulates resulting from cooling tower operation. Cooling tower drift is rarely an issue in the air regulatory processes of the ARB and the Air Pollution Control Districts (APCD). Towers may even be specifically exempted from APCD regulations as in the South Coast Air Quality Management District.

In view of these limitations, cooling tower drift is not considered as a screening factor in this study.

GEOLOGY

Nuclear

- o Coastwide
- o Non-nuclear

Landscape Instability

- o Active Sand Dunes
- o Quaternary Landslides
- o Steep Riverbank Slopes/Recognized Sea Cliff Instability

Faults and Related Seismic Hazards

- o Ground Surface Rupture
- o Seismic Shaking
- o Seismically Induced Liquefaction

Selected Mineral and Geologic Resources

- o Fossil Fuel Production
- o Other Mineral Deposits

This section includes an analysis of selected geological conditions at the five CCC UAs. It also discusses coastwide conditions affecting opportunities to locate nuclear facilities. These analyses are intended to identify potential effects from the major geological constraints on opportunities for nuclear and non-nuclear power plants. The geological factors considered in these analyses are identified above.

The nuclear opportunity discussion applies to approximately 141 CCC UAs initially identified; BCDC UAs are not considered in this nuclear opportunity analysis due to the prohibitive effects of population density criteria. The non-nuclear analysis at the five CCC UAs is based on extensive information and research provided by California Division of Mines and Geology (CDMG) staff on these specific areas.

Nuclear--Coastwide

Due to the safety-critical nature of nuclear power plants, natural conditions which are adverse to the safe operation of these facilities often become severe and/or exclusionary constraints in the site selection process.

Geologic hazards are safety-critical siting parameters and play a significant role in the siting of nuclear power plants in California. The presence of geologic hazards or adverse conditions creates a degree of constraint to siting that will vary from nominal to prohibitive, depending on the conditions, severity, and the alternatives for mitigating impacts.

In addition to the actual exposure to hazards, the conservative nature of the NRC geologic/seismic siting and design criteria which are used to evaluate conditions and develop design increase the degree of constraint created by potentially adverse geologic conditions. The NRC siting criteria require an applicant to show positive evidence that geologic hazards do not exist at a proposed site or can be acceptably mitigated prior to NRC acceptance. Thus, in regions of high seismicity and known active faulting, the temporal costs and potential failure associated with meeting the NRC siting criteria create an additional constraining effect.

Fundamental geologic factors within the coastal zone of California which could render a proposed site unacceptable would include:

- o The potential for surface rupture along faults;
- o The potential for strong ground shaking during an earthquake; and
- o Adverse foundation conditions/slopes instability.

The most favorable geologic setting for a nuclear power plant is one which lacks the factors listed above. However, in addition, the favorable setting should have the geologic ingredients to show positive evidence that adverse geologic conditions do not exist. A favorable setting, for example, would be laterally continuous, sufficiently old, undeformed stratigraphic horizons, in demonstrating the lack of surface faulting.

Virtually the entire length of the California coastline represents a region of high seismicity and known active and Quaternary faulting (see Figure 3). This region also generally lacks the characteristics necessary to demonstrate geologic stability. Within certain areas of the coastline, sufficiently old (35,000 ybp) marine and alluvial terraces exist which might be used to demonstrate local geologic stability. However, these are limited in extent and generally fall short of providing substantial positive evidence of geologic stability.

The staff effort to assess the potential for nuclear power plant siting in the Coastal Zone focuses on identifying those UAs containing favorable geologic conditions not previously excluded by population density constraints. The effort represents a cursory review of Quaternary faulting and the presence of sufficiently old coastal marine and alluvial terraces at a scale of 1:250,000.

In assessing the UAs, known Quaternary faults are delineated using five-mile half width bands (see Figure 3) to be consistent with NRC siting criteria (Appendix A, 10 CFR, Part 100). These criteria require detailed studies for all questionably capable faults within five miles of a proposed nuclear power plant. Experience has shown that when conducting detailed studies in areas of known Quaternary faulting, additional faults will usually be disclosed. Thus, the presence of Quaternary faults is usually indicative of more complex problems. Results of such studies can create costly delays to a project and ultimately turn up negative results. For that reason, the five-mile half width band used for this study is considered a severe constraint to locating nuclear power plants.

For this study, areas which are not traversed by known Quaternary faults and containing coastal marine and alluvial terraces which are probably greater than 35,000 years in age and extensive enough to be identified on the 1:250,000 scale geologic map, if present, are considered areas with potential opportunities for siting. The presence of these deposits, if undeformed and widespread, could provide the evidence necessary to demonstrate geologic stability within an area.

The results of the overview assessment are as follows. From a geologic perspective, opportunities for nuclear power plant siting could not be identified; that is, no marine or alluvial terraces of sufficient age could be identified in areas not traversed by (within 5 miles of) known Quaternary faults within the 141 CCC UAs.

In addition, due to the presence of Quaternary faulting, the apparent lack of ingredients to demonstrate geologic stability, and the associated uncertainty in meeting the NRC geologic/seismic siting criteria, constraints on nuclear facilities probably range from severe to prohibitive.

These results are intended to be only a general indication of opportunities for locating new nuclear facilities in the CCC UAs. This analysis is not a detailed site review, nor does it consider opportunities in the extensive designated areas of the CCC jurisdiction. The noted conclusions are thus clearly qualified and do not purport to be, and should not be interpreted as, conclusive with respect to opportunities to locate new nuclear power plants along the coast.

NON-NUCLEAR

Geological factors can play a significant role in the siting of non-nuclear (i.e., nonsafety-critical) power plants in the coastal zone of California. The degree of significance depends on parameters such as facility type (base load versus peaking), potential costs due to failure (including environmental costs), and exposure to hazards. Although geological factors usually do not prohibit the siting and construction of nonsafety-critical facilities, such as non-nuclear thermal power plants, adverse geological conditions can often times make site preparation and mitigation extremely expensive and time-consuming. In this situation (assuming no other trade-offs), a site may be excluded in favor of one with more acceptable geological conditions.

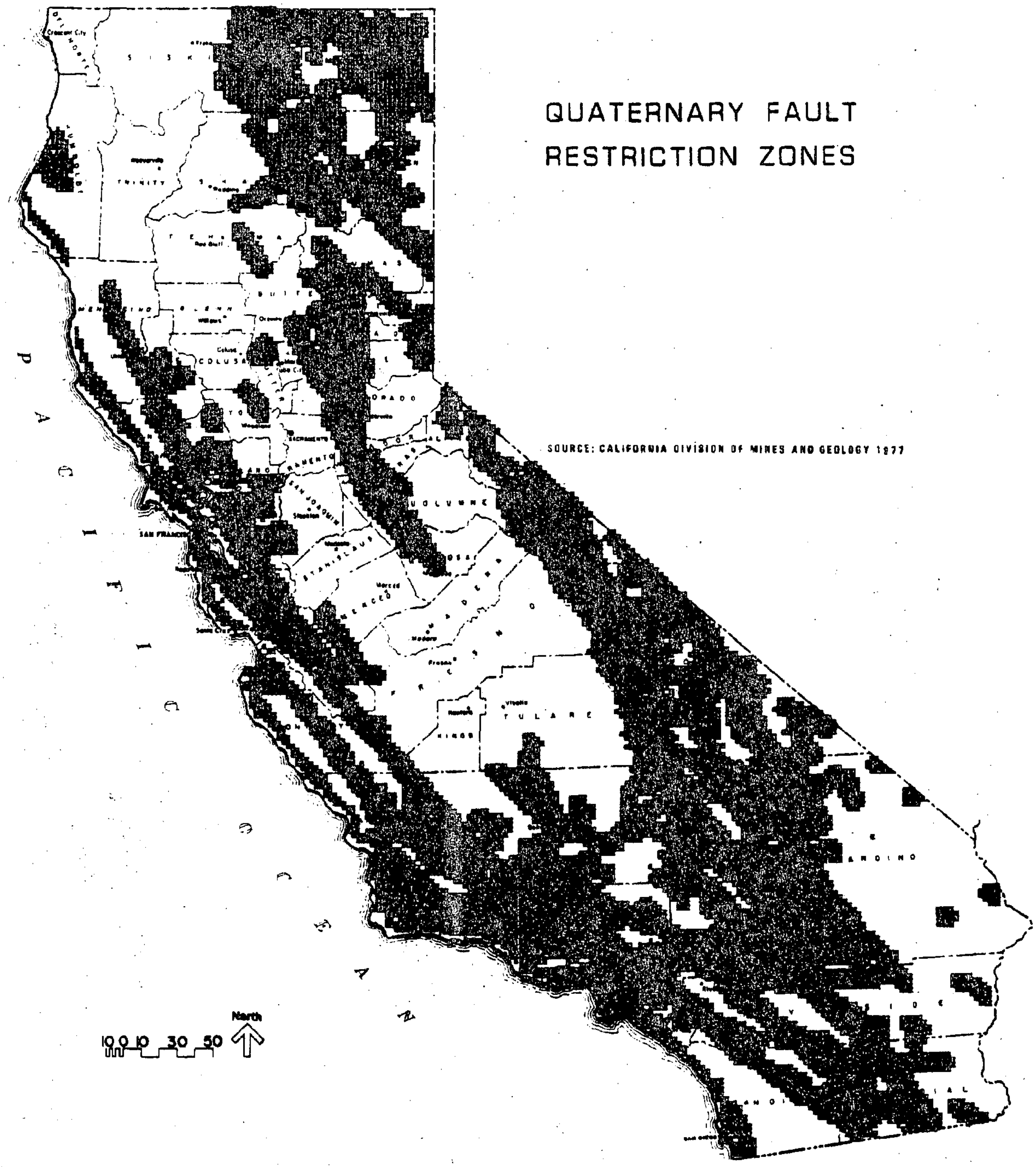
UA Analysts

The following is a discussion of opportunities/constraints for power plant locations at all of the five CCC UAs. As noted, BCDC UAs are not discussed due to lack of existing data. The following discussions are based on extensive research of existing data conducted by CDMG. Analysis is done by CEC staff.

Crescent City--UA 1A and 1B

- Faults

  The trace of a probable fault is postulated to exist along the Klamath Mountains hill front in the southern and eastern portions of undesignated area 1B. In addition, several faults of possible significance to both undesignated areas have been identified by the CDMG in the Crescent City area.



CALIFORNIA ENERGY COMMISSION 1980

MAP PRODUCED BY
DIVISION OF ENVIRONMENTAL STUDIES, U.C. DAVIS

FIGURE 3

Potential constraints to power plant development derive from both the potential for surface rupture and strong earthquake shaking. The level of constraint to power plant siting that these faults pose is considered to be nominal to moderate. Avoidance of these faults should minimize the fault rupture hazard in the southern and eastern portions of UA 1B. The potential, however, for associated strong earthquake shaking in both UAs 1A and 1B may necessitate special design and construction techniques.

- Seismically Induced Liquefaction

  Both UAs 1A and 1B are extensively underlain by potentially liquefiable Quaternary sedimentary deposits. Within the two areas, only a small trianglar area of about 0.75 square mile (8500' x 2500') is not underlain by potentially liquefiable materials.

  The level of constraint that these potentially liquefiable materials pose to power plant siting ranges from moderate to potentially severe. Site-specific subsurface investigations would have to be conducted to determine the level of constraint at any particular proposed site.

  Power plant siting opportunities appear to exist in the flatland portions (excluding the southern portion of "undesignated" area 1B) of both "undesignated" areas. However, detailed site-specific subsurface studies to assess the liquefaction potential must be conducted to determine the suitability of the selected site.

Samoa Spit--UA 2

- Active Sand Dunes

  UA 2 is underlain entirely by sand dunes. The degree of constraint posed by these sand dunes depends on the site-specific soil density, groundwater level and dune stability. Constraints from active dunes could range from nominal to severe.

- Seismically Induced Liquefaction

  A major proportion of this UA is underlain by potentially liquefiable Quaternary alluvium, beach sand, and dune sand. The potential for liquefaction could present a moderate to severe constraint to non-nuclear power plant siting in this area.

- Faults

  The North Spit fault (Elk River Segment) is a northwest trending fault which crosses the southern portion of UA 2.

  Potential constraints to power plant development derive from potential surface rupture and strong earthquake shaking. The level of constraint is considered to be nominal to moderate. It is believed that several more faults could be identified through the study area if an intensive investigation was conducted.

Siting opportunities appear to exist; however, detailed site-specific subsurface studies to assess liquefaction potential must be conducted to determine the suitability of the selected site.

Salinas River--UA 3A and 3B

- Faults

  A splay of the King City Fault (a potential source of damaging earthquakes) crosses a very small area at the northern end of the "undesignated" area at Lapis Landing.

  The level of constraint to power plant siting from this fault is considered to be nominal to moderate. Avoidance of the fault should minimize the fault rupture hazard; however, the potential for strong earthquake shaking may necessitate special design considerations.

- Seismically Induced Liquefaction.

  Seismically induced liquefaction potential is shown to exist at two very small areas in the southern portion of the "undesignated" area. These areas are further classified in the CDMG Report as "dune deposits presently stabilized."

  The level of constraint posed by these areas is considered to be nominal because these areas are small and avoidance would be relatively simple as a mitigation measure.

- Dune Deposits.

  Dune deposits which are presently stabilized exist throughout the "undesignated" area.

  The level of constraint that these dune deposits pose to power plant siting depends on the site-specific soil density/dune stability characteristics and could range from nominal to potentially severe. Typical mitigation for this condition would include special foundation design and preparation and/or arrangement of facilities in order to reduce the impact of dune instability to the proposed facilities. Subsurface studies should be conducted as well, to determine whether and to what degree these materials are potentially liquefiable.

- Selected Mineral Resources (Sand).

  Commercial quality sand is being mined in several locations near the beach by Lone Star Industries. However, these localities could be avoided in the siting process, mitigating the land-use conflicts. The level of constraint posed by the presence of this valuable commodity is considered nominal to moderate.

Siting opportunities appear to exist throughout most of the area. However, as mentioned above, detailed subsurface studies should be conducted to determine whether or not potentially liquefiable materials exist over a much larger area than that indicated in the CDMG study of the area.

Santa Maria River--UA 4A and 4B

- o Active Sand Dunes.

  A large percentage of the area is underlain by sand dunes known as the "Guadalupe Sand Dunes." The degree of constraint these sand dunes pose to power plant siting depends on the site-specific soil density/dune stability (characteristics which are not discussed in this study) and could range from nominal to severe. However, oil and gas wells and associated pipelines have been successfully sited and constructed on these dunes, indicating that the dunes are relatively stable and would probably pose a constraint level in the nominal to moderate range. Typical mitigation for this condition would include special foundation design and/or arrangement of facilities in order to reduce the impact of dune instability to the proposed facilities.

- o Seismically Induced Liquefaction.

  The entire "undesignated" area is underlain by potentially liquefiable sediments. However, detailed subsurface investigations may show that an area large enough for the power generation facilities could exist which is not underlain by liquefiable materials. Depending on the results of subsurface studies, constraints due to seismically induced liquefaction could range from nominal to severe.

  If a facility must be constructed on liquefiable materials, extensive and expensive site preparation (e.g., excavation of liquefiable materials) and special foundation design can be employed to mitigate the hazard.

- o Areas of Fossil Fuel Production (Oil).

  The Guadalupe Oil Field generally underlies the Guadalupe dunes area in the northwestern part of the Santa Maria River "undesignated" area.

  Another small (about one half square mile) unnamed oil field is located in the southeast portion of the "undesignated" area.

  Potential adverse conditions associated with fossil fuel production (e.g., differential settlement and induced seismicity) have not been reported in the literature for this area. Therefore, no geologic constraints related to fossil fuel production are anticipated.

  Three oil fields exist within the Santa Maria River area with an estimated 100 to 600 million barrels of oil remaining to be discovered. These fields include the Guadalupe field, the Santa Maria Valley field, and an unnamed field near the town of Guadalupe. In addition, enhanced oil recovery (EOR) methods are currently being used in this area (steam injection). The production attributed to thermal EOR at the Guadalupe field during 1976 was 33 percent or 380,000 barrels (CEC Consultant Report P500-78-15; Table 4).

  The potential for EOR cogeneration development in the Santa Maria River area is identified here as a potential siting opportunity for a preferred electric generation alternative. Analyses to further define this potential would include air quality impacts/trade-offs, water supply implications and estimates of the potential for generating capacity.

Tijuana River--UA 5

o Active Sand Dunes.

A very small strip of land (about 3,000 feet long and 150 feet wide) along the beach in the community of Imperial Beach is comprised of active sand dunes. Due to the limited extent of these dunes, the level of constraint that they pose to the siting of non-nuclear power plants is judged to be nominal.

o Quaternary Landslides.

A large portion of the UA 5 in the Border Highlands area along the California/Baja, California border consists of Quaternary landslides. The total area included in the "undesignated" area is about one-half square mile (1 mile long and 1/2 mile wide). About 15 percent of this is underlain by Quaternary landslides with an addition of 3 to 4 percent underlain by potentially "unstable slopes." The term "unstable slopes" in this area is defined by CDMG as "areas of high slope angle in poorly consolidated seidments."

The level of constraint posed by these landslides and potential landslides to the siting of non-nuclear power plants in this "undesignated" area is judged to be moderate.

o Seismically Induced Liquefaction.

Potentially liquefiable materials underlie large portions of the UAs in the Imperial Beach 7-1/2 minute quadrangle study area. Interstate Highway 5, north of the community of South San Diego at the southern end of San Diego Bay, is underlain by potentially liquefiable materials. About 60 percent (CEC estimate) of the UA 5 along the Tijuana River at the California/Baja, California border is underlain by potentially liquefiable materials.

The level of non-nuclear siting constraint posed by these potentially liquefiable materials in both of the above-described "undesignated" areas is judged to be moderate to potentially severe.

o Faults.

Several splays of an active/potentially active fault system occur in UA 5 in the Border Highlands area along the California/Baja, California border.

The level of constraint to non-nuclear power plant siting posed by this fault system is judged to be nominal to moderate.

Siting opportunities appear to exist throughout most of the area except in the Border Highlands area where much faulting and slope instability/landslides exist. The actual verification of siting opportunities, however, depends on site-specific subsurface exploration to evaluate the liquefaction hazard as well as any other potentially adverse site conditions.

PUBLIC FACILITIES

Urban Areas	Rail Lines/Transportation
Cultivated Agricultural Lands	Available Land
Recreational Activity Areas	Cultural Resources
Military Bases	Transmission Lines
View Protection	Nuclear Population Restrictions

This is a discussion of the effects of the public facility evaluation factors on all nine UAs. This analysis considers the general effects of a variety of factors associated with land use and development on opportunities for new power plants. The effects of these factors can vary widely with the type or size of power plant facility. Their impacts can occur on both a regional and a site specific basis. Due to the limitations of the scope of this study, potential effects are not considered from a site-specific perspective but rather from the broader perspective of each undesignated area.

For a more extensive discussion of opportunities for transmission line corridors, see Appendix F.

CCC UA Analysis

Crescent City--UA 1A

This 300 acre UA is undergoing single family subdivision with many parcels developed. A mobile home park is located at Old Mill Road and Lake Earl Drive. The northwest portion of the UA is in grazing. The Del Norte County General Plan designates the area generally according to existing land use: subdivisions in residential, mobile home park in commercial, grazing in agriculture with five acre minimum lot sizes. Industrial land uses are not located or planned in this UA.

Vehicular transportation access into the county is limited to two highways, 101 and 199. There are no rail lines in Del Norte County due to the terrain difficulty. Crescent City Harbor use currently is limited to fishing/pleasure craft and oil barges. Planned expansions of the harbor would not be enough to accommodate large shipments of oil or coal. Sand accretion and bottom rocks also constrain harbor expansion.

There are no major transmission line rights-of-way in this area. The development of such corridors is possible, but only at high construction cost due to terrain difficulty (see Appendix F).

Existing land uses, ongoing development, and difficult access within this UA severely constrain opportunities for new power plants. Facilities using once-through cooling would be the best alternative for the amount of land available.

Crescent City--UA 1B

The county's major industrial area is located in this UA, along with recreation and scattered residential uses. Land uses in this UA are administered by four jurisdictions. The City of Crescent City administers the western portion of this development except for small scattered vacant lots.

A small subdivided vacant portion of the UA east of Highway 101 lies in the jurisdiction of the Crescent City Harbor District and is planned for harbor-related uses, including tourist and commercial. The southern portion of the UA is within the boundary of the Redwood National Park under the administration of the National Park Service. The largest portion of the UA is administered by Del Norte County and includes the county's prime existing and planned industrial areas as well as agriculturally zoned lands currently in grazing. Highway 101, south of Sitka Spruce Grove and Bluff Road is designated as a view corridor in the Del Norte County Draft Local Coastal Program.

Major vehicular access is limited to two highways, 101 and 199. Rail lines do not exist, and their construction is limited by the difficult terrain. Planned expansion of Crescent City Harbor will not accomodate large shipments of oil or coal. Major transmission line corridors do not exist, and the cost of their construction would be increased by the terrain difficulty.

Crescent City has planned for moderate residential and commercial growth based on increased recreational use of the area.

Samoa Spit--UA 2

Land uses in this UA include industrial (paper mills), military reservation (Coast Guard), and residential. Planned land uses are for generally limited industrial and regional park proposals. The coast and dunes are designated by Humboldt County as environmentally sensitive/open space, and Humboldt Bay is designated as biologically sensitive estuary.

The one rail line into the county leads south to its first east-west connection in southern Sonoma County. Frequent washouts of this line in the past have required increased truck delivery of goods. Humboldt Bay currently is not deep enough to handle large oil or coal deliveries, and dredging may be expected to conflict with its biologically sensitive designation. New transmission lines would be required for all but small power plants.

Scattered vacant areas of up to 20 acres exist in this UA, including the airstrip owned by the City of Eureka. Louisiana-Pacific proposes a 40 MW wood waste cogeneration facility on one of their vacant parcels.

Salinas River--UA 3A

Land uses in this UA include industrial (sand plant), residential, and agricultural. Approximately 400 - 500 acres within this UA are vacant or in low-intensity uses.

Planned land uses within the City of Marina include high intensity industrial and low intensity residential. Designations in the Monterey County jurisdiction include general agricultural and open space. Urban growth planned by Marina (from 23,000 to 48,000 by 2000) may be expected to expand into county areas. Dunes in this area are recommended for inclusion in the Salinas Wildlife Refuge due to their scenic and natural resource value.

The major vehicular access to this area is on Highway 1. A Southern Pacific railroad spur serves this area. No major transmission line corridor exists in this area; however, construction is possible over relatively easy terrain.

The City of Marina may be expected to absorb much of the regional growth on the Monterey Penninsula. This growth will also be dependent on the activities of Fort Ord, a major area industry.

Salinas River--UA 3B

The majority of this UA is located within the Fort Ord military reservation. It is used for military training and is in the flight path of missile launching operations. Artillery shelling occurs adjacent to the study area.

A small portion within the City of Marina is developed in residential with few vacant lots.

Santa Maria River--UA 4A

The major land uses in this UA area are industrial (refinery) and agricultural (intensive cultivated row crops). The refinery occupies approxiately 50 acres with an additional 250 acres within the UA acting as a buffer. West of the UA are the Guadalupe Dunes, which the County of San Luis Obispo designates as recreation with a sensitive resource overlay due to high environmental quality and special ecological/educational significance. An oil field currently operates on the dunes.

The major vehicular access is on Highway 1. Rail lines are available. Existing transmission line corridors can be extended to serve this area.

Growth is occurring in this area although serious water supply problems exist. Housing developed for the construction of the Diablo Canyon power plant could support construction workers in this area, provided that the growing community does not absorb it. In addition, development of the MX missile test site, the space shuttle, and the LNG terminal could impact the use of existing available housing.

Santa Maria River--UA 4B

This UA lies in two counties, San Luis Obispo and Santa Barbara. Major land uses are industrial (oil extraction and sand plant) and agriculture. Land use designations generally follow the existing land uses with San Luis Obispo County designating the Guadalupe Dunes as recreation with an energy extraction overlay. These sand dunes have been further designated as a national natural landmark by the Department of the Interior in recognition of ecological and scenic values. A study for management of energy development in the dunes area identifies the riparian habitat along the Santa Maria River as the most sensitive resource within this UA.

Housing support, transportation and transmission corridor access in this area are readily available, as noted in the discussion for UA 4A above.

County plans indicate the intent to maintain long-term recreational and agricultural uses in this area. However, other major projects proposed for this area of the coast (Santa Barbara County) include the Liquefied Natural Gas Terminal, the MX missile test system, and a space shuttle base, and are current significant growth issues. Land is available within the UA for a variety of power plant sizes if agricultural land is converted.

Tijuana River--UA 5

This UA is composed of approximately 300 acres of undeveloped mesas. A sand and gravel operation is proposed for this area pending approval of extraction and rehabilitation plans by the City of San Diego. A specific plan for this area designates commercial/recreation which would allow trailer camping and off-road vehicle use. Implementation of the specific plan may be delayed pending completion of the proposed mining operations.

Vehicular access in the immediate area is limited to one surface street across the Tijuana River to San Diego. There are no rail lines in the immediate vicinity. Transmission lines may readily connect to the existing system.

Regional housing projections indicate that demand associated with power plant operation and construction could probably be accommodated.

Flood flows in the Tijuana River cannot be controlled by United States jurisdictions and may be expected to isolate this area on a seasonal basis.

BCDC UA Analysis

Oleum--UA 6

This UA is designated by Contra Costa County for industrial land use. It is identified as one of the best undeveloped water ports in the bay area. The area is currently undeveloped, but a permit for a 300 acre oil refinery has been issued. This operation will cover the majority of the existing UA but would be highly compatible with a power plant.

Transportation and transmission line access is readily available in the area.

Point San Pedro--UA 7

The major land use in this UA is a quarry operation. The topography of the area consists of rolling terrain with steep slopes due to the quarry operation. Adjacent land uses consist of residential homes. The quarry operation is expected to exist for 12 - 15 years; and planned land use consists of single and multi-family residents and a shoreline park. It is considered to be severely constrained by planned uses; however, it is included in this report as a marginal opportunity.

Visitacion--UA 8A

This UA includes approximately 53 acres of undeveloped land fill. Other portions are occupied by industrial and recreational uses. Most of the area is designated by the City of South San Francisco as industrial. Specific portions of the area are in BCDC Park Priority Area. In the PGandE Combined Cycle NOI, a proposed site within this area was found unacceptable for a combined-cycle power plant due to impacts on biological and recreational resources.

Visitacion--UA 8B

This UA includes a vacant bay fill parcel of approximately 30 acres. Land use designation is industrial. Transportation and transmission line access is readily available.

Visitacion--UA 8C

This UA includes 30 acres of unused, unimproved bay fill. The City of Brisbane designates it as industrial. Transportation and transmission line corridor access is readily available. A site within this area was found acceptable for a combined-cycle power plant during the PGandE Combined Cycle NOI proceedings.

North San Jose--UA 9

This UA is currently in agricultural land use, and designated as heavy industry by the City of San Jose. Transportation and transmission line access is readily available. A portion of this area was conditionally approved as a combined-cycle power plant site during the PGandE combined cycle NOI proceedings.

CULTURAL RESOURCES

The preparation of this section dealing with cultural resources involved an archival search resulting in a preliminary assessment of the cultural resources in the five CCC undesignated areas. In this effort, the regional offices of the California Archaeological Site Survey (Office of Historic Preservation) were consulted. The information provided is not intended to represent a resolution of the cultural resource issues or these undesignated areas. Prior to certifying these areas for power plant development (or any other development) an intensive historical, archaeolgical, and ethnographic study must be conducted.

This section briefly discusses the range of cultural resources known to be associated with coastal locations. It does not specifically describe or identify locations of known resources in the interests of protecting such resources from vandalism and unauthorized collection. Table 8 summarizes the known status of cultural resources in the region of each of the five CCC undesignated areas considered. This section makes no attempt to identify cultural resources associated with the BCDC undesignated areas due to the known disruptive effects of intensive urban development and bay fill on such resources.

Background

Early Man in California. The initial migration of early people from the Old World across the Bering land bridge to North America occurred 25,000 to 100,000 years before present (B.P.). The land bridge provided a broad tundra and grassland access for many species, including *Homo sapiens*, to enter North America. The land bridge had a periodic existence that was interrupted

TABLE 8 : CULTURAL RESOURCES (CCC) *

NAME	UA NO	ARCHAEOLOGICAL SURVEYED	HISTORICAL SURVEYED	ETHNOGRAPHICALLY SURVEYED	PRESENT ARCHAEOLOGICAL SITE	PRESENT HISTORICAL SITE	SENSITIVE	NON-SENSITIVE
Crescent City	1A 1B	X	X		X	X	X	X
Somoa Spit	2	X	X		X	X	X	X
Salinas River	3A 3B	X	X		X	X	X	X
Santa Maria River	4A 4B	X			X		X	
Tijuana River	5	X	X		X	X	X	

* BCDC cultural resource areas are excluded due to the disruptive effects of urban development and bay fill on such resources.

several times by rising sea levels (marine transgressions). Once across the bridge, southerly migration was possible only intermittently because of ice barriers across Canada during glaciation. According to Stewart (1973), the most likely times for man's descent into what is now the United States were when land corridors opened through the ice east of the Rocky Mountains approximately 14,000 - 10,000 B.P., 28,000 - 23,000 B.P., and 50,000 B.P. In contrast, MacNeish (1976) has estimated man's entry into the New World at 70,000 B.P. + 30,000. If initial human occupation was earlier than 50,000 B.P., a migratory route down the now submerged paleo-coast of the Pacific may have occurred.

Radiocarbon dates of 37,000 B.P. and 40,000 B.P. have been proposed for human occupation of the Santa Barbara Channel islands. These dates, however, provide us only with indirect evidence of early human occupation because the material dated (charcoal, mammoth bones) was associated with human remains. A direct radiocarbon date of 17,150 B.C. + 1,470 has been proposed for skeletal material (cranium and tibia) found in 1933 in Laguna Beach (Stewart 1969). A skull found in 1936, "Los Angeles Man," has yielded a radiocarbon date of 23,600 B.P. A human cranium found at Del Mar in 1929 has been dated at 48,000 B.P. by amino acid raceization. Most archaeological material, however, has been dated at 10,000 B.P.

It is not certain when the California coast was first occupied because worldwide rising sea level (eustatic variation) has submerged the archaeological remains of those early coastal dwellers. Sea level may have reached a low of 144m (472 feet) below present mean sea level (MSL) 40,000 B.P. and 124 m (407 feet) below present MSL 18,600 B.P. This means that much of the early coastal region probably occupied by the earliest Californians is presently submerged, and at great depths in some areas (BLM pp. 3 - 160).

<u>Historic Development.</u> In 1542, Juan Rodriguez Cabrillo became the first European explorer in California. The second was Sir Francis Drake, whose GOLDEN HINDE entered California waters in 1579. Colonization, however, did not soon follow. The founding of San Diego in 1769 marked a change in California cultural and settlement patterns. The Mission Period, during which 21 missions were founded by the Franciscans, had a drastic effect on the Native American population, which had numbered about 300,000 at the time of contact.

Mexican colonists soon followed to Alta California to establish large ranches for which laborers were needed.

Spanish control of California was lost in 1821, and California became a Mexican land. In 1833, the missions were secularized and much of their holdings were dispersed by land grants. Throughout the period of Spanish and Mexican rule the Native American population rapidly decreased as a result of war, disease, and slavery.

Russian fortunes rose and fell rapidly in California. Pursuing seals and sea otters from the Aleutians to Baja California, Russian interests moved further southward as the resource decreased. Arriving in what is now Sonoma County in 1812, the Russians established Fort Ross as a hunting base and an agricultural supply station for their Alaskan colonists. Fort Ross was sold to an American, John Sutter, in 1841.

The discovery of gold in 1848 resulted not only in the "Forty-Niner" movement, but also marked the beginning of a mass westerly movement to the "Golden State" that continues today.

Mexican rule had ended in 1846. By this time, the original population had been decreased by two-thirds to 100,000. By 1870 this number had been further reduced to an estimated 58,000.

Along with the migration of Americans to California came immigrants from Asia and Europe. Some of the groups well represented in California development include the Chinese, Japanese, Filipino, Irish, Finns, Swiss, Scots, Yugoslavians, Italians, and Germans. Much acculturation has occurred between Native Americans, early immigrants, and later groups. Nevertheless, there remain a number of groups today that continue to maintain distinctive ethnic identities and socioeconomic ties within their communities e.g., the Genovese and the Scots-Irish of Santa Cruz.

<u>Onshore Cultural Resources.</u> The coastal lands contain numerous archaeological sites. The heavier concentration of sites recorded in some counties is partially a reflection of large indigenous populations and partially the result of intensive surveying. Other areas northward have not been as intensively surveyed as others.

In recent years, there has been an increased interest in historical archaeology. California's long history has provided a wealth of archaeological material.

<u>Contemporary Native Americans.</u> There are presently about 15 - 20,000 Native American residents in the coastal counties. Many of the Native American residents who are descended from local indigenous peoples continue many traditional beliefs and practices.

Subsistence gathering continues today between Bodega Bay and Fort Bragg both inland and on the coast. The intertidal zone is especially important to coastal dwellers. Although not well documented, family-gathered foodstuffs account for up to 25 percent of total subsistence for some Native American families (BLM ET S Vol. 1, p. 3 - 164). Traditional medicines, herbs, and teas are also gathered.

BLM has documented gathering for ceremonial purposes in Del Norte and Humboldt counties and the Point Conception area.

Both subsistence and ceremonial gathering has been reduced in recent years because of a decrease in the supply of traditional plant and animal foods and a lack of access to traditional gathering sites, many of which are not privately owned. Although the intertidal zone is controlled by the state, beach access in many areas is restricted by private property owners. Some of the traditional dances (e.g., White Deerskin) are now held every other year, instead of annually as in the past, due to current insufficient supply of the traditional foods that are served as part of the dance cermonies (BLM EIS Vol. 1, pp. 3 - 10).

There are numerous geographic landmarks and areas that are of special concern to indigenous groups because they would be termed "sacred." However, the traditional Native American world view does not divide the world into things that are religious or nonreligious, sacred or nonsacred.

Some of the landmarks of concern to contemporary Native Americans are important because they were traditionally used by their ancestors. Many of these places are still being used in traditional ways. In addition, there has been a resurgence of interest in indigenous practices and beliefs that has resulted in a syncretic religious movement involving both young and old. The result is that some traditional ways have been adopted not only by those individuals for whom these beliefs and practices were part of the cultural experience they have known from childhood.

Offshore Cultural Resources. The offshore region of California is rich in cultural resources. Types of submerged resources are aboriginal remains and sunken ships and artifacts. The fields of prehistoric and historic marine archaeology in this region have begun to develop only recently. Thus far, most prehistoric marine work has occurred in Southern California in San Diego and in the Santa Barbara Channel area. This does not necessarily reflect a lack of resources along the central and northern coast, only a lack of investigation in those areas. A major importance of these resources is their potential contribution to anthropological knowledge and theory about man's beginnings in the New World. There is a relatively good chance of preservation of large quantities of submerged prehistoric resources.

Shipwrecks. Shipwrecks are important because they capture an instant in the life of a culture and preserve it fairly intact. On board a ship are nearly all the necessities and many of the amenities of contemporary life. Tools for carpentry, sailmaking, shoe repair, cooking, and eating were often present, as well as cargo and personal items of passengers and crew. Due to long lengths of time away from ports, much had to be carried along to maintain the vessel and personnel. Sinking was generally in the violent circumstances of war, storm, or sudden encounter with unseen reefs or rocks, none of which usually provided ample warning or opportunity to salvage. Materials recently salvaged from old wrecks include such small and perishable items as fabrics, spools of ribbon, hats, shoes, foodstuffs, awls, and needles. Increasing numbers of shipwreck artifacts have been recovered offshore of California in recent years. BLM (1979) conducted an in-house study to compile available shipwreck data. This study identified 1,276 vessels of historic interest that were reported lost. Of these wrecks, 145 were reported grounded and the remainder reported lost offshore. Most of the offshore losses have been reported in state, rather than federal, waters. Though the locations of historic shipwrecks have been in some cases precisely noted, they are often many miles from the location of their reported loss. Locational errors have occurred because of navigational error, loss report error, or because of vessel drift. It is not uncommon for an abandoned damaged ship to drift for a long distance prior to eventual sinking. For these reasons, it is very likely that many of the shipwrecks reported in state waters actually occurred in federal waters.

NUCLEAR POPULATION RESTRICTIONS

Title 10 of the Code of Federal Regulations (CFR) Part 100 contains the basic criteria applicable to nuclear power plant site selection. These criteria are used by the NRC and were established to minimize exposure of individuals outside the station to radioactive substances released during a nuclear power plant accident. In order for an applicant to obtain a license to operate a nuclear power plant, 10 CFR Part 100 "Reactor Site Criteria" requires the following:

- An "exclusion area" surrounding the reactor in which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property;
- A "low population zone" (LPZ) which immediately surrounds the exclusion area in which the population number and distribution is such that "there is a reasonable probability that appropriate measures could be taken in their behalf" in the event of a serious accident;
- The exposure of individuals to a postulated release of fission products (as a consequence of an accident) be less than certain prescribed values at any point on the exclusion area boundary and on the outer boundary of the LPZ;
- That the "population center distance," defined as the distance from the nuclear reactor to the nearest boundary of a densely populated center having more than 25,000 residents, be at least one and one-third the distance from the reactor to the outer boundary of the LPZ.

These criteria are considered inflexible and legally binding.

Areas of low population density are preferred for nuclear power station sites. High population densities projected for any time during the lifetime of a station are considered during both the NRC staff review and the public hearing phases of the licensing process. If the population density at the proposed site is not acceptably low, then the applicant will be required to give special attention to alternative sites with lower population densities.

If the population density, including weighted transient population, projected at the time of initial operation of a nuclear power station exceeds 500 persons per square mile averaged over any radial distance out to 30 miles (cumulative population at a distance divided by the area at that distance), or the projected population density over the lifetime of the facility exceeds 1,000 persons per square mile averaged over any radial distance out to 30 miles, special attention should be given to the consideration of alternative sites with lower population densities.

Transient population should be included for those sites where a significant number of people (other than those just passing through the area) work, reside part time, or engage in recreational activities but are not permanent residents of the area. The transient population is weighted by the fraction of time the transients are in the area.

Historically, the NRC staff has found that a minimum exclusion distance of 0.4 mile, even with unfavorable design basis atmospheric dispersion characteristics, usually provides assurance that engineered safety features can be designed to bring the calculated dose from a postulated accident within the guidelines of 10 CFR Part 100. If the minimum exclusion distance is less than 0.4 mile, it may be necessary to place special conditions on the station design (e.g., added engineered safety features) before the requirements of 10 CFR Part 100 are met. Also, based on past experience, the NRC staff has found that a distance of three miles to the outer boundary of the low population zone is adequate.

At present, NRC siting policy is being revised. Parallel changes are also occurring in emergency planning requirements for new and existing plants. Rule changes under the National Environmental Protection Act (NEPA) Alternate Site Reviews are also being developed for consideration of alternative sites. Rule changes in all three areas will be applied in the future licensing of nuclear power plants and will be used as site selection factors for any new nuclear power plant.

The development of new rules for NRC siting criteria is in compliance with Section 108 of the 1980 NRC Authorization Bill. This new rule development is specifically intended to separate siting criteria from engineered reactor safety systems. In the past the NRC permitted plant design features to compensate for unfavorable site characteristics. The new rules are intended to increase the emphasis on remote siting as well as considering safety-design features.

These proposed rule changes are in NUREG-0625 and in the NRC's "Modification of the Policy and Regulatory Practice Governing the Siting of Nuclear Power Reactors." The final rule changes are expected to be promulgated by the NRC in June 1982. The changes will modify 10 CFR Parts 100, 50, and 51 with regard to nuclear power plant siting and licensing criteria.

U.S. Atomic Energy Commission Accident Analysis Branch (WASH-1308, 1973) recommendations specify population number criteria which are used by CEC staff in this study as screening factors. These criteria are recommendations only and do not have the force of adopted rules. The criteria indicate that nuclear power plant sites should be considered prohibited in areas:

- o Within a 4 mile radius of any 25,000 persons population center (PPC);
- o Within a 5 mile radius of any 30,000 PPC;
- o Within a 50 mile radius of any 500,000 PPC;
- o Within a 40 mile radius of any 2,000,000 PPC; and
- o Areas with densities greater than 500 persons per square mile.

These screening criteria are also used in mapping efforts for the CEC sponsored study, "Underground Siting of Nuclear Power Reactors, Determinaition of Site Characteristics and General Availability in California," (January 1978).

In this study, based on these screening criteria and the NRC's siting criteria, urban and near-urban areas are considered not to provide opportunities for the location of new nuclear power plants.

BIOLOGICAL RESOURCES

Legally Protected Species
Commercial-Recreational Species
Species of Special Concern

Areas of Special Concern
- o Wetlands
- o Riparian Areas
- o Refuges and Reserves
- o Estuaries
- o Natural Areas

This section examines the general physical and biological characteristics of the nine UAs and their vicinities to determine areas of potentially significant impact and to identify biological factors of major concern.

Three general categories of physical characteristics are used to determine the areas of potentially significant impacts around each site, including:

- o The areas of potential power plant development within the CCC undesignated area;
- o The prevailing water movement, ambient temperature ranges and other oceanographic data used to determine potential areas of aquatic biological impacts; and
- o The prevailing wind direction, meteorologic data, and terrestrial characteristics used to determine the potential air quality impacts on biological resources. This study area does not usually exceed a 10 mile radius around the plant and is sometimes much smaller depending on the extent of the anticipated impacts.

The general biological resources within this power plant study area are described and mapped in terms of terrestrial and aquatic biological resources. Resources considered included the types of dominant native vegetative habitats; the quality of wildlife habitat; the types and quality of aquatic habitats; and the associated mammals, fish, invertebrates, vegetation, and planktonic species that are important to the area. Four biological factors of major concern are studied in more detail: rare and endangered species, areas of critical biological concern, species of special concern, and commercial and recreational resources. Definitions of these factors are in Appendix C.

Possible development impacts on the general biological resources and biological factors of major concern for each site are evaluated for the four facility types as described in Appendix B. Assuming a once-through cooling system, development constraints at each site are determined according to the potential for significant adverse impacts on the biological resources, and the ability to mitigate these impacts to an acceptable level. CEC staff policy on wetland siting and mitigation is further discussed in *Constraints and Opportunities for Power Plant Siting: Technical Issues, Appendix 7* (see References).

CCC UA Analysis

UNDESIGNATED CRESCENT CITY AREA--UA 1A and 1B

Physical Characteristics

UA 1A is located inland of Point St. George occupying the western half of Section 17, Township 16N, Range 1W, Humboldt Base and Meridian. The area for potential powerplant development is inland from the coast approximately one mile and is bounded by Lake Earl Drive to the east, Crescent City to the south, County Airport to the west and Lake Earl to the north.

A second portion (1B) of this area is located along U.S. Highway 101 from Cushing Creek in the south to Elk Creek and Crescent City to the north. The northern half of this area runs from Humboldt Road in the east to the Crescent City waterfront. The southern half sets inland from Crescent Beach and runs along U.S. Highway 101.

Prevailing winds are from the north and northwest with occasional gusty winds from the south and southwest during winter storms. The potential areas of high air quality impacts include parts of Crescent City, Elk Valley and Redwood National Park.

The prevailing water movement is onshore tidal movement from the northwest. Depending on the location of the intake and discharge facilities, the area of potential water quality impacts stretch from Pelican Bay to Crescent Beach.

Biological Characteristics

The biological resources within UA 1A include three major types of native terrestrial vegetation: north coastal forest, coastal prairie, and small patches of wetlands associated with the area's high rainfall and high ground water table. The prairie grasslands are utilized as pasture for cattle and horses. The mixture of grassland, forest and pockets of wetlands provides good habitat for a diversity of wildlife despite the increased urban development in the area.

The biological resources of UA 1B include five major types of terrestrial vegetation: north coastal forest, coastal prairie, freshwater marsh, riparian forest and coastal scrub. Much of the northern half of UA 1B has been disturbed by industrial and residential development, however, sections of valuable wildlife habitat still occur along the riparian corridors and remnant coastal forest and prairie-grassland. The southeast half of UA 1B has more open space and some high quality wildlife habitat associated with the Bower Ranch wetland areas and Redwood National Park land.

The surrounding areas that could be impacted from development have, in addition to the five vegetation types already mentioned, two other habitat types: coastal redwood forest to the south and east of UA 1A and 1B and coastal sand dune vegetation to the west of UA 1A. Much of the surrounding area that could be affected by air quality emissions or construction of facilities associated with power plant development (cooling water pipelines, transmission lines, and fuel transportation) is relatively undisturbed and of high wildlife value (CDFG, 1975).

Five aquatic habitat types are within the area of potential cooling water discharge: open water, rocky intertidal, kelp bed, sandy intertidal and protected harbor. Both the rocky intertidal area around Point St. George and the sandy intertidal area of Crescent Beach are of high biological value for their abundant and diverse fauna (Boyd and DeMartini, 1977).

Biological Resources of Major Concern

Biological concerns in the vicinity of UA 1A and 1B include rare and endangered species, areas of critical concern, species of special concern, and commercial and recreational resources.

Rare and Endangered Species

The Aleutian Canada goose (*Branta canadensis leucopaeia*) utilizes the Crescent City-Point St. George area as its spring staging ground and to a lesser extent as a fall and winter feeding area (National Fish and Wildlife Laboratory, 1980). The coastal prairie habitat and offshore rocks around Point St. George are an essential spring staging area (Woolington, 1980) and development of the area should be avoided.

Areas of Critical Concern

- Wetlands. Several areas of freshwater marsh occur within UA 1A and 1B and in the areas of potential indirect impacts. Several small pockets of seasonal wetlands occur in and around UA 1A and 1B. These areas are of high biological value and should be avoided. If power plant development occurs, mitigation will be necessary. Larger wetland areas that are also of concern and could be impacted include: Lake Earl wetlands which is within 1/2 mile north of UA 1A; Crescent marsh which is within the Bower Ranch area of UA 1B; and Redwood Park marsh which is west of UA 1B along the coastal dunes of Redwood National Park.

- Riparian Area. Several valuable riparian habitats occur east of UA 1A and within UA 1B. These areas should be avoided by development. Some level of mitigation might be required for potential indirect impacts such as increased siltation and adverse air emission effects on important habitat.

- Officially Protected Areas. Two areas within UA 1B have recently been acquired by government agencies for the preservation of their natural resources. Development in most of the southern half of UA 1B should be prohibited within the Redwood National Park property and the California Department of Fish and Game (CDFG) Wildlife Area at Bower Ranch.

- Natural Areas. Two areas identified by the California Natural Areas Coordinating Council (CNACC, 1978) could be potentially impacted by power plant development. Lake Earl and Lake Talawa area (CNACC 081212) identifies valuable sand dune vegetation/wetland habitat to the west of UA 1A. If cooling water facilities are routed through this area, careful planning will be required to avoid valuable habitat and to mitigate for possible habitat loss. Crescent City Sitka spruce stand (080380), which was identified for its high value coastal forest and sand dune habitats, is located within UA 1B. Although some of this natural area has recently been protected under the CDFG Bower Ranch wildlife area acquisition, other areas of equally high biological value remain under private ownership and should require some level of avoidance or mitigation, if development is to be considered in the area.

Species of Special Concern

Menzie's wallflower (Erysium menziesii) has been sited in several localities along the coast from Point St. George to Whaler Island. This plant is listed by the California Native Plant Society (CNPS, 1980) and Smithsonian Institute (Ayensu and DeFillip, 1978) as endangered and could be directly impacted by development on its coastal strand habitat. Two other CNPS (1980)-listed plants have been sited within two miles of UA 1A; however, the known plant locations are not anticipated to be significantly impacted by development.

Another species of special concern is the ring tailed cat (Bassariscus astutus), which CDFG recognizes as a fully protected species. The ring tail cat is known to inhabit the area (CDFG, 1975). A more detailed site-specific analysis would be required before recommending any level of avoidance or mitigation.

Commercial and Recreational Resources

Terrestrial resources within the vicinity of UA 1A and 1B which may require some mitigation for direct and/or indirect impacts include: coastal and redwood forested areas and species such as the Roosevelt Elk (Cervus carradens is roosevelti) and the Black Tailed Deer (Odocoileus hemionus columbians).

Aquatic resources are of even greater concern with the rocky shore and kelp bed habitat offshore supporting a valuable fishery resource. In addition, many of the offshore rocks supply bird roosting and marine mammal hauling out grounds.

Overall Site Evaluation. Limited development is possible on UA 1A with probably the most severe limitation associated with cooling water facilities. If the facility was developed toward the west, extensive mitigation or avoidance might be required by the pipelines going through high value sand dune and wetlands areas and endangered species habitat. The closest source of cooling water is the nearshore habitat around Point St. George which is of high commercial and recreational value. These off-shore marine resources might require extensive mitigation or avoidance with the most severe limitation being placed on large facilities such as nuclear and coal units which require a large volume of cooling water and can potentially cause more extensive impacts. On-site wetlands would also require some mitigation or avoidance with more limitations being placed on larger facilities as is required for coal-fired units which could potentially impact larger areas of protected wetlands. Other potential limitations could also occur from indirect impacts on surrounding areas of riparian zones, wetlands, officially protected areas, species of special concern habitat and commercial and recreational resources.

Power plant development in UA 1B would have to avoid the officially protected areas recently acquired by CDFG and the National Park Service. Other than the possible limitations from effects on surrounding areas already mentioned for UA 1A, a most severe limitation in the northern part of UA 1B would be from direct impacts on the Sitka spruce natural area and on the riparian corridors.

SAMOA SPIT--UA #2

Physical Characteristics

UA 2 is located on the Samoa Peninsula from the Highway 255 bridge south to the channel entrance of Humboldt Bay. The prevailing winds are northerly during the summer and southerly gail force during winter storms. The predominate ocean current is an offshore southerly direction with a seasonal northerly surface flow during the winter storm period.

Biological Characteristics

The undeveloped area of UA 2 is predominately sand dune habitat with small patches of salt and freshwater marsh, coastal scrub, and coastal pine forest. The area supplies habitat for several species of special concern and is valuable wildlife habitat for upland game species (CDFG, 1973). Terrestrial habitats surrounding UA 2 which would be indirectly affected include: salt and freshwater marsh along the shores of Humboldt Bay; sand dune vegetation on the South Spit and Elk River Mouth; coastal prairie-scrub in the undeveloped areas around Eureka; and coastal forest north and east of UA 2. These areas provide a diversity of wildlife habitats, much of which is of great value to special concern and/or commercial and recreational species.

Aquatic habitats which could potentially receive impact include the open water and sandy shore environment where cooling water facilities are likely to be placed, and the Humboldt Bay estuarine environment that could be indirectly impacted. Both areas are of commercial and recreational value with fishing and clamming occuring along the spit as well as inside the Bay. However, Humboldt Bay provides a much more abundant and diverse spawning and feeding habitat for numerous species of waterfowl, marine mammals, anadromous fish, and important game species.

Biological Resources of Major Concern

There are four biological factors of major concern which could potentially be affected by development at UA 2, including: rare and endangered species, commercial and recreational species; areas of critical concern; and species of special concern.

Rare and Endangered Species

The California brown pelican (*Pelecanus occidentalis californicus*) and the American peregrine falcon (*Falco peregrinus anatem*) utilize the habitats in and around UA 2 for feeding. Considering the fact that these species currently coexist with industry already on the spit, and that nesting does not occur in the immediate area, it is not anticipated that powerplant development would create a significant impact on either species.

Commercial and Recreational Species

A significant portion of California's commercial fishing industry utilizes Humboldt Bay and the surrounding ocean waters. Water quality impacts could directly affect the commercial and recreational flatfish fishery offshore. Of greater concern is avoidance of potential impacts on the nursery and spawning capacity of Humboldt Bay. Cooling water impacts near the entrance channel could adversely affect the anadromous and oceanic gamefish that go to and from the Humboldt Bay estuary.

The nearshore area is a valuable recreational shellfish and game fish habitat which might require some level of avoidance or mitigation for potential impacts from thermal discharge. The high value of recreational resources of Humboldt Bay, especially the abundant water fowl and water-associated bird populations, may also require some level of avoidance or mitigation due to potential air quality impacts on important habitat.

Areas of Critical Concern

Areas of critical biological concern include wetlands, Humboldt Bay estuary, and natural areas.

- Wetlands. There are several areas of freshwater and saltwater marsh to the north, east, and south of UA 2 that could be indirectly impacted by development. Smaller pockets of freshwater marsh are also located in UA 2. Varying levels of avoidance or mitigation would be required for potential impacts on both the on-and off-site wetland areas.

- Estuaries. Humboldt Bay is a major nursing and feeding ground for many valuable aquatic species and water-associated birds and mammals. This high quality estuarine habitat is downwind of UA 2 and might require varying levels of mitigation or constraint due to potential air quality impacts.

- Natural Areas. A U.S. Army Corps of Engineer's "Area of Environmental Concern" (AEC) is located within UA 2. AEC #27, the North Spit Beach, and coast guard station encompass much of the southern end of the spit and extend up the west side of New Navy Base Road. This area was identified for its high quality dune habitat, and potentially significant impacts might occur if development occurs in this area. Several other areas identified by the Corps of Engineers, Humboldt State University biologists (Environmental Research Consultants, 1974), and CNACC (1978) are within the vicinity of UA 2 and may require varying levels of mitigation or constraint.

- Officially Protected Areas. Humboldt Bay National Wildlife Refuge comes within one-half mile east of UA 2. This refuge contains high quality wetland and mudflat habitat with a high concentration of aquatic life, waterfowl and shorebirds. The potential for adverse air quality impacts on the refuge may require some developmental limitations or mitigation.

Species of Special Concern

Several plant species listed by CNPS and the Smithsonian Institute (SI; Ayensu and DeFillips, 1978) as rare, threatened, or endangered occur within the area of potential impacts. Of greatest concern are three species which inhabit dune or wetland habitat and have been sited within UA 2. Known habitat areas should be avoided and some mitigation may be required for the CNPS and SI

Biological Resources of Major Concern

Biological concerns in the vicinity of UA 3A and 3B include: rare and endangered species; areas of critical concern; and species of special concern.

Rare and Endangered Species

The sand dune habitat in and around UAs 3A and 3B is either an established or potential habitat for the Smith's blue butterfly (*Shijimiaeoides enoptes smithi*), (which is on the federal endangered list and proposed for the state rare list) and the state rare listed Santa Cruz wallflower (*Erysimum teretifolium*). Endangered species area #10, officially set aside by the U.S. Army for the protection of the Smith's blue butterfly and the CNPS listed rare plant coast wallflower (*Erysimum ammophilum*), should be avoided by all development; and the potential habitat along the rest of the coast may require significant levels of avoidance or mitigation. Moderate numbers of southern sea otter (*Enhydra lutris nereis*), which are federally listed as threatened, forage in the offshore/nearshore area. The presence of the sea otter would require a moderate level of limitation or mitigation due to potential water quality impacts and offshore fuel transportation systems.

Areas of Critical Concern

The areas of critical biological concern in the study area include: wetlands, riparian, and natural areas.

- Wetlands--Several seasonal freshwater ponds provide valuable habitats within UA 3A. These ponds may require avoidance or mitigation, and therefore may limit the potentially developable land area.

- Riparian--Adverse air quality impacts on the riparian woodland along the Salinas River, two miles east of UA 3A, may require nominal levels of mitigation.

- Natural Areas--Three natural areas, identified by CNACC (1978), could be affected by development. The Salinas River (271904) is of concern for its riparian community, previously mentioned, and for the saltmarsh habitat two miles north of UA 3A at the river mouth. This area is a potential endangered species habitat for the California clapper rail (Gill, 1979) and California least tern (Atwood 1977) as well as valuable aquatic and waterfowl species habitat. The Marina dunes (271310) stretch from the Salinas River mouth to Fort Ord. UA 3A access to the ocean is within this natural area. Fort Ord dunes (270630) encompass most of UA 3B and are identified for their valuable dune and beach habitat.

Species of Special Concern

Several species identified by the CNPS as rare or endangered occur in the sand dune vegetation both in and around UA 3A and UA 3B. These species include the rare Monterey ceanothus (*Ceanothus rigidus*) and coast wallflower (*Erysimum ammophilum*), and the endangered Sandmat Manzanita (*Arctostaphylos pumila*), Eastwood's ericameria (Ericameria fasciculata), Seaside bird's beak (Cordylanthus rigidus ssp. littoralis), and Menzies'wallflower (Erysimum menziesii). These species may require avoidance, depending on the size and location of the development, with larger facilities sited within the dune area of UA 3B of greatest concern.

Overall Site Evaluation

In UA 3A, protected animal species are the most significant concern limiting development. Direct impacts on the dune habitat and potential air quality impacts on the endangered Smith's blue butterfly may severely limit large facilities with significant air quality emissions. The threatened southern sea otter would severely limit facilities with large cooling water demands and associated discharges and/or facility types with potential adverse impacts related to offshore fuel transportation systems, such as oil tanker off-loading facilities. Other biological factors that are of concern and may limit expansion to varying degrees include the numerous plant species of special concern within the vicinity,onsite wetland areas, downwind riparian habitat, and nearshore/offshore commercial and recreational fish species.

In UA 3B protected animal species are of significant concern with prohibition status recommended for the U.S. Army designated Species Area #10. The Fort Ord dunes natural area sand dune habitat, although largely re-established with nonnative vegetation, is a high quality wildlife and plant species special concern habitat and may require moderate levels of avoidance or mitigation. The commercial and recreational fish species off the coast may also limit expansion.

SANTA MARIA RIVER--UA 4A AND 4B

Physical Characteristics

UA 4A is a several square mile, irregularly shaped parcel inland of Oso Flaco Lake and Nipomo Dunes. The parcel is bounded by the Southern Pacific Railroad track to the west, Callender Black Lake Road to the north, and U.S. Highway 1 to the east.

UA 4B is a several square mile, irregularly shaped parcel inland of the Santa Maria River mouth. The parcel centers around the Santa Maria River west of Guadalupe and inland of Guadalupe dunes and Mussel Rock dunes.

The prevailing winds are from the northwest with some gusty winds from the south during winter storms. The Santa Maria Valley and Nipomo mesa to the east-southeast of UA 4A and 4B would be the area subject to the most significant air quality impacts. The alongshore water movement from the northwest will cause the most significant water quality impacts to occur off the coast of the Nipomo dunes and to the Mussel Rock and Pt. Sal area.

Biological Characteristics

Most of the Santa Maria Valley study area is used for agriculture with some remnant areas of riparian woodland, coastal prairie-grassland, freshwater marsh and mixed evergreen forest on the Nipomo mesa. The most valuable native vegetation and wildlife habitat areas are west of the sites, which include: sand dunes, salt marsh, freshwater marsh, tidal mudflats, riparian, and coastal strand habitats. The Nipomo dunes supports a high quality wildlife community (CDFG, 1976) and is listed as one of the highest valued natural areas in California by CDFG, California Department of Parks and Recreation (CDPR, 1971) and by the Heritage Conservation and Recreation Service (HCRS, 1974).

Aquatic resources that could be potentially impacted include sandy shore, open water, rocky intertidal and kelp bed habitat. The nearshore areas are of high value for shellfish, bottomfish, rockfish and marine mammal resources especially in the Mussel Rock-Pt. Sal area where there is a higher diversity and abundance of marine fauna and flora.

Biological Resources of Major Concern

Within the vicinity of UA 4A and 4B the major biological resources of concern include: rare and endangered species, areas of critical concern, species of special concern, and commercial and recreational resources.

Rare and Endangered Species

Seven protected animal species may exist in the Nipomo-Mussel Rock dunes area. The American peregrine falcon (*Falco peregrinus anatum*), the southern bald eagle (*Haliaeetus leucocephalus leucocephalus*) and the California brown pelican (*Pelecanus occidentalis californicus*) occasionally forage in the area but are not known to utilize the area for nesting.

Local biologists have also identified three other protected animal species that may be in the area: the Belding's savannah sparrow (*Passerculus sandwishensis beldingi*) in the Santa Maria River salt marsh and the Globose dune beetle (*Coelus globosus*) and Morro Bay blue butterfly (*Plebejus icariodes moroensis*) in the dune vegetation of Nipomo and Mussel Rock dunes, (Envicom, 1980). The most extensive constraint on development would be the known and potential nesting habitat of the California least tern (*Sterna albigrons browni*) (Atwood, et al., 1977). In addition to the Mussel Rock dunes nesting area, both the offshore area and Santa Maria marsh foraging area are also of concern.

Areas of Critical Concern

The areas of critical biological concern within the study area include: wetlands, riparian, officially protected areas, and natural areas.

- Wetlands. The salt and freshwater marsh areas at Santa Maria River mouth, Oso Flaco Lakes and the extensive system of coastal marshes and lakes within the Nipomo dunes are a major concern. These wetland areas could extensively limit the placement and operation of cooling water facilities from the two inland sites.

- Riparian. Adjoining the Santa Maria River and its tributaries are several areas of valuable riparian habitat. This habitat should be avoided by development within the sites and potential air quality and water quality impacts on the surrounding habitat may require some level of constraint or mitigation.

- o <u>Officially Protected Areas</u>. Several sections of Nipomo dunes north of Oso Flaco Lake are owned by CDFG and CDPR. They are managed as wildlife areas or state parks. Most of these areas should not be significantly affected by power plant development, with the exception of potential cooling water facility impact which may require some mitigation or avoidance.

- o <u>Natural Areas</u>. Two CNACC natural areas could be impacted by development at UA 4A. Black Lake Canyon (200255) identified for its high value riparian and freshwater marsh habitat is northeast of the site and may be impacted by adverse air emissions. Nipomo dunes (401455) which has already been mentioned as rare and endangered habitat and a wetland area is west of both sites. <u>This is the largest remaining coastal dune complex of the state's diminished dune habitat.</u> This area along with two similarly valuable areas to the south, Guadalupe dunes (420790) and Mussel point (421396) may be affected by cooling water facility construction which would require some avoidance of certain areas or mitigation depending on the location.

The HCRS has also identified the Point Sal-Nipomo dunes area as a national natural landmark due to its high value biological resources. (HCRS, 1974). The area designated by HCRS includes a combination of private and public land from Pismo Beach to Point Sal. While most of UA 4A and 4B are east of the natural landmark, cooling water facilities must travel through the area which may require varying levels of constraint or mitigation.

<u>Species of Special Concern</u>

Four CNPS- and Smithsonian-listed plant species have been sited within the vicinity of UA 4A and 4B. San Luis Obispo monardella (<u>Monardella undulata</u> var. <u>frutescens</u>), crisp monardella (<u>M. crispa</u>), Blochman's leafy daisy (<u>Erigeron foliosus</u> var. <u>blochmaneae</u>) and a pholisma (<u>Pholisma arenarium</u>) have been located both in and around UA 4A. Six other listed plant species are also sited within the area of potential impacts, including: Nipomo mesa lupine (<u>Lupinus nipomensis</u>), Gambel's watercress (<u>Nasturum loncholipis</u>), surf thistle (<u>C. rhothophilum</u>) beach spectacle (<u>Dithyrea maritima</u>), and soft-leaved paintbrush (<u>Castilleja mollis</u>). This large number of rare and endangered plants may require extensive mitigation or constraint of development. The same species are also found in and around UA 4B with the addition of the black flowered figwort (<u>Scrophularia atrata</u>) in the vicinity to the southeast. Although fewer plants have been sited in UA 4B than in UA 5, development may still be severely limited depending on the placement of cooling water facilities to the west and potential air quality impacts on downwind rare plants.

Other species of special concern include several protected species of raptors, shorebirds and water associated birds that heavily utilize the Nipomo dunes area. Several endemic insect species of the Nipomo dunes system are of concern to local biologists and three species of local reptiles and amphibians are considered rare and threatened by some authorities (Envicom, 1980). In addition, several remnant stands of giant Coreopois (Corcopsis gigantea) are of concern because Nipomo dunes has the northern-most population of this unique species, and it is rapidly declining due to heavy recreational use of the area. All of these species of special concern may be affected if proper planning and mitigation is not used in cooling water facility development through the Nipomo dunes habitat.

Commercial and Recreational Resources

The high quality of recreational resources within the Pt. Sal-Nipomo dunes area is of greatest concern. Within the vicinity of UA 4A and 4B are several high use resources including: sport fishing for offshore/nearshore bottomfish and rockfish species, clamming for Pismo clams, bird watching and nature study. As was the case for the Nipomo dunes species of special concern, these recreational resources may require some constraint or mitigation, especially from potential cooling water facility impacts.

Overall Site Evaluation

All development within UA 4A would be most severely constrained by potential construction effects on the CNPS listed plants, and valuable Nipomo dunes area to the west, with the most extreme limitations being placed on coal and larger facility types. Some additional constraints or mitigation may be required for potential air quality impacts on downwind CNPS listed plants, natural area and riparian habitat. Offshore cooling water impacts would also require some additional levels of constraint or mitigation due to potential sea otter habitat and recreational fish and shellfish resources.

Development on UA 4B would require similar levels of constraint or mitigation for air and water quality impacts on the surrounding area. Construction impacts on the onsite CNPS listed plants may be less severe since most of the area is currently used for agriculture or oil prouction and only one species has been sited to date. Cooling water facility construction may be more severely limited since valuable riparian habitat occurs onsite and to the west, wetland habitat occurs along the Santa Maria River mouth and the endangered California least tern nests along the Mussel Rock dunes, an area previously set aside as an undesignated area corridor through the dunes.

UNDESIGNATED TIJUANA RIVER AREAS--UA 5

UA 5 is the southernmost undesignated parcel in California. This small parcel is set back two miles inland along the United States-Mexico border. The site is bounded on the south by the border, the north and east by Monument Road and the west by Smugglers Gulch.

Within the undesignated area there is a plateau which has not been developed and is a potential site if the terrain is not too steep for development.

The prevailing wind direction is from the northwest in winter and southwest in summer, with the area of significant air quality impact located inland of the potential site. Prevailing water movement is an onshore tidal flow from the west-northwest with some seasonal freshwater flooding of the Tijuana River Channel.

Biological Characteristics

In the vicinity of the site, six major types of native vegetation occur in remnant pockets in and around the developed vicinity, including: salt marsh, freshwater marsh, coastal prairie scrub, coastal strand, coastal sagebrush, and riparian habitat. Very high quality wildlife habitats are associated with the wetland areas of the Tijuana River estuary, and along the ocean shore from Silver Strand south to Border Field.

There are three major aquatic habitats of concern: estuary, sandy shore, and open ocean. The estuarine habitat of the Tijuana River and associated Oneonta Slough as well as the vicinity's sandy shore and open water areas provide excellent quality nursery and feeding habitat for an abundant and diverse population of fish and invertebrates and the water-associated birds that prey upon them.

Biological Resources of Major Concern

The major biological resources of concern include: rare and endangered species, areas of critical concern, species of special concern, and commercial and recreational resources.

Rare and Endangered Species

One state and federally listed endangered plant has been sited in the salt marsh habitat of Tijuana Slough. The salt marsh bird's beak (Cordylanthus maritimus ssp maritimus) which was at one time thought to occur at only one location in the United States in the Tijuana Slough (International Boundary and Water Commission, 1974) has been sited in several localities within the Slough area.

The Tijuana River estuary supplies habitat for six state and federally protected bird species: light-footed clapper rail (Rallus longirostris obsoletus), California black rail (Leiterallus jamaicensis coturniculus), Belding's savannah sparrow (Passerculus sandwishensis beldingi), and California least tern (Sterna albifrons browni), all of which reside in the area's salt marsh habitat; the California brown pelican (Pelecanus occidentalis californicus) which forages off the coast; and the American peregrine falcon (Falco peregrinus anatum) which is an occasional visitor. The four salt marsh residents and endangered plants are of greatest concern. Areas adjacent to Oneonta Slough provide habitat for one-third of the known remaining population of light-footed clapper rails.

Additional species using this marsh habitat which are considered locally rare include the western snowy plover, elegant tern, Bell's vireo, and the golden eagle.

Areas of Critical Concern

Areas of critical concern include: wetlands, estuaries, natural areas, and riparian habitat.

- o Wetlands. The freshwater and salt marsh of Tijuana Slough and riverbed will require moderate levels of constraint for air and water quality impacts from the border site and the two mile stretch of cooling water pipeline which may be necessary for the Border Field area. Power plant development with associated of the air station site as well as any cooling water facilities through the marsh from the air station or border site should be avoided.

- o Estuary. The high quality estuarine environment would require nominal to moderate levels of constraint on the two sites for potential water quality impacts. Discharge of any waste water and/or site run-off would require compliance with all applicable water quality standards. Nuclear, coal, and large facility types requiring large cooling water supplies would be the most limited constraint for the site.

- o Riparian. Several areas of remnant riparian woodland occur along the Tijuana river and its tributaries. Moderate levels of constraint would be required of development at the air station or border sites.

- o Natural Areas. The natural areas of major concern near the border area is the Tijuana Slough and riverbed west of Hollister Road. The Tijuana River estuary is considered to be one of the best remaining functional wetland systems in California. Much of the area has recently been acquired by the U.S. Fish and Wildlife Service, which plans to manage the area as a wildlife refuge. The area, which includes Oneonta Slough, is under consideration for estuarine sanctuary status. Areas of the marsh adjacent to the acquired refuge are either proposed for acquisition or are at least being considered for inclusion in a cooperative estuarine marsh management program proposed by governmental interests presently responsible for management of the lands. The high quality of this estuarine marsh, which supports numerous legally protected species, will require that development associated with power generating facilities avoid critical habitat areas. This includes appurtenant facilities such as cooling water intake and discharge lines and electrical transmission lines. CNACC and HCRS have identified two areas along the coast for their high quality biological resources and endangered species habitat, Tijuana Slough (372051) and Border Field State Park (370270).

Species of Special Concern

One CNPS-listed rare plant has been located on the border site. Baja California manzanita (Ornithostaphylos oppositifolia) may occur along the plateau of UA 5 which would require avoidance or mitigation. Nine other plant species listed as rare or endangered have been sited in the Border Field area to the west and plateau areas east of the Tijuana River (CNPS, 1980). Potential air quality impacts from development at the border site may require nominal to moderate levels of constraint and the border site would be further constrained by potential cooling water facility construction impacts on the rare plant species habitat around Border Field.

Other species of special concern include: the only United States breeding colony of elegant tern (Thalaseus elegans) (east of the radio station), an abundant and diverse shorebird population utilizing the surrounding shore and wetland habitat, and a variety of raptors which forage and roost in the surrounding undeveloped habitat. These species of special concern may also be moderately impacted by development at the site.

Commercial and Recreational Resources

Several commercial fish species use the Tijuana estuary as a spawning and nursery area. This habitat, plus the offshore/nearshore commercial fishing for spiny lobster, northern anchovy, and bottomfish species may require moderate levels of constraint due to potential cooling water impacts. Recreational resources such as sport fishing, bird watching, clamming, and nature study would also require some avoidance or mitigation for potential impacts on the high quality biological resources of the area.

Overall Site Evaluation

Development on UA 5 may be moderately to severely constrained by potential cooling water facility construction impacts on the wetland, state park acquisition and endangered species habitat to the west, and by potential on-site impacts on a CNPS-listed, rare plant. If cooling water intake and discharge lines can be placed along Monument Road, it is probable that ocean cooling water access will not be a significant problem. Although sections of Monument Road are within the 100-year floodplain of the Tijuana River, critical habitat areas would be avoided if pipelines generally followed its route to provide ocean cooling water access. Coal and large fossil fuel facilities would be the most severely constrained due to this potential on-site impact and potential air quality impacts on the CNPS-listed plants and riparian habitat to the east. Additional constraint would also be required for potential water quality impacts on the Tijuana River estuary, offshore commercial fishery, Tijuana Slough and near-shore recreational resources.

BCDC UA ANALYSIS

OLEUM UA--6

Physical Characteristics

UA 6 is located on the southeast shore of San Pablo Bay just north of Davis Point. The potential development area covers the waterfront area east of Davis Point and the inland valley area around Tormey. The prevailing wind is from the west-northwest with the area of significant air quality impacts located to the east along Carquinez Strait and inland up the Canada del Cierbo. The prevailing water movement is an alongshore tidal and net outflow through the Carquinez Strait.

Biological Characteristics

Four terrestrial vegetation types occur in the undeveloped portions of the study area: coastal prairie-scrub, mixed evergreen forest, coastal sagebrush, and salt marsh habitat. The inland undeveloped area provides good quality wildlife habitat for a variety of upland game and raptor species, and the remnant sections of native vegetation along the shore provide good quality habitat for water-associated birds.

Three aquatic habitats dominate the estuarine environment near UA 6: mud-flats, rocky shore and open water of Carquinez Strait and San Pablo Bay. The nearshore and intertidal habitats support an abundant population of fish, waterfowl, and invertebrates. The open water area of the Carquinez Strait is the most important migratory route for anadramous fish in California.

Biological Resources of Major Concern

The major biological factors of concern are rare and endangered species, areas of critical concern, and commercial and recreational resources.

Rare and Endangered Species

Several areas of salt marsh habitat along the Carquinez and Mare Island Straits support California clapper rail (*Rallus longirostris orbsoletus*) and salt marsh harvest mouse (*Reithrodontomys raviventris*). Some of these habitats could be moderately to nominally affected by potential air and water quality impacts.

Areas of Critical Concern

Areas of critical biological concern include wetlands, estuaries, and natural areas.

- o Wetlands. Several sections of salt marsh habitat occur within the vicinity of UA 6. The Selby Marsh is within the immediate vicinity of UA 6 and should be avoided as a development site for a power plant and cooling water facilities. The Selby Marsh and other nearby marsh habitats may also require moderate levels of constraint or mitigation for potential air and water quality impacts.

- Estuaries. The offshore/nearshore waters are part of the largest estuary system (San Francisco Bay-Suisun Marsh) in California. The Oleum area is of major concern because migratory fish species congregate there while orientating themselves to the transition between San Pablo Bay and the Carquinez Strait. Intake and discharge impacts within the Oleum area could significantly affect the valuable estuarine habitat of the area, which would require significant constraints, especially for facilities with large cooling water requirements.

- Natural Areas. Four CNACC natural areas are in the vicinity of UA 6, including: Selby Grassland (071930), Davis Point (070410), Mare Island Marsh (481320), and Southhampton Bay area (481970). The coastal prairie scrub habitat of Selby grassland is of concern since it is located adjacent to UA 6 and could be impacted by development or air quality emissions.

Commercial and Recreational Resources

There are three local resources of major concern: Anadromous fish migrating through Carquinez Strait, shellfish beds, and waterfowl areas along the east shore of San Pablo Bay. All of these resources could be impacted by decreased water quality associated with energy facility development.

Overall Site Evaluation

Moderate levels of constraint or mitigation would be required for nuclear, coal, and other fuel type facilities with large cooling water requirements due to potential impacts on the surrounding estuarine and salt marsh habitats, and the commercial/recreational resources they support. Downwind wetlands and endangered species habitat may require moderate levels of constraint or mitigation for coal and fossil fuel facilities with large air quality impacts. Nominal levels of constraint or mitigation would be required on all facility types for potential air quality impacts on surrounding natural areas, wetlands, and endangered species habitat. Potential water quality impacts on surrounding wetlands, estuarine environment, and commercial/recreational resources would also require nominal levels of mitigation for all facility types.

POINT SAN PEDRO--UA 7

Physical Characteristics

UA 7 is located on the west side of San Francisco Bay along the waterfront of San Rafael Bay. The prevailing wind is from the west-northwest with the area of significant air quality impacts dispersed along San Pablo and San Francisco Bays. With the poor water circulation characteristics of the shallow San Rafael Bay, discharge facilities would have to be located out in the deeper water areas of San Francisco Bay. The prevailing water movement is a strong tidal flow through the San Pablo Strait.

Biological Characteristics

UA 7 is dominated by waterfront development and degraded fill habitat with some remnant patches of three types of native terrestrial vegetation in the vicinity of the sites including coastal prairie-scrub, coastal woodland, and salt marsh habitat. These remnant native vegetation areas and some of the waterfront area supports moderate populations of upland game species and water-associated bird species. Two aquatic habitat types dominate intertidal mudflats and the San Francisco Bay estuarine environment. The aquatic habitats in and around San Rafael Bay provide valuable spawning and feeding grounds for an abundant and diverse population of fish, invertebrates and water-associated bird species.

Biological Factors of Major Concern

Major biological factors of concern include rare and endangered species, areas of critical concern, species of special concern, and commercial and recreational resources.

Rare and Endangered Species

Several areas of remnant salt marsh habitat are within the vicinity including the Triangular marsh to the south and San Rafael marsh at the mouth of San Rafael Creek. These areas provide marginal habitat for the state and federally listed endangered California clapper rail (Rallus longirostris obsoletus). The critical habitat and the surrounding nearshore feeding area would require nominal levels of constraint or mitigation for potential water quality impacts.

Areas of Critical Concern

Areas of critical concern include wetlands, San Francisco Bay estuary and natural areas.

- Wetlands. Remnant sections of salt marsh habitat, such as the San Rafael marsh, Triangular marsh and tidal mudflat along the shore of San Rafael Bay, could be affected by potential water quality impacts. Discharge facilities would have to be located in the deep water areas of San Francisco Bay beyond the shallow water area of San Rafael Bay to avoid severe water quality impacts on the wetlands in the nearshore area where water circulation is poor.

- Estuaries. The shallow water areas of San Rafael and San Francisco Bays should be avoided due to thermal discharge impacts, and the impacts on the estuarine habitat offshore may require nominal levels of mitigation.

- Natural Areas. Two areas of remnant salt marsh habitat, San Rafael marsh (212335) and Triangular marsh (212090), and the shallow water habitat around West Marin Island (212335) are the areas identified by CNACC which could be affected by potential water quality impacts. These areas are identified for their valuable aquatic resources and water-associated bird habitat which would require nominal levels of constraint or mitigation for potential cooling water impacts.

Species of Special Concern

Several species of water-associated birds and raptors feed in and around San Rafael Bay including several species of herons and egrets that nest on West

Marin Island. Nominal levels of constraint or mitigation would be required for water quality impacts on the nearshore feeding habitat in addition to construction impacts on the marginal waterfront habitat within the two sites.

Commercial and Recreational Resources

The nearshore estuarine habitat around UA 7 provides valuable spawning and feeding grounds for a number of commercial and recreational fish and shellfish species. This nearshore habitat would require nominal levels of constraint or mitigation for potential water quality impacts.

Overall Site Evaluation

All facility types with significant discharge requirements would have to place discharge facilities in the deeper water areas of San Francisco Bay to minimize the potential of severely impacting the nearshore shallow water environment. Nominal levels of constraint or mitigation would be required for potential water quality impacts on the nearshore estuarine and wetland habitats that support valuable populations of endangered species, species of special concern, and commercial and recreational species.

VISITACION UAs--8A, 8B, and 8C

Physcial Characteristics

All three UAs are located along a three-mile stretch of industrial waterfront from Visitation Point to Point San Bruno in the city of South San Francisco, San Mateo County. Prevailing wind direction is from the west-northwest with the area of significant air quality impact to the east-southeast over San Francisco Bay. Prevailing water movement is onshore tidal flow with a minimal water circulation condition occurring in many of the shallow water areas close to shore.

Biological Characteristics

All three UAs are dominated by industrial development or open areas disturbed by recent landfill activities with remnant patches of coastal prairie-scrub and salt marsh vegetation. The UAs, with their limited vegetation cover, are of minimal wildlife value. However, the San Bruno Mountain area just inland supports an abundant wildlife population.

Tidal mudflats, protected harbor and open water habitats of San Francisco Bay are within the vicinity of three UAs and could be impacted by potential water quality impacts. The nearshore habitats provide spawning and feeding grounds for an abundant and diverse population of fish, invertebrates, and water-associated bird species.

Biological Resources of Major Concern

Major biological factors of concern include rare and endangered species, areas of critical concern, species of special concern, and commercial and recreational resources.

Rare and Endangered Species

Several state-listed endangered species occur in the San Bruno Mountain area including the San Bruno elfin butterfly (Callophrys mossi boyensis), Pacific manzanita (Arctostaphylos pacifica), and San Bruno Mountain manzanita (A. imbricata). Nominal levels of constraint or mitigation may be required for transmission line impacts on the San Bruno Mountain critical habitat areas.

Areas of Critical Concern

The areas of critical concern include wetlands, natural areas, and the San Francisco estuarine environment.

- Wetlands. Small pockets of remnant salt marsh and tidal mudflat habitat occurs in the vicinity of the potential sites. Power plant discharge impacts on these habitats would be severe in the shallow nearshore environment due to its limited water circulation capability. Moderate levels of constraint or mitigation would be required for all facility types with a significant discharge requirement, and discharge facilities would have to be placed far offshore in the deep water channel of the bay where tidal mixing and water circulation is more adequate than in the nearshore environment.

- Natural Areas. CNACC identifies (411905) the San Bruno Mountain area, inland of the potential sites, as one of the last areas containing a sizable portion of coastal prairie-scrub and coastal woodland habitat typical of the Northern San Francisco Peninsula. This area of remnant vegetation, and the valuable wildlife community it supports, could require nominal levels of mitigation for increased use of the existing transmission line corridor through the San Bruno Mountain area.

- Estuaries. As mentioned in the wetlands section, the nearshore estuarine environment should be avoided by thermal discharges, and would require moderate levels of constraint or mitigation for potential water quality impacts.

Species of Special Concern

Several plant species identified by CNPS as rare or endangered are found in the San Bruno Mountain area and may be adversely impacted by increased use of existing transmission line corridors. The CNPS-listed endangered San Francisco owl's clover (Orthocarpus floribundus) has been found in the immediate vicinity of UA 8A and could be affected by power plant construction or air quality impacts. Several species of shorebirds and water-associated birds utilize the nearshore estuarine environment, and to some extent, the degraded waterfront habitat in and around the potential sites. These species of special concern would require varying levels of nominal constraint or mitigation for all facility types.

Commercial and Recreational Resources

Several important commercial and recreational fish and shellfish species occur in the nearshore estuarine environment adjacent to the three UAs. The nearshore environment provides essential spawning and feeding habitat for these species and, as mentioned in the previous wetland and estuarine sections, would require moderate levels of constraint or mitigation for potential water quality impacts.

Overall Site Evaluation

All facility types with a significant discharge requirement would require moderate levels of constraint or mitigation for potential water quality impacts on the nearshore estuarine and wetland habitats, and the commercial/ recreational resources they support. As part of the required constraint, discharge facilities would have to be placed one to two miles offshore in the deeper water channel of the bay where there is more tidal mixing and water circulation than in the shallow nearshore area. Nominal levels of mitigation or avoidance would also be required for transmission line impacts on the San Bruno Mountain natural area, and the critical habitat it provides for endangered species and species of special concern. Species of special concern utilizing the area in and around the UAs would also require nominal levels of mitigation, especially for larger facility types with greater air and water quality impacts.

NORTH SAN JOSE--UA 9

Physical Characteristics

UA 9 is on the west side of Zanker Road, halfway between Highway 237 and the San Jose-Santa Clara sewage treatment plant. The prevailing wind is from the no th-northwest with the area of significant air quality impacts located in the urban agricultural areas to the south-southeast. Due to the potential water quality problems associated with the shallow South Bay environment, discharges from a power plant in this area would probably have to be released north of the Dunbarton Bridge. The deep water channel area north of the Dunbarton Bridge has a greater tidal action and water circulation capability than the South Bay region (South Bay Discharge Authority 1973; U.S. Fish and Wildlife Service, 1976) and would not be as severely impacted by discharges as would the waters around North San Jose.

Biological Characteristics

The terrestrial habitat in and around the site is dominated by industrial, urban, and agricultural development with remnant patches of coastal prairie-scrub, salt marsh, and riparian habitat. The agricultural areas and remnant native vegetation on-site and downwind of the site support moderate populations of upland game species.

The tidal mudflats, salt ponds, and open water habitats of the South San Francisco Bay support a large number of marine and estuarine species of fish and invertebrates with an associated population of waterfowl and shorebirds.

Biological Resources of Major Concern

Major biological factors of concern include: rare and endangered species, areas of critical concern, species of special concern, and commercial and recreational resources.

Rare and Endangered Species

The salt marsh habitat one mile northwest and several other salt marsh habitats throughout the South Bay support the endangered slat marsh harvest mouse (*Reithrodontomys raviventris*) and California clapper rail (*Rallus longirostris obsoletus*). Potential water quality impacts on the critical habitat of these two species would prohibit cooling water discharge south of Dunbarton Bridge, and may require moderate levels of constraint or mitigation for facilities with significant cooling water requirements that discharge north of the bridge.

Areas of Critical Concern

Wetlands, estuaries, natural areas, and the National Wildlife Refuge associated with the South San Francisco Bay are of major concern. As mentioned in the previous section, potential water quality impacts on the areas of critical concern would prohibit thermal discharges into the bay south of Dunbarton Bridge. Cooling water facility construction of a pipeline from the UA 9 to the Dunbarton Bridge area would require an extensive level of constraint or mitigation for the South Bay's areas of critical concern. This would supply all power plant types with significant discharge.

Species of Special Concern

Of concern are several CNPS rare and endangered plant species, shorebirds, water-associated birds, and raptors that inhabit or utilize the South Bay. Water quality impacts mentioned in the previous sections could affect the habitat or food supply of these species of special concern and would require moderate to severe levels of constraint or mitigation.

Commercial and Recreational Resources

Numerous fish, invertebrates and waterfowl species of commercial or recreational value utilize the South Bay environment and would require similar levels of constraint or mitigation as mentioned in the previous sections.

Overall Site Evaluation

All facility types that require a significant level of thermal discharge capability into the San Francisco Bay would be severely restricted for potential water quality impacts. Due to the minimal water circulation south of the Dunbarton Bridge, thermal discharges from the North San Jose site would severely impact the high quality biological resources of the South Bay. Potential water quality impacts on the South Bay's endangered species habitat, areas of critical concern, species of special concern, and commercial/ recreational resources would prohibit discharges south of the Dunbarton Bridge and severely limits all facility types from discharging north of the bridge. These impacts may be mitigated by the use of cooling towers, however, this site is included as a marginal opportunity.

WATER RESOURCES

Cooling Water Availability
Once-Through Cooling Impacts
Waste Disposal Impacts
Water Quality Standards
Waste Water Availability
Flood Hazard

This water resources analysis considers the six factors noted above int he investigation of potential limits of new power plant opportunities at all nine UAs. Depending on the nature of severity of the potential problems identified, the technical opportunity of locating new power plants within specific undesignated areas is determined. The economic feasibility of such location is not determined, since the study is not site-specific. Opportunities, prohibitions, and constraints which may affect facility size and fuel type are identified on an area-by-area basis. Potential mitigation measures to offset constraints are noted where appropriate.

Tables 10, 11, and 12, at the end of this section, summarize the information developed in the narrative analysis.

CCC UA Analysis

Crescent City--UA 1A and 1B

Marine biological constraints at this location indicate that opportunities are not available for facilities larger than 500 MW. Constraints on the development of a cooling wate intake/discharge facility include the presence of an area of special biological significance to the south of Point St. George. Rocky marine habitats, including kept beds, are scattered throughout the shoreline and near shoreline areas. Points of intake and discharge for a 500 MW facility should be limited to beyond the 30-foot contour depth north of Point St. George and 1/2 mile or greater offshore. South of Point St. George it should be placed beyond the 60-foot contour depth and greater than one mile offshore. Special care should be taken to avoid impacts on he Redwood National Park area of special biological significance, which extends 1,000 feet offshore but is south of potential siting areas.

Power plants of 500 MW or less should not pose a significant problem except in the case of coal-fired facilities. Both the lack of sufficient land area, as well as heavy rainfall, make it unlikely that waste generated from a coal-fired facility could be properly handled and disposed of in this area.

The damage to Crescent City associated with the tsunami of 1964 indicates its susceptibility. UA 1A, at an elevation of 50 feet, was not inundated in 1964. Standard construction technologies could elevate a potential size in this area if more detailed analysis indicated tsunami hazard. Portions of this area would be subject to inundation to the 10 foot contour in a 1:100 year flood event and would require design consideration. Local supplies of fresh or waste waters are insufficient to meet the cooling water requirements of the power plant types and sizes considered in this study.

Samoa Spit--UA 2

Due to the high value of habitat for both fisheries and shellfish, this power plant siting location should be limited to no greater than 500 MW capacity facilities. Intake and discharge facilities should be directed toward the ocean rather than the bay side, and should extend offshore and terminate beyond the 30-foot contour and approximately 1/2 mile or greater offshore. The proper disposal of wastes can be achieved for 500 MW facilities or less except for coal. Due to lack of available land area, as well as heavy rainfall, it is unlikely that coal-fired power plant wastes can be disposed of in a satisfactory manner in this location. Waste disposal does not appear to be a significant problem for other types of generating facilities.

Water quality standards conformance should be possible for facilties provided that intake and discharge occurs to the ocean side of Samoa Spit, as opposed to inside Humboldt Bay.

The seaward side of the North Spit would be subject to tsunami run-up and flooding to an elevation of 11.5 feet from a 1:100 event and 22 feet in a 1:500 event. The bay side of the North Spit would be vulnerable to high and wind-driven tides in the bay. The marshy area south of Rolph School and east of Samoa Road would be subject to flood inundation in a 1:100 year event. Industrial waste water discharge to the ocean in this area totals 52,000 acre feet per year (AFY) and could be used to serve the needs of the power plant types and sizes considered (see Table 9).

Salinas River--UA 3A and 3B

The occasional presence of the endangered southern sea otter as well as important commercial and recreational fish species in the nearshore and offshore area should constrain development in this area to 500 MW capacity. Potential problems associated with waste disposal and water quality standards conformance do not appear to be significant for any of the 500 MW generating types of power plants except coal, which should be limited to small facility types.

UA 3A does not appear to be subject to tsunami run-up or 1:100 flooding. The southern portion of UA 3B, susceptible to tsunami hazard, is characterized by low potential damage, but design considerations would minimize this potential. By 1985, the Monterey Water Pollution Control Agency's regional treatment plant will be discharging 23 million gallons per day (MGD) (23,500 AFY) to the Pacific Ocean at a point just north of UA 3A. This volume should be adequate to meet the needs of any of the power plant types and sizes considered.

Santa Maria River--UA 4A and 4B

Development of facilities in these areas should be limited to 500 MW due to the presence of high value commercial and recreational marine resources as well as the endangered southern sea otter. Points of intake and discharge should extend beyond the 30-foot contour and approximately 1/2 mile or greater offshore. Significant impacts upon kelp beds in this region are more likely to be avoided at this location. Although there are no presently developed waste disposal sites which could contain wastes from coal-fired facilities, it appears possible to construct such facilities which would be necessary for a 500 MW coal-fired power plant.

Conformance with water quality standards applicable for 500 MW power plants or less does not appear to be a problem at these undesignated areas.

This area of the central California coastline is not subject to tsunami. UA 4A should not be subject to 1:100 flooding from Oso Flaco Creek although ponding does occur in response to heavy rains. UA 4B is subject to 1:100 flooding below the 60-foot contour in its eastern half and below the 40-foot contour in its western half. Alternate water supplies are not available.

Tijuana River--UA 5

It appears that cooling water could be made available for large size facilities at each of these undesignated areas. Careful study will be necessary to determine design and location of intake and discharge facilities which will minimize impacts to important marine and estuarine aquatic resources. This may require extension of intake and discharge lines to as much as a mile or more offshore.

There is not sufficient land area at any of the undesignated areas to accomodate wastes generated by coal-fired facilities. Disposal of wastes from other types of facilities does not appear to be a problem.

Conformance with water quality standards will not be a constraint for development of any plant size at any of the undesignated areas.

Potential for structural damage from a tsunami is nonexistent at UA 5. However, the area southeast of the air station is flood prone. Flood waters would not reach the hilly portions of UA 5 but would extend from the Tijuana River to Monument Road.

An existing waste water pipeline transports 14,600 AFY of effluent from Tijuana, Mexico, along Interstate 5 to the Point Loma treatment plant. This volume could meet requirements of all but the 1,200 MW nuclear and direct-fired coal plants. A proposed regional treatment plant to be located south of San Diego Bay would have an output of 150 - 200 MGD (168,000 - 224,000 AFY).

BCDC UA ANALYSIS

Once-through cooling probably cannot be employed at any of the areas considered in the San Francisco Bay, with the possible exception of Oleum.

The volume of water necessary to meet the 40°F once-through cooling water requirement imposed by the State Thermal Plan and the San Francisco Bay Regional Water Quality Control Board Basin Plan #2 would cause severe and

TABLE 9: COOLING WATER DEMAND (AFY)*

Technology	NUCLEAR			COAL			STEAM TURBINE			COMBINED CYCLE		
Cooling Water / Size	S	M	L	S	M	L	S	M	L	S	M	L
WATER USE	1400	6450	17000	1100	5500	13000	970	4650	11640	550	2800	6700
BOILER FEEDWATER	30-40	150-200	360-480	30-40	150-200	360-480	30-40	150-200	360-480	30-40	150-200	360-480
NO_x CONTROL	-	-	-	-	-	-	-	-	-	100-200	500-1000	1200-2400
TOTAL WATER USE	1430-1440	6600-6650	17360-17480	1130-1140	5650-5700	13360-13480	1000-1010	5000-5050	12000-12180	600-760	3300-3800	7900-9100

* These figures assume the use of cooling towers, rather than once-through cooling.

unacceptable impacts to the estuarine ecosystem. The requirement to meet 4°F T in estuarine and bay water essentially precludes the possibility of mitigating entrainment impacts due to the significant volume of water required to meet this requirement. Options for cooling include use of reclaimed waste water, or estuarine water in cooling towers (see Table 10). It is unlikely that fresh water would be used because it is in short supply in this basin. The South Bay is designated as a water quality limited segment, which essentially precludes the use of that area for purposes of power plant discharges.

Flood Hazard (See Table 11)

Tsunami--With the exception of the Oleum and North San Jose siting areas, all other areas adjacent to the San Francisco Bay are subject to tsunami run-up. However, the ground surface elevation of the Visitacion site is above the level of the 1:500 year tsunami and renders it invulnerable to flooding. The remaining siting areas are vulnerable to flooding from tsunami run-up. Facilities located in these areas would have to be elevated 4.3 to 7.5 feet above mean sea level (MSL) to avoid this hazard.

Seiche--Historically, there is little evidence of seiche damage within the San Francisco Bay region. The San Andreas Reservoir and Crystal Springs Lake were respectively astride and near the 1906 surface rupture zone, but no evidence of major seiching was noted by investigators of the San Francisco earthquake (NOI Ref. 32).

According to PGandE's review of geologic and seismic literature presented in the "Combined Cycle NOI," no written reports of locally generated seiches with in the South Bay area were discovered. Since there are no other natural, existing enclosed or restricted basins of water near the undesignated siting areas, the only other current seiche potential might come from the bay itself. It is extremely doubtful that, even given the right combination of earthquake, stage of tide, and wind direction, any seiche could traverse areas adjacent to the site areas with enough vigor to cause damage.

The potential seiche hazard would be overshadowed by the tsunami hazard and design precautions for tsunami damage (e.g., elevating the foundations or constricting protective levees) should lower seiche damage as well.

1:100 Overland Flooding--Of the siting areas under consideration only the North San Jose site is vulnerable to total inundation. Point San Pedro and Visitacion Point contain flood-prone portions which should be avoided in siting permanent structures.

1:100 Bay Overflow Flooding--The Oleum, Point San Pedro, and two Visitacion sites (UA 8A and 8B) are not vulnerable to flooding from increased water surface elevations and high velocity tides in the San Francisco Bay. The remaining siting areas are subject to overflow and back-up flooding from the bay and would require commensurate mitigation.

Availability of Alternative Water Supplies

An amount of waste water adequate to meet the needs of the types and sites of plants envisioned is available in all BCDC areas except Point San Pedro. At

TABLE 10: LAND ACREAGE ASSUMPTIONS FOR COOLING PROCESSES

	Plant		Cooling Method		
		Once-Through		Alternative Method (Cooling Tower, Spray Pond)	
Type	Size (MW)	Acres/MW	Acres	Acres/MW	Acres
NUCLEAR*	S- 100	.01	1.0	.2	20.0
	M- 500	.01	5.0	.2	100.0
	L- 1,200	.01	12.0	.2	240.0
COAL**	S- 100	.5	50	1.0	100
	M- 500	.5	250	1.0	500
	L- 1,300	.5	650	1.0	1,300
STEAM TURBINE	S- 150	.024	4	.2	30
	M- 500	.024	12	.2	100
	L- 80	.024	20	.2	160
COMBINED CYCLE	S- 400	.025	10	.3	120
	M- 500	.025	13	.3	150
	L- 1,300	.025	33	.3	390

It is recommended that only small facilities be developed in the San Francisco Bay Area. Such facilities could be accommodated at the Pt. San Pedro, Oleum, Visitacion, and possibly at North San Jose, provided that discharges from that site can be directed to an area in the Bay north of the Dunbarton Bridge to avoid the water quality limited area of the South Bay. Once-through cooling could occur for small facilities at Oleum. Use of once-through cooling at this area will require utilization of waste discharge permits which presently apply to facilities that exist at that location. It does not appear that land area exists to accommodate coal storage and waste disposal facilities at the Pt. San Pedro site. Otherwise, waste disposal is not expected to be a problem. Conformance with water quality standards can be achieved at each of the sites evaluated.

*Physical plant area only; does not include exclusion zone.

**Includes on-site fuel and waste storage; extremely site dependent.

this Marin County site, the amount of waste water available would only meet the needs of the small plants (100 - 400 MW) and the medium-sized (500 MW) combined-cycle plant.

Because of limited local supplies, little if any fresh surface or groundwater supplies would be available for power plant cooling at any of the areas.

TABLE 11: FLOOD HAZARD AND ALTERNATIVE WATER SUPPLY ANALYSIS FOR CCC AND BCDC AREAS

SITE	UA NO.	FLOOD HAZARD				ALTERNATIVE WATER SUPPLY	
		Overland 1:100	Tsunami	Seiche	Bay Flooding 1:100	Available	Source of Alternative Water Supply
Crescent City	1	Partial	No	Possible	N/A	No	No Sources
Samoa Spit	2	Yes	Yes		Yes	Yes	Crown Simpson Pulp Company Louisiana Pacific Company
Salinas River	3A	No	No	No	N/A	Yes	Monterey Water Pollution Control Agency
Salinas River	3B	No	Partial	No	N/A	Yes	Monterey Water Pollution Control Agency
Santa Maria River	4A	Partial	No	No	N/A	No	No Sources
Santa Maria River	4B	Partial	No	No	N/A	No	No Sources
Tijuana River	5	No	No	No	N/A	Yes	Waste Water Pipeline for Tijuana
Oleum	6	No	No	No	No	Yes	San Francisco Bay Area Plants
Pt. San Pedro	7	Partial	4.9-8.3 ft. Yes	No	Partial	Partial	Central Marin Sanitation District
Visitacion	8	No	4.4-6.3 ft. Yes	No	No	Yes	So. San Francisco Joint Outfall
Visitacion	8	No	Yes	No	No	Yes	So. San Francisco Joint Outfall
Visitacion	8	Partial	Yes	No	Yes	Yes	So. San Francisco Joint Outfall
N. San Jose	9	Yes	No	No	Yes	Yes	City of San Jose

TABLE 12: WATER QUALITY AND WASTE DISPOSAL (CCC and BCDC)

SITE	UA NO.	COOLING WATER AVAILABILITY	ONCE-THROUGH COOLING IMPACTS	WASTE DISPOSAL IMPACTS	WATER QUALITY STANDARDS CONFORMANCE	OTHER COMMENTS & LIMITATIONS
Crescent City	1A & 1B	M	M	M (No Coal)	M (No Coal)	No opportunity for coal
Samoa Spit	2	M	M	M (No Coal)	M (No Coal)	No opportunity for coal
Salinas River	3A & 3B	M	M	M (No Coal)	M (No Coal)	Coal fired limited to small size facility
Santa Maria River	4A & 4B	M	M	M	M	See text for intake/ discharge limitations
Tijuana River	5	L	L	L (No Coal)	L (No Coal)	No opportunity for coal
Oleum	6	S	S	S	S	
Pt. San Pedro	7	S	0	S (No Coal)	S (No Coal)	No coal, no once-through cooling
Visitacion	8A,B,C	S	0	S	S	No once-through cooling
N. San Jose	9	S	0	S	S	No once-through cooling

SETBACK RANGES

Setback Analysis

- o Breakeven Cost
- o System Description
- o Setback Results
- o Setback Opportunities

SETBACK ANALYSIS

This section is a discussion of setback siting analyses and opportunities. It contains a limited description of the analyses, results, and application of setback criteria results and setback opportunities. A more extensive discussion of setback systems and assumptions is contained in Appendix E of this report.

Thermal electric power generation plants produce waste heat regardless of fuel source due to basic thermodynamic laws. The amount of these wastes depends on the fuel type, technology, plant design, generating capacity, and other factors. The principal benefit of locating a thermal powerplant in the coastal zone is the availability of ocean water as a source of cooling and dissipation of thermal wastes. Due to California's strict environmental regulations on thermal discharges and land use restrictions along the coast, siting of coastal power generation facilities is often limited. Siting the facility a distance back from the water's edge should increase the siting opportunity by reducing potential land use conflicts. However, the distance a facility can be "setback" is limited by the cost penalties of pumping the ocean cooling water. In order to assess the energy and cost penalties of coastal setback siting for conventional base load plants (nuclear, coal, oil- or gas-fired boilers and combined-cycle facilities), staff estimated the capital cost, penalties, operational costs, and energy requirements of locating plant facilities away from the coastline at various elevations above sea level and setback distances (see Table 13 and Figure 4). This nonsite-specific analysis is intended to:

- o Determine the pumping energy required to supply once-through saltwater coolant to four base load power plant types (nuclear, coal, oil, or gas-fired boiler and combined cycle) located at various elevations (50' to 1,000") above sea level and setback distances (100' to 27,000').

- o Determine the energy benefits and cost penalties of installing a hydroelectric turbine/generator powered by the return water flow from the setback facility.

- o Determine the rough order of magnitude (ROM) construction and operating costs in 1980 dollars to construct and operate, using various power plant fuels, the saltwater once-through coolant systems for the four base load power plant types. The submerged saltwater intake system and the ocean thermal diffuser system are not included in the comparative analysis because they are common in siting opportunities.

- Determine the net cost penalty (1980 dollars) of the once-through saltwater cooling systems using replacement power costs of 60 mil/kWh.
- Determine the breakeven cost (ROM) for once-through saltwater cooling vs. cooling tower systems as a function of plant elevation and setback distance for a 1,200 MWe nuclear and a 500 MWe combined-cycle power plant.
- Determine the total annual operating pumping cost penalties (ROM) of a 1,200 MWe nuclear and a 500 MWe combined-cycle power plant, using saltwater cooling tower, as a function of plant elevation (50' and 1,000') and setback distance (100' and 27,000').
- Determine the construction cost penalties (ROM) for a 1,200 MWe nuclear and a 500 MWe combined-cycle power plant, using saltwater cooling towers, as a function of plant elevation (50' and 1,000') and setback distance (100' and 27,000').

Breakeven Cost

Figure 4 is a depiction of the most cost effective cooling system for various combinations of elevation and setback distances from the coast. It is based on 1,200 MW nuclear and 500 MW combined-cycle power plants.

System Description

Figure 5 is conceptual representation of a base load power generating plant using once-through saltwater cooling. The pump station and hydroelectric turbine/generator facility houses the cooling water pumps, wet wells, turbine/generator, coolant return energy dissipator, and other components related to the intake/discharge system.

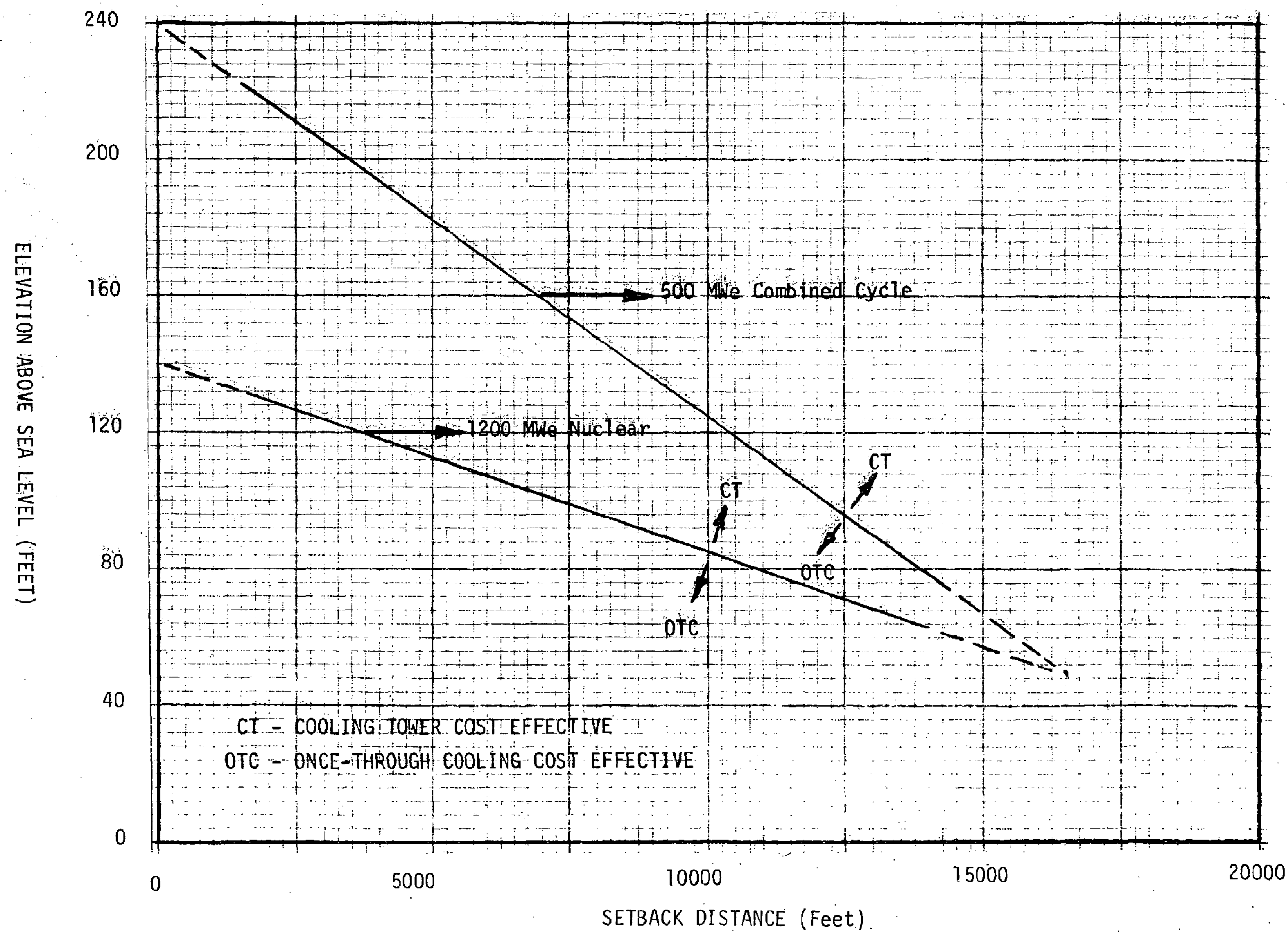
The saltwater intake pumps discharge the saltwater coolant into underground pipes which convey the water to the power plant condenser. After picking up waste heat in the power plant condenser, the heated sea water flows by gravity to the hydroelectric generating facility. If the hydroelectric generating facility is not in use, the sea water flows through a suitable energy dissipator. The return water flows into the ocean through the wet wells and offshore diffuser.

TABLE 13 - SETBACK PUMPING COSTS

POWER PLANT CASE	MW REQUIRED TO PUMP	MW RECOVERED THROUGH HYDROGENERATION	INSTALLED CAPITAL COST FOR PUMPING (1980 \$ 10^{-6})	INSTALLED CAPITAL COST FOR HYDROGENERATION (1980 \$ 10^{-6})
Setback = 100' & Height = 50'				
500 MW Nuclear	8.36	3.38	8.51	5.11
1200 MW Nuclear	20.0	8.40	16.1	10.5
500 MW Coal	3.56	1.42	5.36	3.02
1300 MW Coal	9.24	3.76	9.03	5.52
150 MW Steam Turbine	1.60	0.62	4.08	2.16
500 MW Steam Turbine	5.32	2.14	6.50	3.79
800 MW Steam Turbine	7.12	2.88	7.66	4.60
400 MW Combined Cycle	2.50	0.98	4.67	2.57
500 MW Combined Cycle	3.10	1.23	5.06	2.82
1300 MW Combined Cycle	8.08	3.28	8.28	5.00
Setback = 27,000' & Height = 1000'				
500 MW Nuclear	107.	60.6	119.	66.3
1200 MW Nuclear	251.	145.	235.	157.
500 MW Coal	45.4	25.8	57.1	29.1
1300 MW Coal	116.	67.1	116.	73.3
150 MW Steam Turbine	21.0	11.6	33.8	13.9
500 MW Steam Turbine	67.4	38.6	76.2	42.8
800 MW Steam Turbine	89.7	51.7	94.7	56.7
400 MW Combined Cycle	32.2	18.0	44.9	20.8
500 MW Combined Cycle	39.9	22.5	52.1	25.6
1300 MW Combined Cycle	102.	58.6	104.	64.2

(*) Includes installed pipelines.

Figure 4: Breakeven Costs(Setback Siting)



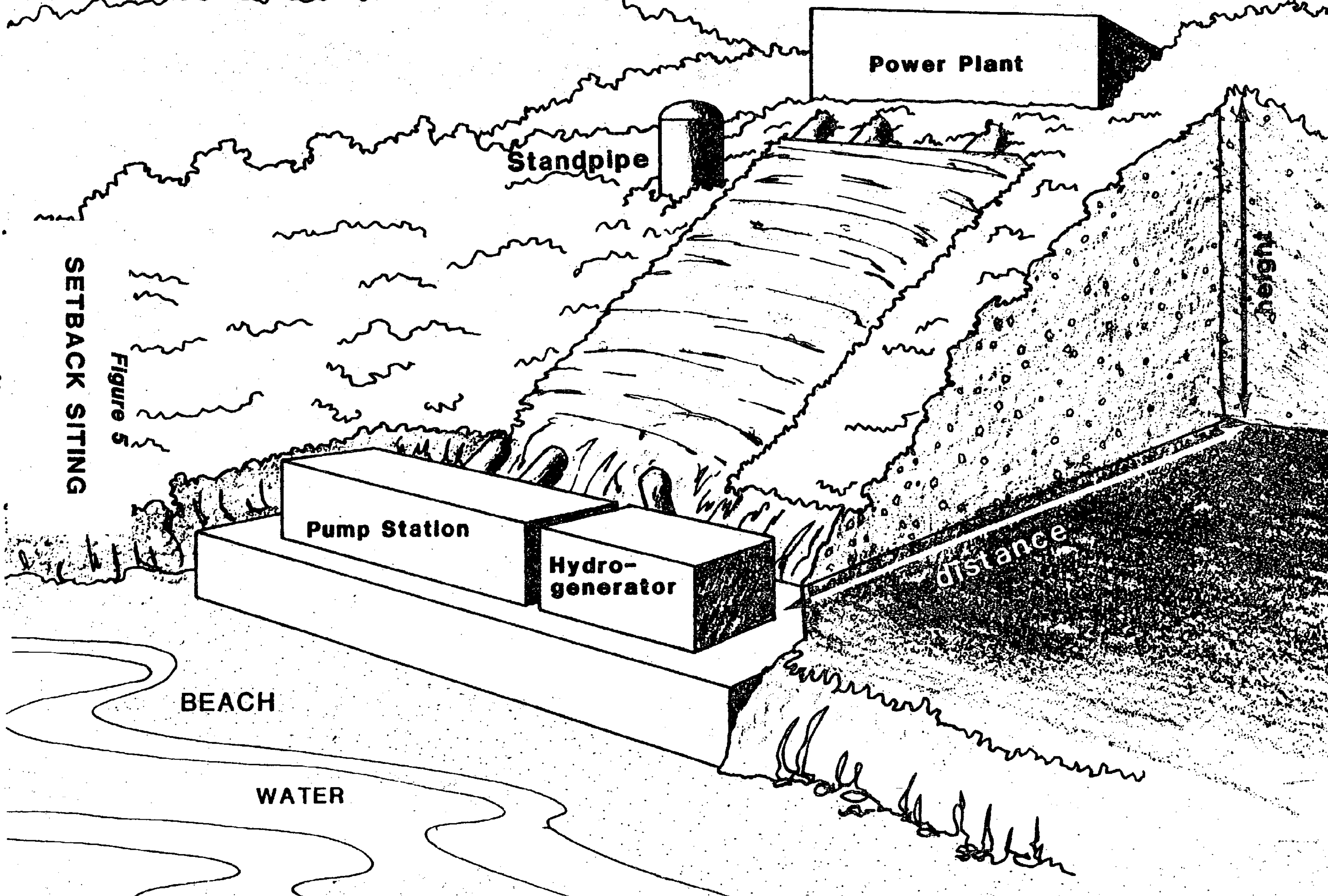


Figure 5

SETBACK SITING

SUMMARY OF SETBACK RESULTS

These results are based on the independent CEC staff study noted above.

A. Approximately 40 to 60 percent of the energy required to pump the once-through cooling water can be recovered by the hydroelectric generating facility at a capital cost of 1,100 to 3,500 $/kW. Nuclear power plants benefit more than other power generation technologies by the inclusion of hydroelectric energy recovery facilities because of the comparatively larger volumes of cooling water required.

B. The total annual costs (in 1980 $) for power plants with coastal setbacks of 27,000 feet and heights of 1,000 feet range from 10 to 90 million dollars depending on the type and the size of the facility. Due to the high price of synthetic fuels, power generating technologies utilizing these fuel types are penalized more in operating costs for increasing setback distances and elevations than power generation technologies utilizing conventional fuels.

C. For a setback of 27,000' and 1,000' elevation, the hydroelectric generation breakeven (i.e., revenue = cost) electric power price is in the order of 60 mils/kWh or more in order to justify the facility investment cost.

D. As the elevation head decreases, the capital and operating costs decrease; however, the breakeven price of power increases because of the lower hydrostatic head and less opportunity for power recovery.

E. The setback distance is not the major contributor to the net penalty for once-through saltwater cooling for a power plant. Rather, the elevation is the most critical variable as well as the required condenser cooling water flow for the power plant. The net cost penalty for a 1,300 MWe combined-cycle power plant at 1,000' elevation and 27,000' setback is approximately one-half that of a 1,200 MWe nuclear plant at the same setback conditions (or 20 million 1980 dollars vs. 37 million 1980 dollars). At 100' setback these costs would be $17 and $30 million, respectively. Approximately 80 percent of the cost is attributable to elevation.

F. The breakeven or trade-off cost analysis for saltwater cooling tower system in lieu of the once-through saltwater cooling system indicates that a cooling tower system is more cost effective for a 1,200 MWe nuclear power plant at an elevation in excess of approximately 150' when sited near the shoreline. For a 500 MWe combined-cycle plant, the shoreline between breakeven elevation is 240'. At a fixed plant site elevation 50', the breakeven setback distance is approximately 16,000' for both the combined-cycle and nuclear plants. Beyond these setback distances, a saltwater cooling tower system is more cost effective.

G. The maximum total annual operating cost penalty of a 1,200 MWe nuclear and a 500 MWe combined-cycle power plant using saltwater cooling towers is approximately $7 million and $1.4 million, respectively. At 1,000' plant elevation, the operating cost is primarily due to the make-up coolant pumping costs, attributable mainly to elevation rather than the setback distance.

H. Cooling tower heat dissipation systems construction cost penalties for a 1,200 MWe nuclear plant range from \$15 million to \$38 million for and \$2 million to \$9 million for a 500 MWe combined-cycle facility.

The above results (when referring to annual costs) are based on the assumption of a 50 percent capacity factor for the hydroelectric generating facility. At higher capacity factors, the annual operating cost would decline.

SETBACK OPPORTUNITIES

Table 14 is an application of these setback criteria results to the location/terrain characteristics of the nine UAs. It is based on extrapolation of numerical values from the line graphs in Figure 4.

TABLE 14: SETBACK OPPORTUNITIES

UA Name	#	Range of Setback Distance (Feet)	Range of Setback Elevation (Feet)
Crescent City	1A	4,000 - 6,000	40
Crescent City	1B	2,000	40 - 240
Samoa Spit	2	Waterfront Location	--
Salinas River	3A	4,000 - 5,000	50
Salinas River	3B	2,000	100
Santa Maria River	4A	2,000 - 16,000	60
Santa Maria River	4B	3,000 - 14,000	60
Tijuana River	5	10,000 - 14,000	50 - 200
Oleum	6	Waterfront Location	--
Point San Pedro	7	Waterfront Location	--
Visitacion	8	Waterfront Location	--
North San Jose	9	6,000 - 14,000	20

This table indicates that setback opportunities using once-through cooling are generally available to all of the 5 UAs located inland of the water's edge. This determination is based on the numerical setback criteria noted in Result F above and applies to the 500 MW combined-cycle facility. An application of air quality factors and these setback criteria indicate that no setback opportunities exist outside the CCC coastal zone jurisdiction behind undesignated or partially designated areas which would increase the opportunities noted above in Table 14.

CHAPTER 4: INSTITUTIONAL FACTORS

Opportunities to construct various types of power plants are affected by various energy policies and laws. The results of the screening analyses in Chapter 3 must also be examined in the context of broader institutional factors. This chapter describes three institutional factors which may constrain new power plant opportunities--the Federal Powerplant and Industrial Fuel Use Act (PIFUA), the demand and supply forecasts of the CEC's 1981 Biennial Report, and state nuclear waste disposal laws. The limitations and probable effects of these three factors on opportunity results are discussed below for purposes of general information, and in more detail in Chapter 5: RESULTS.

INSTITUTION FACTORS

PIFUA
1981 Biennial Report
Nuclear Waste Disposal Laws

PIFUA

The Powerplant and Industrial Fuel Use Act of 1978 is one of several bills encompassed in the National Energy Act. PIFUA places restrictions on the types of fuels which could be used in industrial processes, including electricity generation. The restrictions which apply to power plant fuel use can be summarized as follows:

1. Unless an exemption is obtained, new power plants cannot use natural gas or petroleum as a primary fuel, and must be able to use coal or other alternative fuels.

2. The use of natural gas in existing power plants will either be prohibited or restricted, depending upon past gas usage, on or after January 1, 1990.

3. The Secretary of the Department of Energy is authorized to prohibit the use of petroleum or natural gas or both as a primary source in existing plants if he makes certain findings regarding the ability of such plants to use coal or other alternative fuels.

PIFUA grants temporary or permanent exemptions to requirements of the act due to lack of alternate fuel supplies, site limitations, environmental limitations, emergencies, reliability problems, and other factors. Peaker facilities (for example, combustion turbines) operating no more than 1,500 hours per year, and cogeneration facilities are also exempted.

In spite of the exemption provisions of the act, PIFUA will severely restrict the construction of new oil- or natural gas-fired power plants. This means that, in most cases, new power plants will have to be fueled with synthetic fuels, produced either on or off the plant site, or with coal. There is currently a wide interest in amending PIFUA to permit the use of natural gas as an interim fuel in the transition to the use of synfuels. Pending Congressional action, the restrictions of PIFUA on construction of new natural gas-fired power plants remains as originally promulgated.

1981 Biennial Report

Purusant to Public Resources Code, Section 25309(b), the CEC may not approve construction of new electric power plants unless it finds that the project is in conformance with the Commission's adopted 12-year forecast of statewide and service area electricity demand. In adopting that demand forecast, the CEC is required to balance growth and development, protection of public health and safety, preservation of environmental quality, maintenance of a sound economy and conservation of energy and resources. Based upon these institutional requirements, the CEC has developed and adopted five specific criteria to evaluate demand and six energy supply priorities to ensure that balanced growth and adequate electricity supplies will continue to be available. The five specific demand criteria are:

- o Electric Load Growth
- o Reserve Margin
- o Retirements
- o Contract Expirations
- o Fuel Displacements

The CEC's adopted statewide and service area electric load growth forecast shows that projected peak demand will grow at 1.65 percent annually and that sales will grow at 1.44 percent annually, through the year 2000. However, taking into account the five demand criteria, California will need 13,647 MW of additional electric capacity through the year 1992. To this extent, there is a broad array of supply options available to meet the state's electricity needs. Under state law, the utilities have the initiative of deciding which of the available options actually will be developed. However, the CEC has identified the supply priorities of preferred technologies that should be developed for future electricity supplies. These are:

Priority	Source
1	Conservation and Power Pooling
2	Renewable Resources and Geothermal
3	Fossil Cogeneration, Fuel Cells and Interutility Transfers
4	Repowering (Natural Gas) and Natural Gas Fuel Switching
5	Synthetic Fuels and New Conventional Reservoirs
6	Direct-Fired Coal

These preferred electricity supply options favor investment in energy efficiency and a more diverse, renewable electricity supply base. As a result of the CEC's specific demand criteria and energy supply priorities, opportunities are limited for new conventional coastal zone power plants. However, these technologies, or more important, the opportunities for siting new coastal power plants must be actively considered as a contingency measure. The CEC's energy policies are intended to define a more desirable energy future. Yet, because of the uncertainity associated with energy planning and technology development, the CEC goals may not be achieved. Actual demand for electricity may be higher than anticipated despite the strong emphasis on conservation. The development of conventional technologies, such as clean fuel fired combined cycle, is a relatively certain electrical energy supply option. The results of this study increase the certainty of finding acceptable sites for these technologies. Thus, this study provides a relatively certain option as a contingency, if CEC preferred goals are not achieved.

Nuclear Waste Disposal Laws

Section 25524.2 (Public Resources Code) of the Warren-Alquist Act specifies, in part, that

> "No nuclear fission thermal power plant, including any to which the provisions of this chapter do not otherwise apply, but excepting those exempted herein, shall be permitted land use in the state, or where applicable, be certified by the Commission until both conditions (a) and (b) have been met:
>
> The Commission finds that there has been developed and that the United States through its authorized agency has approved and there exists a demonstrated technology or means for the disposal of high-level nuclear waste.
>
> The Commission has reported its findings and the reasons therefore pursuant to paragraph (a) to the Legislature. Such reports of findings shall be assigned to appropriate policy committees for review. The Commission may proceed to certify nuclear fission thermal power plants 100 legislative days after reporting its findings unless within those 100 days either house of the Legislature adopts by a majority vote of its members a resolution disaffirming the findings of the Commission made pursuant to paragraph (a)."

Though this section, development of new nuclear fission capacity of 50 MW or more might be constrained in California, including the undesignated coastal areas considered in this study. However, the Eastern and Southern Federal District Courts have held this section and other sections of the Warren-Alquist Act to be unconsititutional on the grounds of federal preemption. The CEC is now appealing this decision before the 9th Circuit Federal Court of Appeals. As of this writing, no decision has been issued. The potential limitations of this or other state laws on the results of this study therefore may not be determined at this time.

In summary, this section indicates that opportunities for some types of new coastal power plants are also constrained to a significant degree by institutional factors. PIFUA restricts the construction of new oil-or gas-fired power plants; nuclear laws (pending legal review) restrict new nuclear plants, except those under construction at Diablo Canyon and San Onofre. CEC supply criteria establish a priority order for development of various power plant types. Coal is given a low priority; thus, most opportunities exist for limited alternative fuel technologies. This would limit siting opportunities for conventional power plants with the exception of coal gas or synthetic natural gas.

CHAPTER 5: RESULTS

This chapter describes the results of screening 200 undesignated coastal areas for opportunities for new power plant locations. The information developed here is the result of screening opportunities for 30 plant and fuel combinations at these areas with 27 screening factors. The results are summarized in several different formats so that different characteristics of the information can be emphasized and clarified.

The results indicate opportunities for 3,700 MW - 4,400 MW of new power plant capacity at nine coastal locations. The major coastwide prohibition is the effect of air quality factors on pervasive rugged coastal terrain. The major constraint at the nine UAs described in this report is the effect of once-through cooling system entrainment and thermal discharge on marine and estuarine biological resources. The CEC staff has determined that the opportunities identified in this study and the previously published expansion study should be adequate to meet the needs identified for coastal locations in the CEC-adopted 1981 Supply and Demand Forecast through the year 2000.

In the following sections of this chapter, results are first described on the basis of individual area profiles. For each area, opportunities are described in terms of the various plant and fuel types, and plant sizes. Prohibitive and severe constraints associated with specific screening factors are identified. Table 15 collates these results in a comprehensive format. It tabulates the opportunities for each area by plant and fuel type and by plant size. The table graphically displays the overall results for comparison in a simple format.

Second, the results are summarized in terms of the opportunities for the four plant types. Opportunities as well as prohibitive and severe constraints for each different plant type are noted.

Third, the results are summarized of the basis of the major screening factors. The effects of the factors with the most significant impact on opprtunities to locate new coastal power plants are discussed. The technical factors are air quality, biological and water resources, geology, and public facilities.

The institutional factors are PIFUA, CEC supply criteria, and the state's nuclear waste disposal laws.

The chapter concludes with a summary discussion of the opportunities for new coastal power plants associated with CCC and BCDC undesignated areas.

NOTE:

The noted opportunities are not intended in any way to conflict with or otherwise constrain the intentions of current land owners or local planning efforts. There is no intent to preempt land use rights in a manner which would support a claim of inverse condemnation. Any action to construct power plants at any of the areas identified in this study will require conformance with legal certification procedures, as noted in Appendix A.

While there is currently no necessity to develop any of the nine opportunities identified in this report, a future change in the CEC demand forecast (i.e. BR) may require development of one or more of these UAs.

RESULTS: AREA PROFILES

CCC UA Analysis

Crescent City--UA 1A and 1B

UA 1A (Del Norte County: CCC Map 2) is setback approximately one mile from the coast in the vicinity of Point St. George. It is located between Lake Earl to the north and Crescent City to the south. It is comprised of level terrain. Opportunities are generally located in the western half of this UA.

UA 1B (Del Norte County: CCC Maps 2 and 3) extends south from Crescent City to the vicinity of Cushing Creek. The northern portion borders the coast and the southern portions include setbacks of up to 1500 feet behind a partially designated area. The terrain slopes from 20 to 200 feet in elevation. Opportunities are generally located in the northern one-third of this UA.

Nuclear opportunities are not available in this area due to quaternary fault constraints. Coal opportunities are not available in this area due to air quality impacts and water quality waste disposal impacts. Steam Turbine opportunities exist for small and medium facilities (150 - 500 MW) which are coal gas or methanol-fired. Large facilities (800 MW) are prohibited by impacts to marine biological resources associated with once-through cooling. Oil fuels are prohibited by air quality impacts. Wetland and endangered species habitat impacts are severe, but not prohibitive constraints. Combined Cycle opportunities are limited to small and medium size facilities (400 - 500 MW) due to marine biological impacts associated with once-through cooling. Air quality impacts would preclude the use of fuel oil. Wetlands and endangered species habitat impacts are severe, but not prohibitive constraints. Cooling Water (ocean) supplies are available for up to medium size facilities. Available Land constrains development of facilities requiring cooling towers or development requiring more than 100 acres. Current and planned development will be further limiting to currently identified opportunities. Setback opportunities exist; however, a corridor is required at UA 1A for access to the ocean water for cooling.

Samoa Spit--UA 2

UA 2 (Humboldt County: CCC Map 14) generally covers the southern five miles of the North Samoa Spit. The westerly (seaward) portion is composed of sand dunes and the easterly (bayward) portion supports industrial and residential land uses, the Coast Guard reservation and vacant airport facilities. Opportunities are generally located in the northern one-third of this UA.

Nuclear opportunities are not available due to quaternary fault and population density impacts. Coal opportunities are not available due to waste disposal water quality impacts. Steam Turbine opportunities are limited to small and medium plant sizes (150 - 500 MW) due to marine biological impacts associated with once-through cooling. Intake and discharge should occur only in ocean waters. Rare and endangered plants are and area of environmental concern impacts are severe, but not prohibitive constraints. Combined Cycle opportunities are limited to small and medium plant sizes (400 - 500 MW) due to marine biological impacts associated with once-through cooling. Intake and discharge should occur only in ocean waters. Rare and endangered plants are an area of environmental concern. Impacts are severe, but not prohibitive constraints. Cooling Water (ocean) supplies are available for small and medium size facilities. Once-through cooling impacts preclude large size facilities. Available Land exists for small or medium size facilities assuming once-through cooling. Setback opportunities are not required due to the area's waterfront location.

Salinas River--UA 3A and 3B

UA 3A (Monterey County: CCC Map 78) is located between the mouth of the Salinas River and the City of Marina. It is setback approximately 1,800 feet from the coast with the exception of a 1,200 foot wide corridor leading to the ocean. A pocket designated wetland and estuary lies in the middle of this UA. Opportunities in this UA are generally located directly inland of the corridor to the ocean.

UA 3B is located on the ocean at the northern boundary of Fort Ord. It is approximately five miles in length and includes the Indian Head Beach area. Opportunities are generally located in the pockets of elevation of less than 100 feet.

Nuclear opportunities are not available due to quaternary fault constraints. Coal opportunities are limited to a small size facility (100 MW) due to waste disposal and water quality constraints. Protected animal species are a severe, but not a prohibitive constraint. Steam Turbine opportunities are limited to small and medium size facilities (150 - 500 MW) due to commercial/recreational/endangered species impacts associated with once-through cooling. Protected animal species are a severe, but not prohibitive constraint. Combined Cycle opportunities are limited to small and medium size facilities (400 - 500 MW) due to commercial/recreational/endangered species impacts associated with once-through cooling. Protected animal species impacts are a severe, but not a prohibitive constraint. Cooling Water (ocean) supplies are available for medium (500 MW) plant sizes. Impacts on commercial/recreational/protected species preclude large facilities. Available Land exists for all size facilities including alternative cooling methods. UA 3B is severely constrained by a variety of land and air military operations. Setback opportunities exist.

Santa Maria River--UA 4A and 4B

UA 4A (San Luis Obispo County: CCC Map 109) is immediately north of the mouth of the Santa Maria River. It is setback from the ocean at an elevation ranging from 100 - 200 feet. It is entirely separated from ocean access by a full designation. Opportunities are generally located in the southwestern portion of this UA.

UA 4B (San Luis Obispo and Santa Barbara Counties: CCC Maps 110 and 111) lies astride the Santa Maria River Channel and the county line. The majority of the parcel is setback one to two miles, with ocean access precluded by a designated area. Terrain is relatively even, ranging from 40 to 80 feet in elevation. Opportunities are generally located in the southern half of this UA.

Nuclear opportunities are not available due to quaternary fault and population density constraints. Coal opportunities are limited to a medium size facility (500 MW) due to waste disposal, water quality impacts, and air quality trade-off constraints. Commercial/recreational/endangered species, wetland and riparian habitat, CNPS-listed plants and the Nipomo dunes are severe constraints, but not prohibitive constraints. Steam Turbine opportunities are limited to a medium size facility (500 MW) due to waste disposal water quality constraints. Lack of air quality trade-offs limits oil-fired plants to small sizes. Commercial/ recreation/endangered species, wetland and riparian habitat, CNPS-listed plants, and the Nipomo Dunes are severe, but not prohibitive constraints. Combined Cycle opportunities are limited to medium size facilities (500 MW) due to waste disposal and water quality constraints. Air quality trade-offs are not available for oil-fired plants. Commercial/ recreational/endangered species, wetland and riparian habitat, CNPS-listed plants, and the Nipomo Dunes are severe, but not prohibitive constraints. Cooling Water (ocean) supplies are available but limit facilities to medium sizes due to once-through cooling impacts on marine biological resources. Available Land exists for all plant sizes and all cooling processes. Air Quality regulations in Santa Barbara County severely restrict all plant types and sizes to the point of prohibition on UA 4B. Other constraints and opportunities are as noted above. Setback opportunities exist; however, both UAs would require a corridor for power plant access to ocean water for cooling.

Tijuana River--UA 5

UA 5 (San Diego County: CCC Map 161) is located immediately on the United States-Mexico border in the floodplain of the Tijuana River. It is setback approximately two miles from the ocean behind a full designation. The UA consists wholly of mesa-type terrain with elevations ranging from 20 to 285 feet. Opportunities are generally located in the immediate western portion of this UA.

Nuclear opportunities are not available due to population density constraints. Coal opportunities are not available due to waste disposal water quality constraints. Air quality impacts limit opportunities to small size facilities (100 MW). Wetlands, endangered species and natural areas are severe, but not prohibitive constraints. Steam Turbine opportunities are available for all size facilities (150 - 800 MW) for natural gas, coal gas and methanol fuels. Oil-fired plants are limited to small size facilities (150 MW) only due to air quality impacts. Wetlands, endangered species and natural areas are severe, but not prohibitive constraints. Combined-Cycle opportunities are limited to medium size facilities (400 - 500 MW) due to air quality impacts. Wetlands endangered species and natural areas are severe, but not prohibitive constraints. Cooling Water (ocean) supplies are available for large size facilities. Intake/discharge structure design and location requires mitigation due to potential impacts on marine and estuarine organisms. Available Land exists for all size structures, assuming once-through cooling. Fewer constraints exist on UA 5. Setback opportunities exist; however, a corridor is required at this UA for access to ocean water for cooling.

BCDC UA Analysis

Oleum--UA 6

UA 6 (Contra Costa County: BCDC Maps 10 and 12) is located approximately one mile northwest of the existing Oleum power plant. It lies at the mouth of Canada del Cierbo on the southern bank of the mouth of the Carquinez Straits. Construction of an oil refinery has already been permitted in this UA by BCDC.

Nuclear opportunities do not exist due to population density constraints. Coal opportunities are not available due to waste disposal and water quality impacts. Air quality opportunities are available for a medium size facility (500 MW). Steam Turbine opportunities are limited to a small size facility (150 MW) due to impacts on the bay's estuarine ecosystem associated with once-through cooling. Estuarine and salt marsh habitat, commercial/recreation species, wetlands and endangered species are moderate constraint. Combined Cycle opportunities are limited to a small size facility (400 MW) due to impacts on the bay's estuarine ecosystem associated with once-through cooling. Estuarine and salt marsh habitat, commercial/recreational species, wetlands, and endangered species are moderate constraints. Cooling Water (bay) supplies are severely constrained due to impacts on estuarine ecosystems with the volume of water required to achieve thermal gradient requirements; however, once-through cooling may be possible for a small facility. Land requirements for alternative cooling methods will further limit facility size. Setback opportunities are not required due to the area's waterfront location.

Point San Pedro--UA 7

UA 7 (Marin County: BCDC Map 3) is located in an unincorporated area of Marin County on the southern side of the Point San Pedro peninsula. This UA lies bayward of San Pedro Road and encompasses wetland, quarry, and commercial land uses. Elevation ranges from 0 to 200 feet. The UA, which is flanked by designated areas is one-half mile long and one-half mile deep (to San Pedro Road). Opportunities are generally located on the southern part of the UA that is currently a quarry mining operation.

Nuclear opportunities are not available due to population density criteria. Coal opportunities are not available due to lack of available land for fuel and waste storage facilities. Steam Turbine opportunities are limited to a small size facility (150 MW) due to thermal gradient impacts on the estuarine ecosystem. Combined Cycle opportunities are limited to a small size facility (400 MW) (coal gas and methanol fuels) due to thermal impacts on the estuarine environment. Oil-fired facilities are prohibited due to air quality impacts. Cooling Water (bay) supplies are not available for once-through cooling due to the necessity to meet thermal gradient discharge requirements. Alternative water supplies (waste water) are available. Available Land exists to support small size facilities. Cooling towers will further constrain noted opportunities. Setback opportunities are not required due to the area's waterfront location. Due to limited availability of land and potential aesthetic impacts, this UA is considered only a marginal opportunity.

Visitacion--UA 8A, 8B, and 8C

UA 8A (San Mateo County: BCDC Map 29) is located on Oyster Point in the City of South San Francisco. Most of the site is undeveloped land fill.

UA 8B (San Mateo County: BCDC Map 29) is located on Sierra Point in the City of South San Francisco. Most of this area is unimproved bay fill.

UA 8C (San Mateo County: BCDC Map 29) is located on Visitacion Point in the City of Brisbane. Most of this area is unimproved bay fill.

Nuclear opportunities are not available for any of these areas due to population density constraints. Coal opportunities at all areas are limited to a small size facility (100 MW) by thermal discharge impacts on the estuarine ecosystem and by lack of available land. Steam Turbine opportunities at all areas are limited to a small size facility (150 MW) by thermal discharge impacts on the estuarine ecosystem. Combined Cycle opportunities at all areas are limited to a small size facility (400 MW) by thermal discharge impacts on the estuarine ecosystem. Cooling Water (bay) supplies are not available for once-through cooling due to the necessity to meet thermal gradient discharge requirements. Alternate water supplies (waste-water) are available. Available Land exists to support small size facilities. Use of cooling towers may further constrain noted opportunities. Setback opportunities are not required due to the area's waterfront location.

NOTE: The identification of combined-cycle opportunities at UA 8B (Oyster Point) is not intended to be inconsistent with CEC findings that this site was not preferred for such a facility. As noted in Chapter 2 of this report, this study assumes that problems identified in the PGandE Combined Cycle NOI proceedings would have to be resolved prior to any construction. The findings of relative acceptability made in the PGandE Combined Cycle NOI proceedings with respect to all of the various sites in that study are not inconsistent with this subject study.

North San Jose--UA 9

UA 9 (Santa Clara County: BCDC Map 22) is located in the City of San Jose. It is set back approximately one mile from the southern end of San Francisco Bay between Highway 17 to the east and Highway 237 to the south. Principal land uses are agriculture and sewage treatment facilities. Opportunities are generally located southeast of the San Jose-Santa Clara Sewage Disposal Plant.

Nuclear opportunities are not available due to population density constraints. Coal opportunities are limited to a small size facility (100 MW) due to thermal discharge impacts on the estuarine ecosystem. Steam Turbine opportunities are limited to a small size facility (150 MW) due to thermal discharge impacts on the estuarine ecosystem. Combined Cycle opportunities are limited to a small size facility (400 MW) due to thermal discharge impacts on the estuarine ecosystem. Cooling Water (bay) supplies are not available for once through cooling due to the necessity to meet thermal gradient discharge requirements. Alternate water supplies (wastewater) are available.

Discharge from facilities located in this UA should occur north of the Dunbarton Bridge. Available Land exists to support small size facilities. Use of cooling towers should not constrain noted opportunities due to land areas available. Setback opportunities exist; however, this UA is considered a marginal opportunity.

NOTE: The identification of combined-cycle opportunities at UA 9 (North San Jose) is not intended to be inconsistent with CEC findings that this site was not preferred for such a facility. As noted in Chapter 2 of this report, this study assumes that problems identified in the PGandE Combined Cycle NOI proceedings would have to be resolved prior to any construction. The findings of relative acceptability made in the PGandE Combined Cycle NOI proceedings with respect to all of the various sites in that study are not inconsistent with this subject study.

TABLE 15 : SUMMARY OF OPPORTUNITIES

UA NO.	PLANT TYPE / FUEL / NAME	NUCLEAR	COAL	STEAM TURBINE			COMBINED CYCLE		
		UO_2	COAL	OIL	COAL GAS	METHANOL	OIL	COAL GAS	METHANOL
1	Crescent City [2]	0	0	0	M	M	0	M	M
2	Samoa Spit	0	0	M	M	M	M	M	M
3	Salinas River	0	S	M	M	M	M	M	M
4	Santa Maria River [2]	0	S	S	M	M	0	M	M
5	Tijuana River [2]	0	0	S	L	L	M	M	M
6	Oleum	0	S	S	S	S	S	S	S
7	Point San Pedro [1]	0	0	S	S	S	0	S	S
8	Visitacion [1]	0	S	S	S	S	S	S	S
9	North San Jose [1]	0	S	S	S	S	S	S	S

0 - No Opportunities For Any Plant Size
S - Opportunities for Small Plant Size Only
M - Opportunities for Small and Medium Plant Size
L - Opportunities for Small, Medium and Large Plant Size
1 - No Once Through Cooling
2 - Requires partial designation for power plant development

RESULTS: PLANT TYPE PROFILES

Nuclear
Coal Direct-Fired
Steam Turbine
Combined Cycle

Nuclear*

Based on the design characteristics of this study, opportunities for the location of new nuclear power plants are not available at any of the CCC or BCDC undesignated areas.

Opportunities in the CCC jurisdiction are constrained by Quaternary faults, lack of necessary ingredients to demonstrate geologic stability, and population density criteria. The effect of these factors is influenced by the difficult geologic conditions along the coast, the conservative nature of NRC siting criteria, and the location of population centers. The constraints range from severe to prohibitive.

Opportunities in the BCDC jurisdiction are collectively prohibited by the effects of population density criteria. These results reflect the general level of the study analyses. Results of more site-specific studies or of studies of opportunities in CCC and BCDC designated areas may differ. Ongoing regulatory review by the NRC may also have a significant impact on such opportunities.

California law currently makes opportunities to construct new nuclear power plants in state dependent on the resolution of nuclear waste disposal problems (with the exception of Diablo Canyon and San Onofre 2 & 3). As noted, this issue is now under consideration in the federal courts, and potential limitations are undetermined at this time.

Coal Direct-Fired

Of the nine UAs reviewed in this study, opportunities to locate small (100 MW) new direct-fired coal plants exist at five areas. Two of the areas are in the CCC jurisdiction:

Salinas River	100 MW
Santa Maria River	100 MW

Three of the areas are in the BCDC jurisdiction:

Oleum	100 MW
Visitacion	100 MW
North San Jose	100 MW

*The conclusions are equally valid for both PWR and BWR reactors since the population density controls and regulatory review are similar for both technologies.

All of these opportunities are limited to small size (100 MW) plants. This size coal plant does not meet current requirements for economics of scale, and these opportunities, while existing, are not considered practical.

At Salinas River the opportunities are limited to small facility types by waste disposal and water quality standards conformance. At Santa Maria River the limitations are due to lack of available air quality trade-offs. At Oleum, Visitacion, and North San Jose the limitations to small facilities are due to waste disposal impacts.

At Crescent City, Samoa Spit and Tijuana River, the lack of opportunities is due to waste disposal impacts. At Point San Pedro, the lack of opportunities is due to lack of available space for fuel storage and waste disposal facilities.

This study did not identify any opportunities for medium or large size coal direct-fired power plants at the nine UAs examined.

Steam Turbine

Opportunities to locate new steam turbine power plants exist at all of the nine UAs examined in this study. Opportunities in the CCC jurisdiction are:

Crescent City	100 - 50 MW
Samoa Spit	150 - 500 MW
Salinas River	150 - 500 MW
Santa Maria River	150 - 500 MW
Tijuana River	150 - 800 MW

Opportunities in the BCDC jurisdiction are:

Oleum	150 MW
Point San Pedro	150 MW
Visitacion	150 MW
North San Jose	150 MW

Once-through cooling impacts account for all of the limitations at the CCC areas with the exception of oil-fired opportunities at Crescent City, Santa Maria River, and Tijuana River. At these latter three UAs, the limitations on oil-fired steam turbine power plants are due to air quality impacts. Opportunities for large size steam turbine plants exist only at Tijuana River for coal gas and methanol fuels.

Combined-Cycle

Opportunities to locate new combined-cycle power plants exist at all nine UAs examined in this study. Opportunities in the CCC jurisdiction are:

Crescent City	400 - 500 MW
Samoa Spit	400 - 500 MW
Salinas River	400 - 500 MW
Santa Maria River	400 - 500 MW
Tijuana River	400 - 500 MW

Opportunities in the BCDC jurisdiction are:

Oleum	400 MW
Point San Pedro	400 MW
Visitacion	400 MW
North San Jose	400 MW

Once-through cooling impacts account for all of the limitations in the CCC areas with the exception of oil-fired opportunities at Crescent City and Santa Maria River. At these latter two UAs, the opportunities are respectively prohibited or limited to small size facilities due to air quality impacts.

Thermal discharge impacts account for all limitations in the BCDC areas, with the exception of Point San Pedro where air quality impacts prohibit oil-fired opportunities.

RESULTS: FACTOR PROFILES

Air Quality
Geology
Public Facilities
Biology
Water
Institutional Constraints
Undesignated Opportunities

Air Quality

Of the approximately 200 UAs initially considered in this study, air quality impacts account for the elimination of the majority from further review (see Appendix I). These impacts are generally the result of potential AAQS violations due to plume impacts on the rugged terrain encompassing much of the coast. The nine UAs discussed in this report conform with air quality criteria for the plant types and sizes, and fuel types noted. The exceptions are oil-fired steam turbine and combined-cycle facilities at Crescent City, which are prohibited due to lack of available trade-offs, and oil-fired combined-cycle facilities at Point San Pedro which are prohibited due to PSD impacts.

Air quality impacts are not significant constraints to opportunities at the nine UAs discussed in this study. These UAs represent areas which generally passed the air quality screening process. Those UAs located in urban regions are generally eliminated due to the lack of available trade-offs. Overall, air quality impacts on opportunities for locating new coastal power plants are due more to the pervasive ruggedness of the California coast than to intensification of existing air quality problems.

Geology

The most significant effect of geology factors is on opportunities for locations for new nuclear power plants. This study, based on its general level of review, did not identify any nuclear power plant opportunities at any of the approximately 200 UAs initially considered. The effects of Quaternary faults and the lack of necessary ingredients to demonstrate geologic stability are determined by staff to be severe to prohibitive. The effect of these factors generally reflects the conservative nature of NRC siting criteria. These factors also constrain opportunities at the nine UAs discussed in this study, although preclusion at the BCDC UAs is based more specifically on effects of population density criteria.

Analysis of designated areas, or a more detailed analysis of opportunities for nuclear facilities in undesignated areas, may possibly identify opportunities not discovered in this study. The results of this current study should not be interpreted as an indication that nuclear facility sites do not exist in coastal areas. This study is limited by its focus on undesignated areas only to a relatively limited segment of the total coastal area. The noted results apply only to those undesignated areas.

Geology factors do not prohibit any fossil-fueled opportunities. Constraints of this type are generally amenable to resolution/mitigation through design considerations. Geology factors are neither prohibitive nor severely constraining at any of the nine UAs discussed in this study.

Public Facilities

The impacts of public facility factors in this study function more as nominal to severe constraints rather than as prohibitions and therefore do not impact opportunities to a significant degree. The principal exception is the effect of population density criteria in prohibiting nuclear facilities in urban areas of sufficient size and density. Of the nine areas discussed in this study, it functions as a prohibition on nuclear facilities primarily at the four BCDC UAs.

Available land is a severe, but not a prohibitive constraint at the four UAs. In the CCC jurisdiction, these UAs are:

Crescent City
Tijuana River

In the BCDC jurisdiction, these UAs are:

Oleum
Point San Pedro

The generally rural/suburban location of the other five UAs indicates the general availability of adequate land area for the opportunities noted. Overall, the availability of adequate land area is severely to prohibitively constrained by the ruggedness of California's coastal terrain.

Private land ownership and local land use plan designations may be expected to severely constrain opportunities at all of the nine UAs in this study. Resolution of this constraint is not addressed in this study, but its impact on specific siting opportunities may be significant. Many of the opportunities noted in this study will be precluded as development of currently vacant land continues. Due to the competition for the benefits of coastal locations, this development may be expected to be relatively rapid.

NOTE:

The noted opportunities are not intended in any way to conflict with or otherwise constrain the intentions of current land owners or local planning efforts. There is no intent to preempt land use rights in a manner which would support a claim of inverse condemnation. Any action to construct power plants at any of the areas identified in this study will require conformance with legal certification procedures as noted in Appendix A.

Biology

Of the nine UAs considered in this study, biology resource factors are severe constraints at the five CCC areas. These effects are due to wetland and riparian habitats, rare and endangered species, and commercial and recreational species. The majority of these constraints focus on the marine biological resource impacts which are also associated with once-through cooling and/or thermal discharge impacts. While biological factors alone do not prohibit any plant types or sizes, the severity of their constraints contribute to the prohibition associated with cooling water constraints.

The severity of the impacts of the noted biological resource factors inversely reflects the relative health and viability of these resources in the regions of the five CCC areas. These areas are, with the exception of Tijuana River, in regions of low development, and the biological resources exist in more natural and less degraded conditions. In the four BCDC UAs, biological impacts are limited to nominal to moderate constraints. This is a reflection of the intense urban development associated with these UA's coincidental bay fill, and also of the limitation of all facilities to small sizes. The relative moderation of these impacts assumes that once-through cooling will not be used and that discharge facilities be extended into the deeper waters of the bay away from the more sensitive shallow water estuarine habitats. These impacts are also associated more prominently with marine biological resources.

Overall, trade-off or mitigation from nominal to severe is required at all nine UAs to offset impacts to biological resources.

Water

The impacts of water-related constraints are the most significant of all factors limiting opportunities for locating new fossil-fueled plant types at the nine UAs. These constraints assume the use of once-through cooling water systems at all five CCC UAs, and possibly at Oleum in the BCDC jurisdiction. The study recommends that once-through cooling not be used at the three remaining BCDC UAs and that such discharge systems that are used be located in the deeper bay waters away from the more sensitive shallow water estuarine habitats. This analysis specifically states that any discharge associated with the North San Jose UA should be located north of the Dunbarton Bridge.

Waste disposal impacts prohibit coal direct-fired opportunities at Crescent City, Samoa Spit, and Tijuana River. Lack of available land to support fuel and waste disposal facilities prohibits opportunities at Point San Pedro. The impacts of once-through cooling on marine biological resources limit coal opportunities to small size facilities at Salinas River, Santa Maria River, Oleum, Visitacion, and North San Jose. Waste disposal is a significant constraint only for coal direct-fired plant types. The treatment, discharge, and/or disposal of liquid wastes generated from fuels other than coal are not factors which would necessarily limit facility construction and operation.

Cooling water intake and discharge is a significant constraint for all plant types except combustion turbines (not considered in this study) which do not require significant am unts of cooling water for operation. At CCC UAs, the impacts of once-through cooling limit opportunities at Crescent City, Samoa Spit, Salinas River, and Santa Maria River to medium size facilities for both steam turbine and combined-cycle plant types. At Tijuana River, cooling water opportunities exist for large size facilities, both steam turbine and combined-cycle plant types.

At the four BCDC UAs, thermal discharge effects limit all opportunities for steam turbine and combined-cycle plant types to small size facilities. This assumes the use of alternate cooling water supplies, since it is recommended that with the possible exception of Oleum, once-through cooling operation using bay water not be used at these areas. The use of cooling towers as an alternate cooling method is not considered in this study, but may be expected to be limited by lack of available land at all BCDC UAs except Visitacion and North San Jose. It is assumed that freshwater supplies are not available for power plant cooling processes due to the supply problem that already exists for this resource in the bay area. Waste water supplies of sufficient volume for small plant sizes are considered to be available at all four BCDC UAs, although this resource remains to be developed for this use.

Institutional Constraints

PIFUA

The restrictions imposed by PIFUA (see Chapter 4) on use of oil and gas as power plant fuels may be expected to further limit the opportunities noted above. In this study, these restrictions would apply to the opportunities noted for the use of oil and natural gas as fuels for steam turbine and combined-cycle plant types. The effect of these restrictions will be dependent on the future of exemptions now under consideration by Congress and the development of reliable synthetic fuel supplies. Pending these developments, PIFUA restrictions on these fuel supplies are considered to severely constrain steam turbine and combined-cycle opportunities.

This study indicates that opportunities for new nuclear power plants are not available at any of the approximately 200 UAs initially reviewed. The CEC cannot license new nuclear plants until "there exists a demonstration technology or means for the disposal of high-level nuclear waste." In 1978, the CEC found on an interim basis that no such technology or means existed, and no such finding has since been issued. This requirement does not apply to existing nuclear facilities or those under construction. Pending federal court action may affect this limitation.

1981 Biennial Report

The CEC 1981 Biennial Report forecasts a peak demand of 43,365 MW for the year 1992 and 49,588 MW for the year 2000. This is an expected average annual peak demand growth rate of 1.63 percent for the year 1979 - 1992 and 1.65 percent for the years 1979 - 2000. This report indicates the need for capacity additions of 13,647 MW for the years 1979 - 1992, including oil and gas displacement. To meet projected demand, the CEC's preferred capacity supply options in order of priority, are:

1. Conservation and Power Pooling,

2. Geothermal and Renewables,

3. Cogeneration and Interutility Transfers,

4. Repowering Natural Gas and Natural Gas Fuel Switching,

5. Synfuel and New Hydroelectric,

6. Direct-Fired Coal.

New nuclear facilities are not a preferred option.

These projections of supply potential provide information which may be compared to meet projected demand, the CEC's preferred capacity supply options, in order of priority, are:

Nuclear--Utility resource plans do not include any additional nuclear facilities, beyond Diablo Canyon and San Onofre, for construction in California during the 1980 - 1992 period. This does not conflict with the results of this study, which indicate a lack of opportunities to locate new nuclear facilities in undesignated coastal areas.

Coal--Utility resource plans show an increase in direct coal-fired capacity additions for the period 1980 - 1992 (BR). The CEC preferred supply outlook, however, ranks coal as the least preferred power plant technology when compared to the other supply options for the same period. Coastal locations are not proposed for any direct coal-fired capacity additions and opportunities noted in this study indicate that the availability of undesignated areas to support such facility is limited.

Steam Turbine--CEC policy calls for a 50 percent reduction in utility reliance on oil and gas use by 1992. This indicates that existing oil-/gas-fired steam turbine facilities will be refueled or retired in the 1979 - 1992 and 1979 - 2000 periods. It is unlikely that construction of major new steam turbine facilities will occur in the future, and opportunities for such facilities noted in this report are not expected to be an issue in future coastal siting scenarios.

Combined Cycle--Utility resource plans call for moderate increases in combined-cycle capacity in the 1980 - 2000 period. This capacity growth may be expected to be dependent on the availability of synthetic fuels due to PIFUA restrictions. The opportunities for combined-cycle synfuel facilities noted in this study provide opportunities for substantial support of these capacity needs.

Capacity Distribution

All opportunities for new power plants identified in this study are for base load capacity. Peaking facilities are not considered in this study due to the relative balance between supply and demand indicated for this capacity through

2000. As noted in Table 16, if the smallest plant size opportunities are assumed to exist simultaneously at each of the UAs, a total of 1,100 MW of capacity results. If the largest plant size opportunities are assumed to exist simultaneously, a total of 4,400 MW of capacity results. If more practical* circumstances are assumed to exist simultaneously at each of the nine UAs, a total of 3,700 MW of capacity results.

Of the 3,700 MW total in the practical case, 2,500 MW is located at CCC UAs and 1,200 MW at BCDC UAs. All of these 3,700 MW of capacity are of the combined-cycle type, reflecting the greater efficiency of this facility design from the prespectives of capacity, acreage required, environmental and health impacts. Nuclear, coal, and steam turbine opportunities are <u>not</u> included in the practical case total for similar reasons.

*Determined by selecting the most efficient technology (combined cycle) at sites with a reasonable opportunity for development, without regard for regional impacts.

TABLE 16: CAPACITY DISTRIBUTION (MW)

CASE	RANGE OF TECHNOLOGY SIZES		
UA	SMALLEST	LARGEST	PRACTICAL*
CRESCENT CITY	150 ST	500 CC	500 CC
SAMOA SPIT	150 ST	500 CC	500 CC
SALINAS RIVER	100 C	500 CC	500 CC
SANTA MARIA RIVER	100 C	500 CC	500 CC
TIJUANA RIVER	150 ST	800 ST	500 CC
OLEUM	100 C	400 CC	400 CC
PT. SAN PEDRO	150 ST	400 CC	-0-
VISITACION	100 C	400 CC	400 CC
NORTH SAN JOSE	100 C	400 CC	400 CC
-TOTAL-	1100 MW	4400 MW	3700 MW
NUCLEAR	-0-	-0-	-0-
COAL	500 C	-0-	-0-
STEAM TURBINE	600 ST	800 ST	-0-
COMBINED CYCLE	-0-	3600 CC	3700 CC

KEY

N - Nuclear

C - Coal

ST- Steam Turbine

CC- Combined Cycle

* - Most Practical Capacity Distribution: Based on Selection of Most Efficient Technology at Areas With Reasonable Development Opportunity

UNDESIGNATED AREA OPPORTUNITIES

Of the approximately 200 UAs initially considered in this study, opportunities to locate new power plants exist at nine UAs. The CCC jurisdiction contains five of these UAs located along the entire length of the coast. The BCDC jurisdiction contains four of these UAs which are well spaced in four different sections of the bay shore.

Opportunities for nuclear power plants are not available at any of the 200 UAs initially considered, or any of the nine UAs discussed in this study, due to a combination of geological and population density constraints. Opportunities for coal direct-fired facilities (100 MW) exist at two central coast UAs in the CCC jurisdiction and at three BCDC UAs; constraints are due to waste disposal impacts and lack of available land for storage facilities. Opportunities for medium size (500 MW) steam turbine and combined-cycle facilities exist at all five CCC UAs, with limitations on larger sizes being due to once-through cooling impacts. Use of cooling tower technologies could expand these opportunities. Opportunities in the BCDC UAs for steam turbine and combined-cycle power plants are limited to small size facilities due to thermal gradient impacts on the estuarine ecosystem of the bay. Opportunities for large steam turbine facilities exist at Tijuana River.

Of the approximately 200 initial UAs, air quality impacts (see Appendix I) associated with the rugged coastal terrain account for the elimination of the majority. Of the nine UAs discussed in this report, water quality impacts are the most significantly constraining. Once-through cooling opportunities are considered to be available for the five CCC UAs but not for the four BCDC UAs, with the possible exception of Oleum. Use of cooling tower technologies could expand these opportunities. Lack of available land is not a significant constraint at most of the nine UAs given the limitation to small to medium plant sizes. At the BCDC UAs, however, the noted opportunities will be further constrained by the necessity for more land-intensive alternative cooling systems; waste water supplies are available but not developed for cooling purposes (for example, cooling towers or spray ponds).

Overall, coastwide locational opportunities significantly reflect three major physical developmental constraints: pervasive, rugged coastal terrain, limited river mouth/floodplain terrain, and dense pockets of urban development. Prime opportunities for power plant locations correspond to prime opportunities for urban development, and the two needs clearly compete for scarce coastal land resources.

Opportunities for some types of new coastal power plants are also constrained to a significant degree by institutional factors. PIFUA restricts the construction of new oil- or gas-fired power plants; nuclear laws (pending legal review) restrict new nuclear power plants, except those under construction at Diablo Canyon and San Onofre. CEC supply criteria has established a priority order for development of various power plant types (1981 CEC BR). Coal power plants are given low priority; thus, opportunities appear to exist for medium size combined-cycle plants fired by clean fuels.

Overall, opportunities to locate new power plants in CCC and BCDC undesignated areas total up to approximately 3,700 - 4,400 MW at nine locations. These opportunities should be adequate to meet the needs identified for coastal locations in the CEC-adopted 1981 Supply and Demand Forecast through the year 2000. Additionally, staff has previously identified* 7,000 - 10,000 MW of capacity available for expansion at 20 existing coastal power plant sites. These expansion opportunities were for both base load and peaking power plant types. Staff concluded that the CCC and BCDC designated areas did not preclude opportunities for the reasonable expansion of existing coastal zone power plants.

Based on the results of these two studies, CEC staff concludes that there are reasonable opportunities for both base load and peaking capacity additions on the coast through the year 2000 and that no changes to CCC and BCDC designated areas are required at this time. While there is currently no necessity to develop any of the nine opportunities identified in this report, a future change in the CEC Demand Forecast (BR) may require development at one or more of these UAs.

*Opportunities to Expand Existing Coastal Power Plants in California (see Appendix G).

CHAPTER 6: RECOMMENDATIONS

This study suggests that moderate opportunities for new power plants exist at a limited number of coastal areas. These opportunities may serve to help California meet its electrical-generating supply needs through the year 2000. This chapter describes actions recommended by staff to assist in developing opportunities in a practical manner.

1. The CEC, the CCC, and the BCDC should adopt and issue a joint policy statement identifying the priorities for future development of coastally located electrical generating capacity. This statement should be based on opportunities and constraints identified in this study and in the previous coastal power plant expansion study. Such a statement should provide for continuing safeguards of coastal resources as required by law and provide for developmental capacity with the following priorities:

   - Expansion of existing power plant sites;
   - Development of new sites adjacent to existing sites;
   - Development of new sites in other undesignated areas; and
   - Development of new sites in designated areas only as a last resort.

2. The CCC should allow development of cooling water conduits at Crescent Crescent City (CCC Map 2), Santa Maria River (CCC Maps 109, 110, and 111), and Tijuana River (CCC Map 161) to accommodate opportunities identified in this report. This would allow for necessary power plant ancillary support facilities. Proposals for development at these areas should consider the priorities identified in recommendation number one. Prior to such designation, the applicant should submit a detailed site-specific evaluation of the proposed area to the CCC to ensure that no substantial adverse impact on the environment occurs as a result of site development and operation. This submittal should occur prior to or concurrently with the CEC Notice of Intent regulatory proceedings. The CCC can allow this development by either adopting a partial designation or by making a finding under PRC Section 25526.

3. The CCC should adopt regulations on procedures for approval of ancillary power plant support facilities in designated areas pursuant to Section 25526 of the Public Resources Code. The regulations should provide a procedure for CCC review of utility proposals to locate underground cooling water intake and outfall pipelines through designated areas to determine if the facilities can be sites consistent with the primary uses of the land and if the substantial adverse environmental effects of the proposal can be mitigated.

4. The CCC and the BCDC should ensure that study results are incorporated into coastal planning studies at the local level to assist in maintaining options for any opportunities identified. The agencies should cooperatively participate in local planning efforts to promulgate the

necessary information and interpretation. The CCC and BCDC staffs should participate in the development of local coastal plans to ensure that such plans are not inconsistent with the results of this study and the previous site expansion study.

REFERENCES

Atwood, J.L., P.D. Jorgensen, R.M. Jerek and T.D. Manlis. California Least Tern Census and Nesting Survey. CDFG Endangered Wildlife Program E-1-1, Job V-2.11. 1977.

Ayensu, E.S., and R.A. DeFillips. Endangered And Threatened Plants Of The United States. Smithsonian Institution and World Wildlife Fund, Inc., Washington, DC. 1978.

Beard, T.J., Iachetta, F.A. and Lilleleht, L.U. Combustion Evaluation In Air Pollution Control. Associated Environmental Consultants. North Carolina. 1978.

Benson, James R. and David A. Fredrickson. Archaeological Reconnaissance Of The Humboldt Bay Area: An AIR On File At The Cultural Resources Facility, Sonoma State University, Rohnert Park. 1977.

Berger, B.D. and Anderson, K.E. Modern Petroleum: A Basic Primer Of The Industry. Tulsa, Oklahoma. 1978.

Bonneville Power Administration: Draft Environmental Impact Statement. The Role Of The BPA In The Pacific Northwest Power Supply System. Bonneville Power Administration. Portland, Oregon. July 1977.

Boyd, M.J., and J.D. DeMartini. The Intertidal and Subtidal Biota Of Redwood National Park. National Park Service Contract No. CX8400-4-0665. 1977.

Browning, B.M., and J.W. Speth. The Natural Resources Of San Diego Bay. California Department of Fish and Game Coastal Wetland Series No. 5. Sacramento. 1973.

Bureau of Land Management. Final EIS Proposed 1981. OSC Sale No. 53, Vol. 1. 1980.

California Coastal Zone Conservation Commission. California Coastal Plan. San Francisco: California Coastal Zone Conservation Commission, 1975.

California Department of Fish and Game. At The Crossroads: A Report On California's Endangered And Rare Fish And Wildlife. Sacramento. 1978.

California Department of Fish and Game. Natural Resources Of Lake Earl And The Smith River Delta. Coastal Wetland Series No. 10. 1975.

California Department of Parks and Recreation. California Coastline Preservation And Recreation Plan. Sacramento. 1971.

California Department of Parks and Recreation. California Inventory Of Historical Resources. Sacramento. 1976.

California Department of Transportation, District 5, San Luis Obispo, personal interview with Robert Peterson. October 7, 1980.

California Department of Water Resources. Bulletin 204 Water For Power Plant Cooling. July 1977.

California Division of Mines and Geology. Geology For Planning: Cayucos And Cypress Mountain 7.5 Quadrangles. San Luis Obispo. 1980.

California Division of Mines and Geology. Geology For Planning: Guadalupe And Point Sal 7.5 Quadrangles. San Luis Obispo. 1980.

California Division of Mine and Geology. Geology For Planning: Imperial Beach 7.5 Quadrangles. San Diego. 1980.

California Division of Mines and Geology. Geology For Planning: Marina And Salinas 7.5 Quadrangles. Monterey. 1980.

California Department of Mines and Geology (CDMG). Urban Geology Master Plan. 1973. p. 42.

California Energy Commission. Air Quality Statewide Coal Plant Area Screening Study--A Staff Report. Sacramento. 1979.

California Energy Commission. Constraint Mapping Study: Environmental Factors Influencing Power Plant And Transmission Line Siting. Sacramento. 1980.

California Energy Commission. Draft Report--Status Of Nuclear Fuel Reprocessing Spent Fuel Storage And High-Level Waste Disposal. Sacramento. January 1978.

California Energy Commission. Final Report On The Pacific Gas And Electric Company's Notice Of Intention To Seek Certification For The Combined-Cycle Project. Sacramento. 1978.

California Energy Commission. Opportunities To Expand Coastal Power Plants In California. A Staff Report. Sacramento. 1980.

California Energy Commission. Technical Assistance Manual, Electrical Generation. Vol. 1. Sacramento. 1979.

California Energy Commission. Underground Siting Of Nuclear Power Reactors Determination Of Site Characteristics And General Availability In California, Nuclear Assessments Office. Sacramento. 1978.

CH_2 M. Hill, Dodson and Young, Jordan/Avent and Assoc., Inc., and Jefferson Assoc. San Francisco Bay Area Regional Waste Water Reuse Study--Phase I --Preliminary Report. January 1979.

California Natural Areas Coordinating Council. California Natural Areas Summary And Report. Sacramento, 1978.

California Native Plant Society. Inventory Of Rare And Endangered Vascular Plants Of California. Berkeley. 1980.

City of Berkeley. Berkeley Master Plan. Berkeley: City of Berkeley. 1977.

City of Coronado. Water And Marine Resources' Environmentally Sensitive Habitat Areas. Coronado. 1979.

City of Marina. Marina 2000--A General Plan. Marina. 1975.

City of Richmond. Richmond Coastline Plan. Richmond. 1973.

City of San Diego. Tiajuana River Valley Plan. San Diego. 1977.

City of San Diego, California. Flood Plain Maps--Tijuana River Sheets 3, 6, And 7 Of 13. July 1979.

City of San Diego. Tijuana River Valley Plan: Local Coastal Program Addendum. San Diego. 1979.

City of South San Francisco, South San Francisco-San Bruno Sewage Treatment Plant. Personal communication. October 30, 1980.

Cooper-Clark Associates. Geotechnical Study Of The North San Jose And Alviso Area, unpublished report for the City of San Jose. 1971.

Considine, Douglas M. Energy Technology Handbook. McGraw-Hill Book Company, New York. 1977.

Contra Costa Flood Control and Water Conservation District. Personal communication. October 24, 1980.

Del Norte County. Local Coastal Program: Land Use Plan, Del Norte County, Crescent City. 1979.

East Bay Municipal Utility District. Personal communication. October 29, 1980.

Ecological Analysts, Inc. and Jefferson Associates, Inc. Moss Landing Community Plan Energy And Industrial Expansion Alternatives: Draft Background Report. Monterey County, Salinas. 1980.

Envicon Corporation. Energy Facility Siting Management Plan For The Nipomo Dunes System. Vol. I Mussel Rock Unit and Vol. II Guadalupe Unit. San Luis Obispo. 1980.

Environmental Research Consultants, Inc. Eureka-Arcata Regional Sewage Facility Project EIR. Arcata. 1974.

Fowler, Lloyd. Flooding Potential At The (PGandE) North San Jose Site. Testimony by the Chief Engineer, Santa Clara County Flood Control and Water Conservation District introduced into PGandE Combined Cycles Hearings before the California Energy Commission. Sacramento. August 1977.

Garcia, A.W., and J.R. Houston. *Type 16 Flood Insurance Study: Tsunami Predictions For Monterey 2nd San Francisco Bays And Puget Sound,* U.S. Army Engineer Waterways Experiment Station, Technical Report H-75-17, 1975.

Gill, R. *Status and Distribution Of The California Clapper Rail (Raillis Longirastris Obsoletus).* California Fish and Game 65(1): 36-49. Sacramento. 1979.

Graves, Harvey W. *Nuclear Fuel Management.* New York. 1979.

Heizer, Robert F. *In Handbook Of North American Indians,* California. Vol. 8, Smithsonian Institution. Washington, D.C. 1978.

Hertiage Conservation and Recreation Service. *Natural Landmark Brief: Nipomo Dunes--Point Sal Coastal Area.* Department of Interior. San Francisco. 1974.

Huston, J.R., and A.W. Garcia, *Technical Report H-78-76 Type 16 Flood Insurance Study: Tsunami Predictions For The West Coast Of The Continental United States Hydraulic Laboratory.* U.S. Army Engineer Water Way Experiment Station. Vicksburg, Mississippi. December 1978.

Humboldt County Flood Control District. Personal communication with Joel Canzoneri. October 2, 1978.

International Boundary and Water Commission, United States Section. *Draft Environmental Statement. Tijuana River Flood Control Project.* USS IBWC-EIS-74-1. San Diego. 1974.

Jefferson Assoc., Inc., Personal communications. October 29, 1980.

King, Thomas F., Michael J. Moratto and N. Nelson Leonard III. *Recommended Procedure For Archaeological Impact Evaluation.* Society for California Archaeology. 1973.

Kroeber, Alfred L. *Handbook Of The Indians of California.* Bureau of American Ethnology Bulletin 78. Smithsonian Institution, Washington, D.C. 1925.

Lom, W.L. and Williams, A.F. *Substitute Natural Gas: Manufacture and Properties.* Essex, England. 1976.

Loud, Llewellyn L. *Ethnogeography And Archaeology Of The Wiyot Territory.* University of California Publications in American Archaeology and Ethnology, 14-221-436, University of California Press, Berkeley. 1918.

Marin County Flood Control District. Personal communication. October 26, 1980.

Marin County Sanitation District. Personal communication. October 24, 1980.

Monroe, G.W. *The Natural Resources Of Humboldt Bay.* California Department of Fish and Game. Coastal Wetland Series Report No. 6. 1973.

Monterey County Planning Department. North County Recreation And Visitor-Serving Facilities: Background Report. Monterey County. Salinas. 1980.

Monterey County Pollution Control Agency. Personal communication with Robert Jaques. October 7, 1980.

National Fish and Wildlife Laboratory. Selected Vertebrate Endangered Species Of The Seacoast Of The United States. U.S. Fish and Wildlife Service, Biological Services program; FWS/OBSO/1. 1980.

National Register of Historic Places (Annual listings and supplements). 1979 Federal Register., V. 44, No. 26 and V. 45, No. 54. General Services Administration, Washington, D.C. 1980.

Pacific Gas and Electric Company. Application For Certification For Potrero 7. September 1978.

Pacific Gas and Electric Company. Belle Air Island Site Supplement: Notice of Intention For Combined-Cycle Project, 76-NOI-3. Sacramento. 1977.

Pacific Gas and Electric Company. Notice Of Intention For Combined Cycle Project. Sacramento. 1976.

Radian Corporation. Assessment Of Advanced Coal Based Technologies For Use In California. Final Report of the CEC. Sacramento. 1980.

Rubin, B., I.Y. Borg, and W.J. Ramsey. An Assessment Of The Potential for Using Alaskan Coal In California. Lawrence Livermore Laboratory, Livermore. 1978.

San Diego County Sanitation and Flood Control Agency. Personal interview with Ronald LaRosa. October 8, 1980.

San Luis Obispo County. Environmental Plan: Conservation Element, Historic Element, And Esthetic Element. San Luis Obispo. 1974.

San Luis Obispo County. Open Space Plan. San Luis Obispo. 1972.

San Jose-Santa Clara Water Pollution Control Plant. Personal communication. October 29, 1980.

Santa Barbara County. Santa Barbara County Coastal Plain: Hearing Draft. Santa Barbara. 1979.

Shapiro and Associates, Inc. Humboldt Bay Wetlands Review And Baylands Analysis. Draft. 3 Volumes. U.S. Army Corps of Engineers Contract No. DACW 07-78-C0082. 1979.

Smith, K.A. The Natural Resources Of The Nipomo Dunes And Wetlands. California Department of Fish and Game Coastal Wetland Series No. 15. 1976.

South Bay Discharge Authority. Overall Program For Water Quality Management In South San Francisco Bay EIR. 1973.

Southern California Edison Company. Notice Of Intent: Combined-Cycle Generating Station. Rosemead. 1978.

South Richmond Shoreline Special Area Plan Citizen's Advisory Committee. South Richmond Shoreline Special Area Plan. Richmond. 1977.

U.S. Army Waterways Experiment Station, Vicksburg, Mississippi. Personal communication with James R. Houston. October 28, 1980.

U.S. Department of Housing and Urban Development. Flood Insurance Rate Map--Santa Barbara County, California. Community Panel Number 060331 0075 B. March 1979.

U.S. Environmental Protection Agency. Compilation Of Air Pollutant Emission Factors. North Carolina. 1973.

U.S. Fish and Wildlife Service. Acquisition Of Lands For The San Francisco Bay National Wildlife Refuge. Draft E.S. 1976.

U.S. Geological Survey. Cayucos Quadrangle Flood Map. 1974.

U.S. Geological Survey. Crescent City Quadrangle Flood Map. 1973.

U.S. Geological Survey. Flood Hazard Map San Francisco South, California 7-1/2 minute Quadrangle Sheet. 1972.

U.S. Geological Survey. Marina Quadrangle Flood Map. 1970.

U.S. Geological Survey. Nuclear Energy Resources: A Geologic Perspective. Washington, D.C. 1977.

U.S. Nuclear Regulatory Commission. General Site Suitability Criteria For Nuclear Power Stations. Regulatory Guide 4.7. Washington, D.C. 1975.

U.S. Nuclear Regulatory Commission. Modification Of The Policy And Regulatory Practice Governing The Siting Of Nuclear Power Reactors. Washington, D.C. 1980.

U.S. Nuclear Regulatory Commission. Reactor Site Criteria Title 10, Chapter 1, Code Of Federal Regulations--Energy, Part 100. Washington, D.C. 1975.

U.S. Nuclear Regulatory Commission. Report Of The Siting Policy Task Force NUREG-0625. Washington, D.C. 1979.

Western Interstate Energy Board. Administrator's Guide For Siting And Operaion Of Uranium Mining And Milling Facilities. Colorado. May 1978.

Western Gasification Company. Coal Gasification: A Technical Description. New Mexico. 1977.

Westinghouse Electric Corporation. Gas Turbine Systems Primer. Westinghouse Corporation. Gas Turbine Systems Division. Lester, Pennsylvania. October 1976.

Williams-Kuebelbeck and Associates, Inc. Crescent City Harbor Port Land Use Plan: Technical Report. Del Norte County, Crescent City. 1980.

Williams, Ruebelbeck and Associates, Inc. Crescent City Port Land Use Plan. January 1980.

Woodward-Clyde Consultants, Draft Environmental Impact Report/EA For The Proposed Wickland Oil Company Petroleum Products Facility At Selby, California, 2 Vol. State Lands Commission, Sacramento. 1979.

Woolington, D.W. Migration and Wintering Ecology Of The Aleutian Canada Goose. Humboldt State University MS thesis. Arcata. 1980.

APPENDICES

Appendix A discusses the relationship of the enabling legislation of the three agencies--the CEC, the CCC, and the BCDC--with jurisdiction in locating coastal power plants. Section notations are included as appropriate in the discussion for easy reference by the reader.

Appendix B briefly describes the major technological and operating characteristics of the four types of power plants considered in this study--nuclear, coal (direct-fired), steam turbine (oil and gas), and combined cycle. These descriptions are based on standard generic assumptions for each specific plant type, and do not include descriptions of more unique or detailed systems or components. For information and comparison purposes, a gas turbine system is also described although this plant type is not considered in this study.

This appendix also describes various physical and chemical characteristics of the six fuels considered in the study--uramium dioxide, coal, oil, natural gas, coal gas, and methanol.

Appendix C briefly defines each of the 27 screening factors used in the study's opportunity analyses. The definitions also contain standard land use assumptions associated with various factors and describe the factor's application to the study.

Appendix D consists of tables of power plant air emissions and heat rates. This information supports the air quality analysis discussion in Chapter 3.

Appendix E contains various technical information, formulas, and charts in support of the setback analysis in Chapter 3.

Appendix F contains various technical information and maps in support of the transmission corridor analysis in Chapter 3.

Appendix G is a discussion of the results of the previously published final CEC staff report "Opportunities to Expand Coastal Power Plants in California." It is included for purposes of reference and comparison with the results of this current study.

Appendix H describes both the comments received on the draft report and the general staff response or action to them. Oral comments received in four public workshops are noted and written comments (letters) are described by author, date, and subject.

Appendix I consists of area maps for each of the nine UAs discussed in this report as opportunity locations. Each map is a copy of the standard United States Geographical Survey (USGS) 7.5 minute quadrangle map. These maps are printed at a scale of 1:24,000 which means that one inch on these maps represents 2,000 feet (24,000 inches) on the ground at the actual site.

APPENDIX A

CEC/CCC/BCDC SITING MANDATES

CCC JURISDICTION

To ensure appropriate protection of coastal resources, CEC coastal power plant siting responsibilities must be coordinated with the CCC, which is responsible for regulating the development and planning of coastal areas. The Coastal Act of 1976 requires the CCC to "designate" areas of the coastal zone where the construction and operation of a thermal power plant or electric transmission lines would prevent achieving the objectives of the Coastal Act [PRC Section 30413(b)]. The Warren-Alquist Act [PRC Section 25526(a)] specifies that the CEC may not permit power plants or transmission lines in designated areas, unless (1) the CCC first finds that such use is consistent with the primary uses of such land and finds that there will be no substantial adverse environmental effects from such use, and (2) that the approval of any public agency having ownership or control of the site has already been obtained. The Coastal Act requires the designations to be revised and updated biennially by the CCC [PRC Section 30413(c)].

For the remaining undesignated areas, the review of a siting proposal is still quite extensive, again requiring the cooperation of the CEC, the CCC, other agencies and the public. If a site and related facility found acceptable in the NOI process is located in the coastal zone, no AFC may be filed for such site unless the CEC determines that the coastal site has greater relative merit than other available sites approved, in the NOI process and in the applicant's service area (PRC Section 25516.1). The CCC shall also make findings on any conflicts with existing or planned coastal dependent land uses, potential adverse effects on coastal aesthetic values and fish and wildlife habitats, conformance with certified local coastal programs, and relative mitigation required for potential adverse effects. In NOI proceedings, comments and findings of the CCC must be included in the CEC's Final Report [PRC Section 25514(b)]. In AFC proceedings, the conditions recommended by the CCC to meet the objectives of the Coastal Act must be included in the AFC decision unless the Energy Commission specifically finds that their adoption would result in greater adverse environmental effects or would be infeasible [PRC Section 25523(b)].

As of September 1980, the CCC has assigned designations to approximately 845 miles, 75 percent of the state's 1,100-mile coastline. Of these, full or blanket* designations cover approximately 265 miles of the coast; specific** and partial*** designations cover another 580 miles. The remaining 255 miles

*The entire area of the coastal zone is designated between the Mean High Tideline (MHT) and the inland coastal zone boundary.

**Pockets of the area of the coastal zone are designated between the MHT and the inland coastal zone boundary.

***A designation which allows the underground placement of ancillary facilities such as cooling water pipes and transmission lnes.

of coastline consists of undesignated areas with 130 miles being federal property exempt from the Coastal Act and the designation process. The remaining 125 miles are various types of private property (including urban areas) under the jurisdiction of the state. Approximately five miles of the undesignated area are occupied by existing power plant sites. Although the designated areas, to date, have been generally perceived by utility supply planners as power plant exclusion zones, the law (as noted above) does, in fact, provide for the possibility of energy facility siting in these areas upon the required stringent findings by the CCC.

Current CCC designations identify 13 categories of natural resources for protection under the objectives of the Coastal Act. These categories do not include air quality, water quality, seismic safety, economic, or public health and safety issues (all are to be included in NOI and AFC proceedings). In view of the variable quality of the natural resource areas designated, the wide range of power plant types and sizes, and the potential for mitigating the impacts of these facilities on coastal resources, it should not be considered conclusive that the impacts of electrical-generation facilities on designated areas would always be significant enough to prevent achievement of the objectives of the Coastal Act.

BCDC JURISDICTION

Statutory provisions for identifying designated areas in the San Francisco Bay and Suisun Marsh areas are essentially identical to those applicable to the CCC jurisdiction; the BCDC plays a role analogous to the CCC for the San Francisco Bay area and Suisun Marsh resources [see PRC Sections 66645(b) - (c) 25514(c), 25516.1, 25523(c), 25526(b)]. Under this legislative scheme [Government Code Section 66645(b)], the BCDC must "designate" those areas within its jurisdiction that are not suitable for the construction and operation of a thermal power plant. The purpose of these designations is to prevent impacts on the resources of the bay and the marsh. The BCDC has identified natural resources public access areas, and priority-use areas for the entire San Francisco Bay and Suisun Marsh Area. Government Code Section 66645(c) requires the BCDC to revise and update its designations every two years. These biennial revisions enable the BCDC to assist in updating energy forecasts and site planning activities proposed by the CEC in its most recent biennial report.

Although the Energy Commission is the sole authority for permitting thermal power plants, it is prohibited from approving any power plant development within the areas designated as unsuitable by BCDC unless the BCDC first finds that the proposed facility would not be inconsistent with the primary use of the land and that there would be no substantial adverse environmental effects, and unless any public agency having ownership or control over the area approves.

For the remaining undesignated areas, the review of a siting proposal is extensive, requiring the cooperation of the CEC, the BCDC, other interested agencies, and the public.

APPENDIX B

DESCRIPTION OF PLANT TECHNOLOGIES

NUCLEAR

The operation of a nuclear power plant is similar to that of a traditional fossil-fueled steam plant. Water is heated to steam, then passes through a steam turbine which drives an electric generator. The steam cycle is different in that the source of heat is a controlled nuclear reaction. There are three basic forms of nuclear reactors: boiling water reactors (BWR), pressurized water reactors (PWR), and high temperature gas reactors (HTGR). The last will not be discussed here. The BWR produces steam directly in the reactor, which is then fed into the turbine; it operates at a pressure of about 1,000 pounds per square inch. The PWR has two loops, one in which the coolant remains inside the containment vessel; it uses a heat exchanger to transfer heat into a second loop which then produces steam for the turbine.

The BWR tends to release more radiation because the coolant flows directly past the fuel elements and leaves the containment vessel to pass through the turbine. In the case of the PWR, the primary coolant loop is entirely within the containment vessel and the opportunity for releasing radiation is reduced. Both forms have a thermal efficiency of nearly 32 percent.

The major environmental advantage of nuclear power plants is that they do not release large amounts of air pollutants and do not require large quantities of fuel. The problem of condenser water heat addition is the same in principle for nuclear plants as for fossil-fueled plants.

Five environmental problems are related to the use of nuclear power plants:

- Low-level release of radiation,
- High-level release of radiation,
- Diversion of atomic materials,
- Storage of waste materials, and
- Decommissioning.

Low-level release of radiation may be expected and permitted by existing regulations, or it may be accidental. Radiation losses occur regularly in nuclear power plants because of leakages from the core as a result of fuel or waste handling. High-level release of radiation can occur as a result of an accident in the plant or during various stages of processing or transportation. The threat of earthquakes, which could destroy plant safety systems, has limited the development of nuclear plants in parts of the United States, particularly along the California coast. The third problem is the danger of diversion or stealing of nuclear fuel, particularly while it is being transported. Finally, the problem of safe storage of undesired nuclear wastes has to be solved.

Nuclear plants generally serve as base load plants to meet a level of load demand which is always present in the supply grid.

STEAM TURBINE (OIL-OR GAS-FIRED)

The steam electric power plant converts fuels into energy combustion. Heat produced in the combustion process changes water into high pressure steam. This high pressure steam enters the turbine and drives the turbine's blades. The steam is then exhausted into the condenser where it cools and condenses into water, and is pumped back into the boiler to be made into steam again. Modern steam power plants have actual efficiencies near 38 - 40 percent for fossil fuels.

Fossil-fuel power plants have a significant impact on the environment in two ways. First, they release about 60 percent of the heat available from their fuel to the environment as waste heat in the form of exhaust gases. Second, they release miscellaneous undesirable combustion by-products, varying in quantity and kind, depending on the fuel burned and the heat of the reaction.

Large steam plants generally serve as base load facilities.

COAL (DIRECT-FIRED)

A direct-fired coal power plant is a steam power plant that is fueled by pulverized raw coal rather than gas or oil. The process of electricity generation is the same as that described for a steam turbine plant above.

The coal is crushed into a fine powder, blown into a furnance firebox through special nozzles, and is burned in mid-air. Combustion results in products of gases and ash. Some of the ash (15 percent) falls to the bottom of the fire-box as slag, and is routed to a water bath where it hardens as it cools. The remaining ash is removed as fly ash in the flue gas. The combustion gases are forced by fans around banks of steel boiler tubes, to create steam. These hot gases are discharged into the atmosphere through tall stacks after passing through emission control equipment.

Environmental impacts of coal-fired plants with emission controls tend to be similar to the impacts from oil-fired facilities. The emission control equipment required for coal plants includes; (1) fabric filters, or "baghouses," capable of removing as much as 99.9 percent of the particulates from the stack, gas, and; (2) wet scrubbers, utilizing limestone slurry to reduce SO_2 emissions by as much as 95 percent. Coal direct-fired plants usually require on-site fuel and waste storage which takes large amounts of space, and can be unsightly and polluting if not properly managed.

Coal direct-fired steam plants serve as base load facilities.

COMBINED CYCLE

A combined-cycle power plant combines the best features of a gas turbine system and a steam turbine system to produce electricity. The combined-cycle power plant uses the hot exhaust gas fr m a gas turbine to provide boiler heat for a conventional steam turbine unit. The gas turbine exhaust gases pass through a heat recovery system connected to the steam turbine boiler. The gas turbine system and the steam turbine system drive separate electric generators. Combining these two generation technologies creates a system which has an efficiency of about 40 - 42 percent. This combined system has the flexibility to adjust to changes in energy demand because:

- Gas turbines are fast in starting up and in responding to changes in energy demand but are relatively inefficient.
- Steam turbines are slower in starting up and in responding to changes in energy demand but are more efficient than gas turbines.
- Combined-cycle plants may be designed to handle peak, intermediate or base load energy demand.

COMBUSTION TURBINE

A combustion turbine power plant operates much like a steam turbine power plant except that the medium which flows past the turbine blades, causing them to turn, is the gaseous product of a combustion process. The turbine drives both the electricity generator and also a compressor which compresses input air to a relatively high pressure before it is mixed with gas or liquid fuel in the combustion chamber. The exhaust gases are released to the air after passing through the turbine. The efficiency (20 to 30 percent) of combustion turbine power plants is lower than that of steam turbine power plants, so operating costs tend to be higher.

A combustion (gas) turbine system is distinguished by three major differences from that of a steam turbine:

- The combustion turbine is an internal combustion engine, unlike the steam turbine in which fuel is burned in an external boiler.
- The combustion (gas) turbine uses a different working fluid--some type of gaseous substance (usually atmospheric air and products of combustion). A common misconception with gas turbines is that its name refers to the fuel that the engine uses, for example, natural gas. Because of this misconception, the name "combustion turbine" is sometimes preferred.
- The combustion turbine operates at high temperatures and low pressures, while the steam turbine generally operates at high pressures and moderate temperatures.

Combustion turbines have some environmental advantages when compared with other thermal power plants. Since they do not use a steam cycle, they do not add heat to water. Exhaust heat is vented into the air from a short stack. They are relatively small plants, so they tend not to disfigure their sites and require little ground space.

Combustion turbine plants are generally used as peakload facilities to meet a load demand level occurring only at certain times of higher than normal electricity use or demand.

gas should be available as a transition fuel through the 1980s and beyond, but at costs above the prices paid under natural gas regulations. Uncertainties, such as PIFUA, which prohibits the use of natural gas in new power plants, cloud the analysis of long-term availability of this fuel.

OIL

Oil is a petroleum product, like natural gas, occuring in nature and formed by chemical decomposition of organic sediments. It consists of chains of hydrocarbon molecules which are a product of the petroleum refining process which also produces gasoline.

California power plants use two grades of oil as fuels. Residual fuel oil (No. 6) comprises 90 percent of the oil burned in California power plants; distillate fuel oil (No. 2) essentially constitutes the other 10 percent. Residual fuel oil while more polluting than natural gas would be significantly less polluting than coal. Pollutants commonly associated with the burning of oil as a power plant fuel include nitrogen dioxide, sulfur dioxide, particulates, and hydrocarbons (see Appendix D). Air pollution control technology reduces the amount of these pollutants released into the atmosphere.

PIFUA also prohibits the use of oil as a fuel for new plants, and CEC supply criteria call for a 50 percent reduction in the use of oil for power generation by 1991. In-state oil production accounts for 40 percent of California's total oil needs. Alaskan oil contributes another 40 percent, and, in 1978, the remaining 20 percent was imported from foreign sources. The state's most abundent petroleum resource is heavy crude oil.

METHANOL

Methanol is a liquid synthetic fuel which can be derived from a variety of organic sources, including coal. It is also known as methyl alcohol or wood alcohol. It is cleaner burning than natural gas and hence is a promising fuel for use in California power plants. Commercial quantities of methanol are not projected to be available in California until the mid-to-late 1980s, at which time it may be expected to have to compete with coal direct-fired plants. This competition would be highly dependent on the fuel source logistics, local air quality standards for power plants and other power plant siting variables such as water supply.

As a power plant fuel, methanol supplies may most logically be tied to the coal source. Coal-to-methanol processes such as the Otto-Saarberg/Lurgi and Texaco/Chem already exist, but are not commercially available. The methanol synthesis involves the reaction of the coal gasification product gas with a catalyst suspended in oil. The methanol product is condensed from the gas of this reaction.

Deployment of this technology will likely require on-site back-to-back arrangement of the methanol producing facility and the coal mine due to the economics and logistics involved. A methanol pipeline to a single power plant would not be economical, rather a terminal/distribution facility would be required.

APPENDIX C

FACTOR DEFINITIONS

1. Parcel Size

Different types of power plants and cooling processes require different amounts of land area for optimum plot design. An area of at least four acres is required for the smallest of the plant types considered in this study. The effect of the application of this factor is to initially eliminate from further analysis all UAs of less than four acres.

2. Terrain Difficulty

A power plant (depending on shape, size, and type of technology) requires a certain amount of level ground. This amount varies to some degree because there is flexibility in plant configuration and the number of ancillary facilities which may be required for the power plant will vary. However, it is generally desirable that the slope of a site be within three to four percent. Where sites have natural grades which exceed this amount, the ground is prepared at some additional costs by excavating and filling. In addition, the use of the multi-level pad concept can be used to reduce the level area required and also the excavation costs. However, this type of layout may increase the operating cost of the plant, a trade-off which also should be considered.

Terrain difficulty is commonly used as a power plant siting parameter from a cost-effectiveness perspective in screening large regions and in comparing specific power plant sites. Generally, areas which have rough terrain (i.e., high access/site preparation costs) will rank lower than those with desirable terrain conditions. However, acres with rough terrain, on-hand supply, and close proximity to existing ancillary facilities may be very desirable for power plant siting regardless of any rough terrain and relatively high site preparation costs. Therefore, in most cases (especially in weighing the merits of specific areas), terrain difficulty as a siting parameter should not be used alone to determine the degree of siting constraint it may represent for a particular area (e.g., 10 - 15 percent slope = moderate constraint, 15 - 35 percent = severe constraint, 35 percent plus = prohibitive); other parameters which are site-dependent, related to siting and construction costs, and in terms of site advantages, could overshadow the disadvantage of difficult terrain, must also be evaluated.

Terrain difficulty is used in this study as a screening factor to indicate the relative degree of siting constraint within large areas of the coastal region. Terrain difficulty as used, incorporates general site preparation cost considerations into the project planning process. Site preparation costs related to terrain difficulty include those costs related to developing an accessible, stable site with the level ground necessary for the power plant and ancillary facilities, and those costs related to mitigating all potential impacts which go along with siting in rough terrain. The areas indicated in this study as having terrain conditions imposing constraints to power plant siting represent the most severe terrain conditions in the coastal regions of California.

Identification of these areas was based on the severity of the terrain conditions (e.g., cliff faces rising abruptly to high elevations above sea level), combined with the lack of any apparent advantages which could offset the difficulty and costs of construction and operation of a power plant.

3. Emission Limitations

Emission limitations regulate the maximum rates of particulate matter, oxides of nitrogen, and sulfur dioxide that a fossil fuel plant may emit. The emission rates for the power plant and fuel type combinations considered in this study were calculated based on currently available information on emissions, and emission control technology applicable to facilities which would come on line by 1990. These emission rates were then compared with the applicable emission limitations of the air pollution control districts or air quality management districts having jurisdiction over the specific sites.

4. New Source Review

Under New Source Review (NSR) regulations, mandated by the California Air Resources Board (and by many air pollution control and air quality management districts), if a new source would violate ambient air quality standards or would aggravate an existing violation, it can only be built if adequate trade-offs are obtained. These trade-offs would consist of reductions in similar emissions and in similar quantities from other pollutant sources in the area.

For purposes of this study, it was assumed that if the new plant would cause an ambient standard violation where none existed before, the plant could not comply with NSR regulations. This is because only a major trade-off source located very close to the new plant could mitigate such an impact, and such a source would not generally exist. It was also assumed, however, that if a new plant would exacerbate an existing ambient standard violation, the impact could be mitigated if sufficient trade-offs could be obtained in the same county (or air basin, in the case of the Bay Area). Using these criteria, the quantity of potentially available trade-offs in the county of concern was assessed to determine whether NSR regulations could be met.

5. PSD

Prevention of Significant Deterioration (PSD) regulations are enforced by the federal government (EPA). These regulations limit the amount of air quality deterioration permitted in areas where existing air quality for sulfur dioxide and/or particulates is better than the ambient air quality standards. It was determined whether a new plant, at a specific site, would exceed the allowable PSD deterioration increments.

6. Slope Instability

a. Active Sand Dunes

Active sand dunes are "those regions covered with unvegetated (cohesionless) windblown sand." As defined, active sand dunes pose a unique constraint to power plant siting for two basic reasons. First, the transient nature of the active dune environment may significantly change the site characteristics over the design life of a facility. Secondly, the loose, generally well-sorted poorly graded) sand, if continuous at depth and accompanied by a high groundwater table, creates poor foundation conditions for structures and a high potential for liquefaction in the event of seismic shaking.

b. Quaternary Landslides

These are landslides that have demonstrated activity during Quaternary time (the past two to three million years).

Quaternary landslides may be hazardous to power generating facilities, depending on the proximity of the facilities to the unstable ground. It is assumed in this report that if an identified landslide has shown movement during Quaternary time, it has the potential to move again at any time. If a facility is sited in close proximity to a slide, the slide could destroy the facilities by encroachment or loss of all foundation support.

c. Steep Riverbank Slopes and Recognized Sea Cliff Instability

These two phenomena have a similar constraining effect on power plant siting, both areas are subject to slope failure primarily due to undercutting by erosion with potential for failures caused by seismic shaking (lurching, etc.).

Slope instability problems should be considered during the siting of power generation facilities by weighing the advantages of avoidance against engineering and design mitigation. In many cases, adequate setback from unstable slopes will be the most effective mitigation.

7. <u>Faults and Related Seismic Hazards</u>

a. Ground Surface Rupture Due to Faulting

The CDMG report identifies many "potentially active" and "active" faults in the study areas. For this study, CDMG considers a fault active if it can be shown to cut Holocene (the past 11,000+ years) strata, and potentially active if it has not been shown to be overlain by (unfaulted) strata at least two to three million years old.

Fault movement can literally tear facilities apart if they are built on fault traces that have a potential for ground surface rupture. Therefore, recognition and avoidance of such fault traces is generally the best mitigation for this hazard.

b. Seismic Shaking

Seismic shaking is the shaking of the ground due to earthquake activity.

The coastal zone of California is generally considered a seismically active area and seismic shaking can he expected. Severe damage to power generation facilities can occur unless adequate precautions are taken in the site selection process to adequately identify this potential and develop appropriate facility design. During the site selection process, early identification, delineation, and quantification of the potential for seismic shaking are essential to cost-effective design and construction. Siting constraints can arise from potentially strong seismic shaking when seismic design costs begin to dominate facility design and construction.

c. Seismically Induced Liquefaction

Liquefaction refers to the almost complete loss of strength in saturated, cohesionless, sandy deposits accompanying ground shaking during an earthquake.

Many of the "undesignated" areas studies by CDMG are underlain by potentially liquefiable materials.

In identifying the potentially liquefiable regions, CDMG used the following methods and assumptions:

(1) The region is seismically active and earthquakes of sufficient magnitude and duration to cause liquefaction in appropriate soil conditions will occur.

(2) These soil conditions occur in nonindurated, well sorted, sandy and silty sand areas, as described on the geologic maps of Woodring and Bramlette (1950).

(3) Liquefaction could only occur if these sediments were in a saturated condition below the water table.

(4) Liquefaction would probably not occur at a depth greater than 18 meters due to high confining pressures below this depth.

Using these assumptions, CDMG has identified areas of sand dunes, and alluvium with groundwater levels less than 18 meters in depth, as potentially liquefiable. Mitigation of these conditions can range from avoidance to excavation, dewatering, and special foundation design.

7. Selected Mineral and Geologic Resources

a. Fossil Fuel Production

Fossil fuel production defines the withdrawal or mining of oil, gas or coal from below the surface of the ground. Large quantities of oil have been and are still being produced in the well-explored and highly productive oil fields which are located within the CDMG study areas.

Some of the potential power plant siting constraints associated with oil field development and operation are related to hazardous conditions created by oil field production. These include:

(1) Differential settlement and potential reactivation of faults due to fluid withdrawal.

(2) Induced seismicity associated with secondary recovery methods such as steam injection.

(3) The loss of petroleum resources if production is stopped to mitigate the types of problems associated with oil field production.

In addition, opportunities for power plant development may exist within areas of oil field development and operation in the form of cogeneration from enhanced oil recovery techniques (e.g., steam injection). These are identified and discussed on an area-by-area basis.

b. Other Mineral Deposits

Portions of the coastal zone contain extensive deposits of commercial quality minerals, such as diatomite. Extensive power plant development which conflicts with the development of a valuable or potentially valuable mineral resource can effectively eliminate that resource as a mineable commodity. These potential resources have been identified by CDMG and the degree of constraint these resources create to power plant siting is indicated on an area-by-area basis.

9. <u>Urban Areas</u>

a. Residential--Land use designation for areas with single or multi-family dwelling units of a density not less than four units per acre.

b. Industrial--Land use designation for areas predominantly used for manufacture or treatment of goods from raw materials or transportation of those goods.

c. Commercial--Land use designation for areas predominantly used for the retail sale of goods or services or for governmental and commercial offices.

10. <u>Cultivated Agricultural Lands (From the Williamson Act)</u>

"1) All land which qualifies for rating as Class I or Class II in the Soil Conservation Services' Land Use Capability classification.

2) Land which qualifies for rating 80 through 100 in the Storie Index Rating.

3) Land which supports livestock used for the production of food and fiber and which has an annual carrying capacity equivalent to at least one animal unit per acre as defined by the U.S. Department of Agriculture.

4) Land planted with fruit or nut-bearing trees, vines, bushes or crops which have a nonbearing period of less than five years and which will normally return during the commercial bearing period on an annual basis from the production of unprocessed agricultural plant production not less than $200 per acre.

5) Land which has returned from the productions of unprocessed agricultural plant products an annual gross value of not less than $200 per acre for three of the previous five years."

11. Recreational Activity Areas

Areas designed or established for play, amusement, or relaxation such as public parks and beaches, resorts, campgrounds, and open space.

12. Military Bases

Areas managed by the United States Defense Department for training, target practice, bombing range, and weapons center.

13. View Protection

Preservation of areas with high scenic value including scenic highways, wild and scenic rivers, and areas identified in the Coastal Plan as scenic areas.

14. Transportation/Rail Lines

Areas with various modes of access to a site--land (road or rail) or sea (harbor, pier, or landing).

15. Transmission Lines

A network of lines designed to transmit electricity from one point to another. These lines also include the corridor or utility right-of-way.

16. Available Lands

A measure of vacant land actually present on a site. A specific parcel must be of sufficient size to support an individual unit or ancillary facility. Vacant land encumbered by easements or utilities was not considered available. Land areas with intensely developed uses immediately adjacent to existing sites was also not considered available.

17. Cultural Resources

Cultural resources are prehistoric and historic remains comprising a nonrenewable resource base that provides anthropologists and historians with information for reconstruction of past cultural systems and behaviors. In addition to traditional cultural (i.e., archaeolgical) resource concerns, religious and other cultural elements of concerned ethnic minorities are addressed in this document.

18. Legally Protected Species

Legally protected species are those rare, endangered or fully protected species of plants and animals officially recognized by the state or federal government as being legally protected because of their uniqueness, scarcity, or threatened extinction. Any activity that results in a significant impact to these species by way of disturbance or loss of habitat or part of the population should be avoided. On a statewide or regional level, presence of these plants or animals indicates an area of high avoidance in terms of power plant development. Determination of the precise location of the species and the actual impacts must be made on a site-specific level.

19. Commercial/Recreational Species

Commercial and recreational species are those plants and animals that are valuable because of their commercial or consumptive and nonconsumptive recreational values. The presence of the species, the value of the area to the natural history of the species, and the existence of its commercial or recreational use in the area must be considered in evaluating this concern. Power plant siting is not excluded from areas supporting commercial or recreational species. Depending on the value of the area and the species, however, mitigation may be required.

20. Areas of Critical Concern

Areas of critical concern are unique or special habitats or biological communities that may need protection from potential adverse effects resulting from energy facility development. They include:

a. Wetlands--Includes salt marshes and associated tidal mudflats and extend beyond the upper edge of tidal influence to where freshwater marsh is the predominant habitat. Wetlands can be either seasonal or permanent.

b. Estuaries--Tidal influenced area of high potential biological productivity due to mixing of freshwater with seawater as a river empties into the ocean.

c. Riparian Area--Ecologically distinct habitat created by growth of vegetation dependent upon water from a river or stream for continued existence.

d. Refuges and Reserves--Areas recognized by the government as set aside to preserve the ecology, plant, and/or animal species indigenous to an area. Can include ecological preserves, areas for educational and scientific study, and wildlife refuges.

e. Natural Areas--Areas which are unique or are of particular scientific or educational interest. These include habitats of rare or endangered plant and animal species, reflect or disjunct populations, paleontological sites, note worthy geological features, and areas of historical interest. Also includes those areas representative of the various biotic communities found in the state.

21. Species of Special Concern

Species of special concern are candidate rare or endangered species, unique species, or ecologically valuable species that may need protection from potential adverse effects resulting from project development. This includes those rare and endangered plants recognized by the Smithsonian Institution and California Native Plant Society. Various raptors and carnivores may also be included in this group. Species in this category may be identified by local, state, and federal agencies with resource protection responsibilities or by educational institutions, museums, biological societies, or special interest groups that have specific knowledge of the biological resources in an area.

22. Cooling Water Availability

A finding that cooling water is available indicates that there appears to be no overriding technical or environmental constraints which would preclude the use of ocean water for once-through cooling.

23. Waste Water Availability

A finding of waste water availability for cooling indicates that waste water is expected to be available from a specific source or sources in sufficient quantity and time frame to allow its possible future use.

24. Once-Through Cooling Impacts

Once-through cooling impacts include impingement and entrainment of marine organisms as well as impacts from heated discharges. Potential for unacceptable impacts relate primarily to the existence of unusually high concentrations of susceptible organisms in the intake/discharge vicinity and the inability, due to physical factors, of avoiding potential high impact areas in placement of intake and discharge structures.

25. Waste Disposal Impacts

Waste disposal impacts can result in a constraint if it is not likely that a satisfactory disposal site can be developed to contain expected wastes generated at a site consistent with applicable standards and regulations.

26. Water Quality Standards Conformance

All facilities constructed and in operation must conform to applicable water quality standards. If it appears that a particular technology located at a site will result in noncompliance, this is identified as a constraint.

27. Flood Hazard

This factor is based on the effects from known/projected results of 100-year floods and tsunami run-up.

APPENDIX D

TABLE D-1 EMISSION LIMITATIONS

DISTRICT	POLLUTANT	RULE	LIMITATIONS
Del Norte County	PM	420(b)	.23g/m^3 @12% CO_2 (steam generating units)
		420(a)	.46g/m^3 @12% CO_2 (general combustion sources)
	NOx	-	None
	SO_2	440	1000 ppm
Humboldt County	Same and Del Norte		
Bay Area AQMD	PM	6-311	Up to 40 lb/hr @57,320 lb/hr process wt.
		6-310	0.15 gr/DSCF
	SO_2	9-1-302	300 ppm (dry)
		9-1-304	.5% by wt. S content
	NOx	9-3-301	gas fuel 175 ppm liquid or solid 300 ppm
Monterey Bay Unified	PM	403(b)	Up to 40 lb/hr @60,000 lb/hr process wt. (solid fuel); all PM covered
		403(a)	.15 gr/scf
	NOx	404(b)	140 lb/hr
		404(c)	225 ppm @3% O_2 for units with heat input greater than 1.5 X 10^9 BTU/hr
	SO_2	404(a)	0.2% by vol.
		412,413	S content 0.5% w/FGD exemption
San Luis Obispo Co.	PM	403(b) 403c.1 403c.2	Up to 40 lb/hr @60,000 lb/hr process wt. (solid fuel) (dust and fumes only) 0.3 gr/scf @12% CO_2 10 lb/hr 140 lb/hr
	NOx	405A.2 405A.1	225 ppm (gaseous fuel) and 250 ppm (liquid/solid fuel) @ 3% O_2 for sources w/heat input 1.775 x 10^9 BTU/hr
	SO_2	404A 404D 404E	 0.2% by vol. 200 lb/hr S content 0.5% w/FGD exemption
Santa Barbara Co.	PM	306	Up to 40 lb/hr @60,000 lb/hr process wt. northern zone (dust and fumes)
		305	Minimum of 0.01 gr/SCF@2.5 X 10^6 scfm discharge rate (solid fuel only), southern zone

DISTRICT	POLLUTANT	RULE	LIMITATIONS
Santa Barbara Co.		304	0.3gr/scf (no CO_2% given), northern zone
		307	Up to 30 lb/hr @ 10^6 lb/hr process wt. (all particulates), southern zone
	PM	309A.2	0.3 gr/scf, northern zone 0.1 gr/scf, southern zone
		309E.3.c	10 lb/hr (fuel derived)
	NO_x	309E.3.b	140 lb/hr
		309F	125 ppm (gaseous fuel) and 225 ppm liq./solid fuel) @3% O_2, southern zone
	SO_2	311A	FGD exemption for Rule 311
		311B	15 gr/100 ft^3, as H_2S, gaseous fuel S content, or 0.5% sulfur liq./solid fuel, southern zone
		311C	50 gr/100 ft^3, as H_2S, gaseous fuel S content, or 0.5% sulfur fuel, northern zone
Ventura County	PM	53	Up to 30 lb/hr@10^6 lb/hr process wt. (all solid particulates)
		52	Minimum of 0.01 gr/scf@2.5 X 10^6 scfm exhaust flow rate (solid fuel only)
		57B	0.1 gr/scf@12% CO_2
		60	10 lb/hr
	NO_x	59	125 ppm (gaseous fuel) and 225 ppm (liq./solid), 250 X 10^6 BTU/hr
		59.1	systemwide NO_x emission limitations, with scheduled emission reductions and NO_x dispatch
		60	140 lb/hr
	SO_2	60	200 lb/hr
		54A	300 ppm
		54B	at or beyond property line, ground level concentration limited to 0.04 ppm (24 hr) and 0.5 ppm (1 hr)

DISTRICT	POLLUTANT	RULE	LIMITATIONS
Ventura County (Continued)		64	15 gr/100 ft^3 S content, as H_2S, natural gas; 50 gr/100 ft^3 other gas; 0.5% by wt. S content, liq./solid fuels; <u>no</u> FGD exemption
South Coast AQMD	PM*	405	Up to 30 lb/hr@1.1 X 10^6 lb/hr process wt. (all particulates)
		409	0.23 g/m^3 (.1 gr/scf) @ 12% CO_2
		475 476	11 lb/hr and .01 gr/scf @ 3% O_2 (<u>both must be exceeded for violation</u>)
	NO_x*	474	Los Angeles, Orange: ppm NO_x @ 3% O_2 heat input (10^6 BTU/hr) — gas — liquid/solid 555-1786 — 300 — 400 1786-2143 — 225 — 325 2143+ — 125 — 225 Riverside, San Bernardino: for 50 X 10^6 BTU/hr heat input, 125 ppm NO_x (gas); 225 ppm (liq./solid)
		475	for 50 X 10^6 BTU/hr heat input, 80 ppm NO_x (gas); 160 ppm (liquid); 225 (solid), all @ 3% O_2 NO_x emissions must be less than 1.70 lb/net MW-hr
		476	steam gen. equipment 50 X 10^6 BTU/hr treat input: 125 ppm NO_x (gas); 225 ppm (liquid/solid)
		1135.1	systemwide NO_x control strategy; 4 options available for achieving systemwide NO_x reductions of 90% by 1990; NO_x dispatch also required.
	SO_2*	431.1(a)	Natural gas or substitute N.G. limited to 80 ppm sulfur compounds (as H_2S), with FGD exemption

* The SCAQMD portion of the SIP still has Rule 67: 10 lb/hr for PM, 140 lb/hr for NO_x and 200 lb/hr for SO_2.

DISTANCE	POLLUTANT	RULE	LIMITATIONS
South Coast AQMD (Continued)		431.2(b)	for steam generators, 0.25% S liquid fuel, with FGD exemptions
		431.3	no fuel with sulfur content resulting in .56 lb/10^6 BTU (with FGD exemption)
San Diego County APCD	PM	54**	up to 40 lb/hr @60,000 lb/hr process wt. (dust and fumes)
		53(b)	0.1 gr/dscf @12% CO_2
	NO_x	68	for heat inputs 50 X 10^6 BTU/hr @ 20^oC: 125 ppm (gas); 225 ppm (liquid/solid)
	SO_2	53(a)	.05% by dry vol.
		62	S content 0.5% by wt., with FGD exemption (liquid/solid); S content 10 gr/100 scf, as H_2S (gas), with FGD exemption

** APCD staff have indicated that this rule does not apply to power plants; ARB staff have held that similar rules in the Sacramento Valley do apply.

APPENDIX D

TABLE D2: PLANT TYPES & SPECIFICATIONS

Technology/Fuel	Size (MW)	Emissions (g/sec) SO_2	NO_x	Partic	HC	Stack Specifications ht(m)	Temp(^{o}k)	flow(m^3/sec)
Direct-fired Coal	100	8.6	3.8	0.63	0.9	150	355	222
	500	43	19.2	3.2	4.4	150	355	1110
	1300	111	49.8	8.2	11.6	150	355	2880
Steam Turbine/Oil	150	2.4	3.4	4.3	1.2	137	394	200
	500	7.8	11	14	4.0	137	394	665
	800	12	18	23	6.4	137	394	1065
Steam Turbine/Natural Gas	150	.10	1.8	.05	.17	137	394	200
	500	.34	6.2	.17	.56	137	394	665
	800	.54	9.9	.27	.91	137	394	1065
Steam Turbine/Methanol	150	0	1.0	.17	.17	137	394	200
	500	0	3.4	.56	.56	137	394	665
	800	0	5.5	.91	.91	137	394	1065
Steam Turbine/Coal Gas (SNG)	150	.50	2.5	.17	.17	137	394	200
	500	1.7	8.4	.56	.56	137	394	665
	800	2.7	13	.91	.91	137	394	1065
Combined Cycle/Oil	400	24	7.1	.62	3.0	60	441	1247
	500	30	8.8	.77	3.8	60	441	1558
	1300	93	26.5	2.0	9.8	60	441	4051
Combined Cycle/Natural Gas	400	0.24	6.3	.12	.42	60	441	1247
	500	0.30	7.9	.16	.52	60	441	1558
	1300	0.78	21	.41	1.3	60	441	4051
Combined Cycle/Methanol	400	0	5.8	.12	.42	60	441	1247
	500	0	7.2	.16	.52	60	441	1558
	1300	0	19	.41	1.3	60	441	4051
Combined Cycle/Coal Gas (SNG)	400	1.2	6.4	.12	.42	60	441	1247
	500	1.6	7.9	.16	.52	60	441	1558
	1300	4.1	21	.41	1.3	60	441	4051

TABLE D3: TRADEOFF REQUIREMENTS

Technology/Fuel	Size	SO_2 T/D	SO_2 #/hr	NO_x T/D	NO_x #/hr	Partic T/D	Partic #/hr	HC T/D	HC #/hr
Direct-fired Coal	100	.82	68	0.4	30	.06	5.0	.09	7.1
	500	4.09	340	1.8	152	.30	25	.42	35
	1300	10.6	880	4.7	395	.78	65	1.10	92
Steam Turbine/Oil	150	2.3**	190**	.32	27	.41	34	.11	9.5
	500	7.4**	620**	1.05	87	1.3	100	.38	32
	800	12.0**	1000**	1.71	140	2.2	180	.61	51
Steam Turbine/Natural Gas	150	.01	.79	.17	14	.01	0.4	.02	1.3
	500	.03	2.7	.59	49	.02	1.3	.05	4.4
	800	.05	4.3	.94	79	.03	2.1	.09	7.2
Steam Turbine/Methanol	150	0	0	.10	7.9	.01	0.4	.02	1.3
	500	0	0	.32	27	.02	1.3	.05	4.4
	800	0	0	.52	44	.03	2.1	.09	7.2
Steam Turbine/Coal Gas	150	.05	4.0	.24	20	.01	0.4	.02	1.3
	500	.16	13	.80	67	.02	1.3	.05	4.4
	800	.26	21	1.24	100	.03	2.1	.09	7.2
Combined Cycle/Oil	400	2.3	190	.68	56	.48	40	.29	24
	500	2.9	240	.84	70	.60	50	.36	30
	1300	7.4	620	2.52	210	1.52	130	.93	78
Combined Cycle/Natural Gas	400	.02	1.9	.60	50	.01	.95	.04	3.3
	500	.03	2.4	.75	63	.02	1.2	.05	4.1
	1300	.07	6.2	2.00	170	.04	3.3	.08	10.1
Combined Cycle/Methanol	400	0	0	.55	46	.01	.95	.04	3.3
	500	0	0	.68	57	.02	1.2	.05	4.1
	1300	0	0	1.81	150	.04	1.3	.08	10.1
Combined Cycle/Coal Gas	400	.11	9.5	.61	50	.01	.95	.04	3.3
	500	.15	13	.75	63	.02	1.2	.05	4.1
	1300	.39	32	2.00	170	.04	3.3	.08	10.1

* Does not include 1.2:1 factor

** 0.25% sulfur oil; for 0.1% sulfur oil, factors multiplied by 0.4 (South Coast Basin).

APPENDIX D

INFORMATION SOURCES

1. Direct-fired Coal: Emissions--Proportionate to those indicated for 1985 - 1990 plant designs in the CEC staff report "Air Quality Statewide Coal Plant Area Screening Study", Anderson, et al., February 1979; for NO_x, however 80 percent control with selective catalytic reduction (SCR) is assumed. Stack Specifications--SCE Cal Coal NOI.

2. Steam Turbine/Oil: Emissions--Same as those indicated in "Opportunities to Expand Coastal Power Plants in California", CEC, June 1980, except SO_2 emissions are based on 0.25 percent sulfur oil (0.10 percent in the South Coast Basin) and particulate emissions are assumed to be 0.025 lb per 10^6 Btu, based on the CEC staff document "Vol. 1: Technical Assessment Manual, Electrical Generation", CEC, September 1979. Stack Specifications--Based on PGandE Pittsburg 7 Unit, proportionately scaled.

3. Steam Turbine/Natural Gas: Emissions--Based on Compilation of Air Pollutant Emission Factors (AP-42, U.S. EPA, April 1973, for SO_2 and hydrocarbons, the SCE Coal Gasification Project AFC for particulates, and the SCE Alamitos 5 Unit, plus 90 percent SCR for NO_x; heat rate equivalent to Alamitor Steam Turbine/Methanol: Emissions--Based on "Assessment of Advanced Coal-Based Technologies for use in California", Radian Corp., January 1980, plus 90 percent SCR for NO_x hydrocarbon emissions assumed the same as for (3) above. Stack Specifications--Same as (2) above.

4. Steam Turbine/Coal Gas: Emissions--Same as (4) above.
   Stack Specifications--Same as (2) above.

5. Combined Cycle/Oil: Emissions--Based on SCE Combined Cycle NOI, using 0.1 percent sulfur oil, 90 percent SCR for NO_x and a heat rate of 7809 Btu/kWh. Stack Specifications--Based on PGandE's Potrero 7 AFC.

6. Combined Cycle/Natural Gas: Emissions--Same as (4) above for NO_x same as (3) above for particulates, SO_2 and hydrocarbons. Stack Specifications --Based on PGandE Potrero 7 AFC.

7. Combined Cycle/Methanol: Emissions--Same as (4) above.
   Stack Specifications--Same as (7) above.

8. Combined Cycle/Coal Gas: Same as (8) above.

APPENDIX E

SETBACK CRITERIA

Background

A necessary part of the steam electric (Rankine) generating cycle is the condensation of the spent steam after it is exhausted from the steam turbines. This is typically accomplished by conducting the spent steam through a condensing heat exchanger, where it contacts a series of condenser tubes through which water is circulating. In the process the steam is cooled, condenses back into water, and is pumped back to the boiler for reuse. Inside the condenser tubes, the water is heated and circulated back to the heat sink, which can be a cooling tower (wet or dry) disposing of the heat to the atmosphere, a water body (pond, lake, or ocean), or some optimized combination thereof.

Every steam electric generating plant requires a system for heat disposal, and the cooling system is a major item in the plant construction and operating costs. Cooling system types also range widely in their costs and environmental effects, with costs appearing to vary inversely with perceived mitigation of environmental effects.

When practical, in California the preferred cooling method has been "once-through", in which water is removed from the ocean, run through the condensor, and returned to the sea. This cooling method has been selected principally on the basis of least cost (it allows design of more efficient plants) and proximity to large load centers on the coast. In the face of increasing environmental regulations of thermal discharges and land use conflicts along the coast, California utilities have turned their attention to inland siting the the use of cooling systems (cooling towers) that reject heat to the atmosphere.

Once-Through Cooling System Description

When power plants are located very near large water bodies or major rivers, the least cost and preferred cooling method involves conducting water withdrawn from the nearby source directly through the condensing heat exchanger. Within the heat exchanger, an increment of heat is added to the water, raising its temperature by a predetermined designed amount called the condenser "delta T" (ΔT). The quantities of water needed for this function by modern generating facilities are large and depend on plant size, type, efficiency, and design Δ T. Table E-1 illustrates the quantities of water needed for different types and sizes of plants.

Once-through systems can entail a variety of environmental effects that vary with plant size, type, and method of generation. Adverse water quality effects can result from the heat rejected to the water body receiving the plant discharge. The significance of the heat addition varies as a function of plant location, the size of the water body heat sink, circulation and current patterns in the water body, and the ecological system present in the water body. At inland sites waste heat can, by increasing water body surface temperatures, cause slightly increased evaporation rates and thereby affect the overall heat budget and potentially the dissolved solids level of the water body.

TABLE E1

COOLING WATER REQUIREMENTS

PLANT TYPE	SIZE (MWe)	HEAT RATE (Btu/Kwh)	EFFICIENCY (%)	HEAT REJECTED (Btu/Sec x 10^{-3})	COOLING WATER REQUIREMENTS THEORETICAL (1) FT3/SEC	GPM x 10^{-3}	ACTUAL GPM x 10^{-3}
A. PWR	500	10500	32.5	984	804	361	393 (3)
B. PWR	1200	10500	32.5	2362	1931	867	942 (3)
C. Coal (DF)	500	10425	32.7	975	797	358	167 (4)
D. Coal (DF)	1300	10425	32.7	2536	2072	930	435 (4)
E. STG	150	9400	36.3	250	204	92	75 (7)
F. STG	500	9400	36.3	832	680	305	250 (5)
G. STG	800	9400	36.3	2997	1087	488	335 (6)
H. CC	400	8370	40.8	550	450	202	117 (2)
I. CC	500	8370	40.8	688	562	252	146 (2)
J. CCC	1300	8370	40.8	1788	1461	656	380 (2)

(1) All heat is removed by the cooling water system.

(2) Based on the Potrero 7 (414 MWe) AFC, subtracting out stack gas losses and ratioing to the plant size in this table.

(3) Based on San Onofre 2 and 3 (1057 MWe) FSAR and ratioing to the plant size in this table.

(4) Based on Cal Coal NOI and ratioing to the plant size in this table.

(5) Based on Potrero (501 MWe) NPDES and ratioing to the plant size in this table.

(6) Based on Scattergood (823 MWe) NPDES and ratioing to the plant size in this table.

(7) Ratioed by plant size based on (5) above.

Another group of effects are a result of the large volumes of water required for once-through cooling systems. Current at the intake and discharge structures can cause sediment movement as well as effects on floating, suspended, and swimming aquatic organisms. Fish and larger organisms can be trapped against intake screens (impingement), while smaller organisms and plankton can be drawn into and thorugh the cooling system (entrainment). The significance of these effects has been the subject of much study and appears to vary widely. Recent findings will be discussed in a later section.

- Beach and Riverside Systems

  Traditional systems have been designed on least-cost criteria which have dictated the placement of intake and outfall structures as well as condenser and plant location. In such systems, costs have been as low as 3 - 5 percent of total plant capital costs, and cooling system energy requirements are minimal.

  Intake and outfall structures have frequently been very short and have used canals across the beach to conduct water to or from the plant. Water temperatures off the California coast are sufficiently low that the slight increases in turbine back-pressure from the minimal summer sea surface temperature rises were more than offset by the capital savings of the very short intake and outfall conduits.

  Condenser evaluation has ideally been restricted to approximately 30 feet above the surface of the cooling water body, allowing for siphon heat recovery as the cooling water leaves the condenser. Pumps can thus be sized only slightly larger than would be required to overcome condenser and conduit friction losses, and minimum energy is required to cool the plant.

  At certain locations in the state, plants have deviated from this general pattern with either slightly greater distances to the coast (Huntington Beach) or higher lifts (Diablo Canyon), but in most cases plant sites have been chosen at both low elevations and in close proximity to the ocean or estuary shores. The coastal proximity of the state's largest load centers has also tended to foster coastal siting from the standpoint of transmission cost minimization. A further factor mitigating for coastal sites, but historically of lesser importance is the Rankine cycle efficiency gains possible from this lowest possible temperature heat sink. Power plants using once-through cooling have not as yet been sited at inland locations in California. However, certain rivers in the northern portion of the state could possibly be used for cooling moderate sized plants, especially if condensing systems were designed to operate in conjunction with reservoirs having selective height intake structures. Power generation efficiency increases, power plant dispersion, and environmental thermal management goals could potentially all be served by consideration of certain such sites.

- Setback and Other Innovative Systems

  With the arrival of public sentiment for coastal protection in the late sixties and later embodied in legislation forming the California Coastal Commission, plant configurations entailing greater distances from the marine cooling water source have been considered. Such semi-coastal or set-back plants are thus able to avoid coastal land use conflicts while still retaining the principal benefits of ocean once-through cooling. The system selected for economic analysis in this study involves a traditional type of cooling system (with or without environmental mitigation measures on the intake and outfall facilities) in which the plant is moved inland and further above the cooling water source. Cooling water would be transported to and from such plants in large diameter pipes by pumping from the typical beachside intake screen well, with water returning to the source by gravitational flow thorough a hydroelectric generating facility into an energy dispersing chamber and subsequently into the ocean diffuser pipe.

Within the set-back siting concept there are several alternate system configurations that are also potentially useful in specific instances but will not be dealt with in detail. As in this study, one such alternate involves energy recapture turbines on the return water conduits. For plants with relatively short, high lifts such turbines reduce pumping energy requirements, and in today's economic climate are cost effective. A drawback to such facilities is the probable lack of compatibility of such systems with the pressurized diffuser outfalls that are currently mandated by thermal discharge regulations. This shortcoming may be overcome by proper design of the discharge structure which feeds the diffuser.

Another possible system allowing plants to be placed further from the coast could utilize smaller volumes of cooling water and greater condenser temperature increases. To meet thermal criteria, this water could then be mixed with an equal or greater volume of cool water at the beachside before being discharged to the marine environment. Problems with this concept center on the higher incidence of thermal damage to entrain organisms in the cooling system transported to the plant. However, this factor may be partially balanced by a lower incidence of damage to organisms in the mixing stream and the ability to design the mixing stream to achieve any given outfall temperature, making across-the-beach discharges possible within state thermal goals.

Yet another cooling system configuration involves utilization of the thermal gradient present off the California Coast (to a greater degree south of Pt. Conception) to achieve maximum plant efficiency with potentially minimal (or positive) environmental impact. In such a system, the intake conduit would reach sufficient depths so that cold profundal waters of essentially constant year-round temperatures are available for plant cooling. With such waters, the cooling system can be designed to add an increment of heat that is limited to the natural rise found between waters at the intake depth and warm summer surface temperatures under stratified conditions. The effluent could then be discharged across the beach into the wave zone or in a near-surface conduit and remain stratified in an equal temperature environment in the summer. In the winter months, outfall temperatures would remain at summertime levels but would be within ranges regularly experienced by the local biota.

A final and most innovative system could, where topographically and geologically possible, involve the combination of a set-back base load plant with a pumped storage capability providing hydroelectric peaking. Such a project would involve storage, at or above plant elevation, of the warmed cooling water pumped during off-peak hours by the base load plant. This water could then be released during peak demand hours, providing short-term capacity at an instantaneous generation level of perhaps four to six times that required to pump water for the plant cooling system. As in the aforementioned energy recapture turbine configuration, 35 - 40 percent of the total pumping energy generated could be emptied once each day; larger reservoirs would allow greater operational flexibility, i.e., energy storage on weekends. Environmental effects could include greater duration of thermal stress for entrained organisms, vegetation removal in the storage reservoir, and potential salt water contamination of ground waters below the reservoir site. The latter problem in the storage reservoir, and potential salt water contamination of ground waters below the reservoir site. The latter problem is not expected to present major difficulties, since reservoir sizes are relatively small and reservoir sealing techniques are a well-known and proven technology.

Technical Aspects of Once-Through Cooling System Design

The most significant aspects of once-through cooling systems for thermal electric power plants are the potential savings in consumptive water use and increases in plant efficiency with accompanying reductions in fuel use. Systems using marine waters completely avoid consumption of freshwater resources in the cooling system. Plants located at selected inland locations using large rivers or lakes for cooling can benefit from the complex heat transfer relationships occurring in the microclimate above these water bodies and achieve significant reductions in water consumption over wet cooling towers. This is a result of the radiative heat transfer from these water bodies to the atmosphere, which is not a significant heat transfer pathway in cooling towers.

Plant efficiency is a second and more complex aspect of thermal electric power generation that is significantly affected by the cooling system. The second Law of Thermodynamics dictates the maximum efficiencies achievable in thermal heat engines. Efficiency is a function of temperature difference between the working fluid entering the machine and its final exit temperature before it returns to the boiler (or other heat source) for reheating. With the steam temperatures currently in use in large fossil fueled plants, the maximum theoretical thermal efficiency is slightly above 60 percent. At present, the best overall efficiency that can be achieved in such plants is about 40 percent, including all thermal, mechanical, and electrical losses. In order to attain an efficiency of 40 percent, it is necessary to incorporate such features as high turbine steam pressure, superheat and reheat of the steam, and preheating of the feedwater entering the boiler. Substantial increases in theoretical and practical efficiencies can only be attained by much higher steam temperatures and pressures and would require materials that could withstand these high temperatures and pressures.

The low temperature heat sinks of preference have been large water bodies or rivers which, on an absolute basis, vary little in temperature during the year, require minimum cost cooling systems, and offer the lowest temperatures commonly available in the environment for heat rejection. In 1974, after consideration of a development document prepared by Burns & Roe Engineering, EPA promulgated thermal discharge standards (since remanded) discouraging once-through cooling. Since then, the industry has been shifting to wet cooling towers as the preferred technology for heat rejection, with the temperature of the heat sink tied to higher and more variable atmospheric wet bulb temperatures. This has resulted in small decreases in efficiency in new plants, with the magnitude of the decrease (energy penalty) dependent on plant type and the percentage of the plant's total waste heat that is handled by the cooling system.

Plant heat rates (amount of energy required to produce 1 kWh of electricity) in California vary from 10,000 - 11,000 Btu/kWh for old fossil or nuclear capacity to 8,400 for new combined-cycle facilities. As illustrated in Table E1, the amount of heat discharged to the cooling system is directly related to the heat rate as well as the type of plant. In a fossil-fired plant, part of the heat input is lost in the boiler, the stack, the turbines and generators, and for station use. The cooling system receives the remainder.

In a nuclear plant, there are no stack heat losses, and the in plant losses are approximately one-third that of a fossil-fired plant. As a result, the cooling system heat load is significantly greater than for a fossil plant with the same heat rate. Adding to this problem are the inherently high heat rates of nuclear plants due to steam temperature limitations. The limit on high temperature brings nuclear plant efficiencies down to that of old fossil plants or new fossil plants with extreme levels of emissions control which require stack (flue) gas reheating.

Combined-cycle plants are interesting in that cooling system constraints affect only one-third of the plant's capacity (the heat recovery boiler-steam turbine portion). While efficiencies in that portion of the cycle are low due to low steam temperatures, the overall system does achieve efficiencies equivalent to or above those available from the newest direct-fired thermal-electric plants and rejects substantially less heat to the cooling system.

Geothermal plants must be placed in a different category from more conventional sources when looking at the effects of cooling system performance on the power plant. Due to the low resource temperatures available from most geothermal sources, the energy dissipated by the cooling system will exceed that contained in the electrical power generated by perhaps an order of magnitude. As a result, cooling system constituents play a major role in dictating what is economically and technically possible in plant design. Heat sink temperature reductions of a few degrees become very important in plant efficiency and economics.

Returning to design considerations important to the cooling system itself, the most critical parameters are the cooling water temperature rise and the cooling water volume. Temperature rise and the plant size, type, and heat rate determine the necessary cooling water volume for coastal, coastal set-back, and inland plants using open cycle cooling. The cooling water volumes, in turn, have effects on the environment, and in the case of setback plants can significantly affect plant economics.

For such setback plants, both the distance to the plant (run) and the height above the cooling water source (lift) must be evaluated in conjunction with the necessary cooling water volume to determine costs for the transmission conduits, pumps, and power to move water to and from the plant. Also of importance are the economic environmental trade-offs in equipping the return water conduit(s) with energy recapture turbines, which appear to have substantial economic benefits. Such a generation facility could be used to offset a portion of the capacity penalty (power charge) needed to move water to the plant. The power charge is likely to be a more determinant variable in system design than water transport system capital costs due to its escalation with fuel cost throughout the life of the facility.

For setback systems using salt water cooling towers, design considerations are quite similar to those at plants using conventional wet cooling towers with the exception of the increase in tower size and the costs for corrosion-resistant materials. Salinity markedly affects the cooling tower size and cost. Size increases are necessary due to the reduction in heat capacity and vapor pressure with increasing salt concentrations. At the present time, cooling water cycles of concentration are limited to about two, due to increasing problems with drift, blowdown disposal, heat transfer, and corrosion at greater concentrations. Note, however, that this study does not address salt water or dry cooling towers.

At certain inland locations significant savings in water consumption can be realized using once-through cooling, though this concept is severely constrained by State Water Resources Control Board (SWRCB) regulations. Principle constraints to cooling system design include the sizing of the plant to stay within the environmental and biological water quality objective of the waterway and requirements for dispersal of thermal discharge into the water body.

Assumptions

Tables E1 - 4 define the parameters on which the study is based. For coastal setback of the power plant, there is not a cost penalty for the intake/ discharge structures since these structures are required on once-through cooling systems for environmental reasons. Therefore, these costs are excluded from this study. The constructed capital cost of the pumping capability includes pumps, pump house, inlet and outlet cooling water piping between pump house and power plant. The constructed capital cost of the hydroelectric generation facility includes the standpipe, located near the power plant on the inlet cooling water piping, hydroturbine and generator, generating house, and energy dissipation facilities.

The sizing of the basic system elements was done by conventional engineering practices. The cost estimation is made complex by virtue of the nonsite specific aspects of this study. The investigation of various systems expanded in scope to eventually include 1,110 separate nonsite specific systems. Site conditions were necessarily idealized and conceptual level cost estimates were prepared on that basis. Cost curves developed for this study are based upon information presented in Bulletin No. 200 entitled "California State Water Project" and published by the California Department of Water Resources.

The following assumptions were made for hydraulic analysis and costing purposes.

a. Prestresses circular concrete pipe was chosen for this study.

b. Computations for the friction factors were performed as outlined in Engineering Monograph No. 7 entitled "Friction Factors for Large Conduits Flowing Full" published by the Department of the Interior, Bureau of Reclamation.

c. A limiting downhill velocity of 20 feet for turbine regulation and to minimize scouring the pipe joints was selected.

d. Pipewall thickness and prestress wire gauges as reflected in cost estimates are consistent with those required and used on actual projects under similar heads and loadings.

e. A trapezoidal cross-section was usd for cut and fill sections where sideslopes were maintained at 3/4 to 1, cover was 4 feet, pipe to pipe clearances were 3 feet and the backfill was composed of locally acquired materials. Excavation for the pipes was based on 50 percent cut and 50 percent fill.

f. As a DWR practice, embankments were considered coutoured as much as practicable.

g. In line with the reconnaissance level of this study, a conservative single value pump efficiency of 77 percent was chosed for this study. Similarly, an efficiency of 90 percent was chosen.

h. The costs of pumping plants, pipelines and hydroelectric plants includes all of those costs necessary to construct each facility in a ready to operate status and include the following:

   1. Labor, equipment, materials and supplies,

   2. Construction superintendence,

   3. Construction engineering and inspection,

   4. Design engineering,

   5. Overhead and profit to contractors and suppliers, and

   6. Allowance for construction contingencies.

i. For the head range covered in this study, reaction type (Francis) turbines were considered for cost purposes. (Reference Bulletin No. 200).

j. A 30-foot diameter, 40-foot high prestressed concrete tank situated adjacent to the consenser was deemed adequate to regulate all of the flows for this study. The 40-foot height is equivalent to the required 15 psi condenser pressure and just over 6 feet in freeboard. Altitude sensors would maintain this water level and also keep the pumps and turbine synchronous. In case of pump failure, the tank water volume would backflow through the pipes until valve closure. This volume of flow thus allows a few seconds for valve closure to prevent water column separation.

k. Outflow energy dissipation for these pipes and head ranges is accomplished by cone dispersion valves and dissipation chamber for the purposes of this study.

TABLE E2

SUMMARY OF DESIGN CRITERIA

Coolant Fluid: Saltwater (once-through).
Temperature of Inlet Saltwater: 55°F.
Velocity of Coolant in Inlet Piping: 7 ft/sec.
Velocity of Coolant in Outlet Piping: 20 ft/sec.
Height (ft): 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1,000.
Setback Distrance From Shireline (ft): 100, 500, 1,000, 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, and 27,000.
Flow Rate of Coolant to Power Plant (thousands of gallons per minute) (per plant type) 75, 117, 146, 167, 250, 335, 380, 393, 435, 942.
Power Plant Condenser Pressure Drop: 15 psi
Condenser Outlet Temperature: 75°F.
Energy Recovery on Coolant Discharge: Hydroelectric Generation Facility.
Energy Dissipation in Discharge Structure: Howell-Bunger or equivalent cone dispersion valve and spray chamber capable of accommodating full rated flow and head pressure.
Design Life: 40 years.
Design Basis: State-of-the-Art 1980.
Coolant Inlet and Outlet Pipes: Prestressed concrete pipe buried in a common trench with four feet of cover.
Excavation Criteria: 50 percent cut and 50 percent fill over the length of the trench and no blasting required.
Pump Efficiency: 77 percent.
Htdro-Turbine/Generator Efficiency: 90 percent.
Hydro-Turbine/Generator Capacity Factor: 50 percent.
Standpipe Near Consenser Inlet: 40' high and 30' in diameter.
Structures: One building for both pumps and hydroelectric generation.
Hrdro-Turbine/Generator and Pumping Plant Annual Maintenance Cost: 3 percent of each facilities capital cost.*
Demusseling of Coolant Inlet and Outlet Structures: Assume a common shoreline structure for both intake and discharge with flow control gates to permit reverse flow in the ocean bottom intake and discharge diffuser and elevating the temperature to eliminate the marine life which fouls the pipes and structures.

*Value chosen by CEC. DWR historical cost data indicated 2 percent but does not represent 1980 $.

TABLE E3

DESIGN CRITERIA - COOLING WATER SYSTEM & CAPACITY FACTORS

PLANT TYPE	PLANT SIZE	CAPACITY FACTORS (7)	COOLING WATER PUMPS*
A. PWR	500 MW	0.60	Four 25 percent capacity pumps.(4)
B. PWR	1200 MW	0.60	Four 25 percent capacity pumps.(4)
C. Coal (DF)	500 MW	0.65	Two 50 percent capacity pumps.(5)
D. Coal (DF)	1300 MW	0.65	Two 50 percent capacity pumps.(5)
E. STM Turbine	150 MW	0.80	Two 50 percent capacity pumps.(6)
F. STM Turbine	500 MW	0.80	Two 50 percent capacity pumps.(5)
G. STM Turbine	800 MW	0.80	Two 50 percent capacity pumps.(5)
H. Combined Cycle	400 MW	0.70	Two 50 percent capacity pumps at 64,000 GPM and 12.5' to 17.5' head.(1)
I. Combined Cycle	500 MW	0.70	Same as the 400 MW plant size.(2)
J. Combined Cycle	1300 MW	0.70	Same as the 400 MW plant size, but two 50 percent capacity pumps for each power module.(3)

(1) This plant would be used for mid-range grid operation. Loss of cooling capacity (one pump) reduces the output to approximately 340 MWe. Simultaneous loss of both pumps does not present a latent heat removal problem and the plant capacity reduces to 280 MW of peaking gas turbine. See Potrero 7 AFC.

(2) Same as (1).

(3) Same as (1) except as follows. Refer to the SCE Combined Cycle Power Generating Station NOI (Ormond Beach Facility). The station is composed of three 430 MW units. Therefore, assume two 50 percent pumps per unit.

(4) Based on the San Onofre FSAR.

(5) For a large utility grid in terms of total MWe installed capacity (as are the California utilities), this size plant would be operated somewhere between the high base-load range and low mid-range considering scrubber start-up/shutdown operational difficulties. No references available.

(6) Same philosophy as the 400 MW combined cycle plant.

(7) CEC Technical Assessment Manual, Table 2 (See References)

* Plant types 1 and 2 were assumed to require four inlet coolant pipes from the pump house to the power plant. All other plant types were assumed to require only two pipes. All plant types were assumed to have one outlet pipe from the condensor to the Hydro-Generator.

TABLE E-4

FUEL COSTS

TYPE		REFERENCE	$/MMBtu and Mils/Kwh
FUEL	PLANT		
Uranium	1 & 2	page 220	$0.68 MMBtu or 7.14 mils/Kwh
Coal	3 & 4	page 130. Base	(1.21 + 1.16) = $1.19/MMBtu (1977$) or $1.53/MMBtu (1980$) with escalation 1978 - 80 = (8.9 + 8.6)/2 = 8.75% yr or 15.95 mils/kwh
Oil	5 -10	page 25, 1980, Medium, 12% sulphur	$\frac{\$3.78 \text{ MMBtu}}{6.05 \times 10^6 \text{ Btu/bbl}}$ (1980$)* or 35.53 mils/kwh (plant types 5,6, and 7) and 31.64 mils/kwh (plant types 8, 9, and 10).
Natural Gas	5 - 10	page 83, PG&E, 1980, P5	$3.00/MMBtu (1980$)* or 28.2 mils/kwh (plant types 5,6, and 7) and 25.11 (plant types 8, 9, and 10)
Coal Gas	5 - 10	page 249, High-Btu	$5 - 8/MMBtu (1979$) Use $8/MMBtu (1980$) or 75.2 mils/kwh (plant types 5, 6, and 7) and 66.96 mils/kwh (plant types 8, 9, and 10)
Methanol	5 - 10	page 244	$6 - 9/MMBtu (1979$) Use $9/MMBtu (1980$) or 84.6 mils/kwh (plant types 5, 6, and 7) and 75.33 mils/kwh (plant types 8, 9, and 10)

* CEC Fuel Price and Supply Projection (See References)

Study Limitations

This cost study has those limitations that are inherent in any work that of necessity assumes an idealized set of conditions. Any specific use made of this report must be with recognition of the following limitations:

a. Construction costs for projects such as those treated herein are sensitive to topography, geology, environmental considerations, and many other factors. Methods employed in developing these cost estimates are consistent with reconnaissance level estimates developed for nonsite specific planning studies conducted by the Department of Water Resources. Cost curves are intended to serve as a cost guide in selecting an alternative system for more detailed study.

   All costs are present (1980) costs and must be escalated for any future use.

   No provisions are made in this cost study for the cost of off-site access roads, unusual or extensive drainage features, lands and right of way for unusually complicated or extensive relocations of existing utilities.

b. There are 1,110 hypothetical plant systems investigated in this report. Although this number appears to cover most situations, it must be noted that each system within itself is idealized. The hydraulic and cost assumptions must be reviewed before applying any site specific significance to any one seemingly similar situation.

Detailed Study Results

Ten base load power plant sizes and types were evaluated in the once-through saltwater coolant analysis and two base load power plants were selected for evaluation in the cooling tower analysis. The data presented in the following figures correspond to the upper and lower limits set for the study, namely, 50' plant elevation with 100' setback and 1,000' plant elevation with a 27,000' setback.

1. Once-through Saltwater Cooling Study Results

   The once-through saltwater cooling analysis study results are shown in Figures E-1 through 14.

Figures E-1 and 2 show the energy required to pump saltwater coolant to each of the 10 power plants and the energy recovered by a hydroelectric turbine/generator facility vs. plant size.

Figures E-3, 4, and 5 show the installed capital cost ($/kW) and the total annual operating and maintenance costs vs. plant size. Figure E-6 depicts the total annual cost vs. plant size (Note - The total annual cost includes the annual operating and maintenance cost and the annual capital charge for the pipelines, pump station and hydroelectric turbine/generator).

Figures E-7 and 8 show the hydroelectric turbine/generator facility installed capital cost and annual kWh generated vs. plant size, respectively.

Figure E-9 depicts the breakeven price of power produced by the hydroelectric turbine/generator facility subject to the study assumptions vs. plant size.

Figures E-10 and 11 show the net cost penalty of the once-through saltwater cooling systems using replacement power costs of 60 mil/kWh.

2. Cooling Tower System Study Results

Figure E-12 shows the results of the breakdown cost analysis for a saltwater cooling tower system vs. a once-through saltwater cooling system as a function of elevation and setback distance for a 1,200 MWe nuclear power plant and a 500 MWe combined-cycle power plant.

Figures E-13 and 14 show the total annual operating pumping cost penalties and construction cost penalties respectively for a 1,200 MWe nuclear and a 500 MWe combined-cycle power plant using saltwater cooling towers as a function of plant elevation and setback distance.

The legends used in Figures E-1 through 14 are as follows:

CC = Combined Cycle
STG = Steam Turbine Generator
NG = Natural Gas
MeOH = Methanol
CG = Coal Gas

TABLE E-5

DESIGN AND COST CRITERIA

Design and cost criteria for determining the breakeven cost for a 1,200 MWe nuclear and 500 MWe combined-cycle cooling towers and once-through saltwater cooling system.

1. Cooling Tower Design Criteria	- Natural draft cooling tower - Closed cycle cooling system - 10% coolant make-up - 3% coolant blowdown - Cooling tower head equivalent to 75 foot - Saltwater coolant from Ocean - Blowdown to Ocean - $\Delta T = 20°F$ - 1% differential efficiency between cooling towers and once-through cooling at 100% power - Nonsite specific - No hydroelectric recovery from cooling tower blowdown - Cooling tower system construction cost for 1,200 MWe nuclear and 500 MWe combined-cycle based on $25/kWe
2. Basis of Coolant Power Requirements & Coolant Piping, Pumping, Hydroelectric Costs	- DWR data
3. Replacement Power Costs	- 60 mil/kWh
4. Construction Cost Components for Once-Through Coolant	- Coolant pumping facilities, piping and hydroelectric facilities
5. Construction Cost Components for Cooling Tower Design	- Make-up coolant pumping facilities, piping, cooling water system (exclusing condenser)

6. Total Annual Cost Components - (1) Cooling system power consumptions at 60 mil/kWh, (2) Capital charge at 20% Fixed Charge Rate (FCR) for pumping facilities, piping, hydro (if required), cooling tower system (if required), (3) operation and maintenance at 3% of the cost of pumping facilities, hydro & cooling tower system and (4) Δ efficiency (difference between once-through cooling and cooling towers at 1% of plant size and costed at 60 mil/kWh).

7. Environmental Aspects - No environmental impact was assessed in the analysis (i.e., Air Quality, thermal discharge, noise, fog, corrosion, salt deposition, aesthetics, etc.).

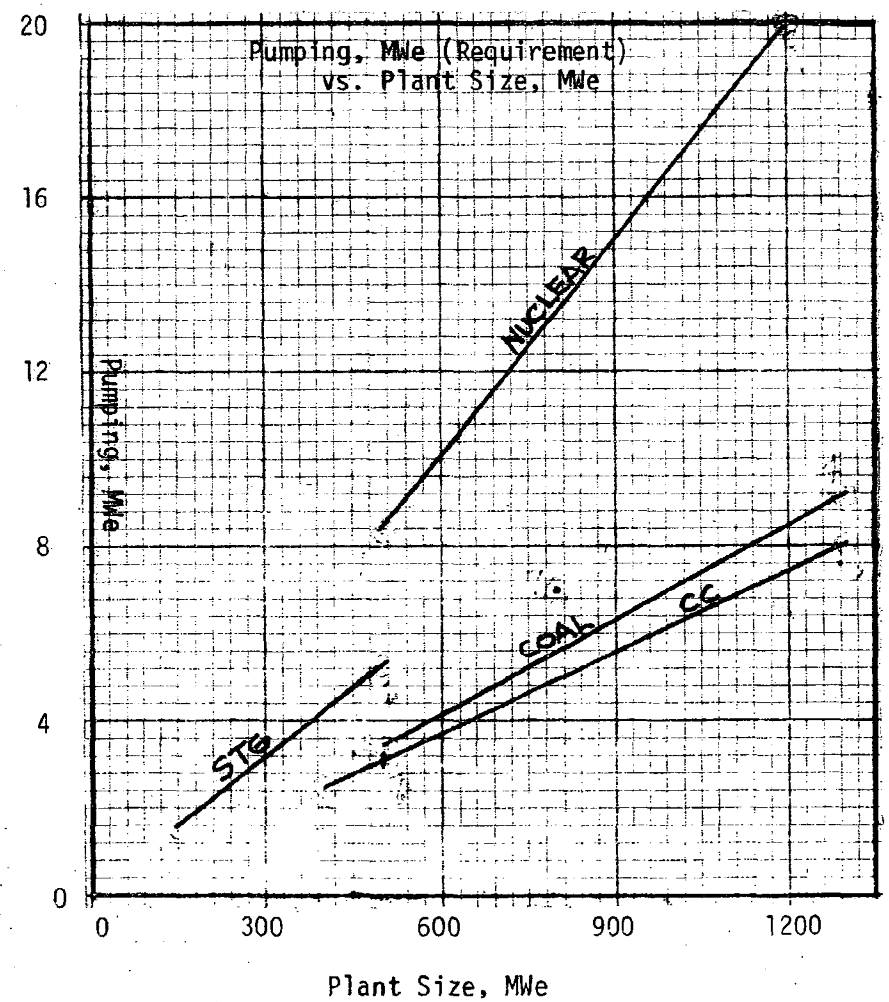
8. Other Considerations - The study assumed that saltwater cooling towers are state-of-the-art for sizes needed in this investigation and rule-of-the-thumb sizing and cost parameters reported in literature are sufficient to give ROM engineering estimates. No consideration was given to the following: System reliability, availability, permits, preferred sites, schedule, meteorological data, optimization procedures and others.

9. Cost Basis - Cost data was based on engineering estimates and in 1980 dollars.

10. Breakeven Cost Comparison of Once-Through Cooling vs. Cooling Towers - Using total annual cost data, the following cases were studies: (1) The breakeven height (at 100 foot setback) which cooling tower costs and once-through saltwater cooling costs are equal, (2) the hortizontal distance (at approximately 50 foot height) at which cooling tower costs and once-through saltwater coolant costs are equal.

Figure E-1

Megawatts (Pumping & Hydroelectric Generation) vs. Plant Size at 50' Height and 100' Setback



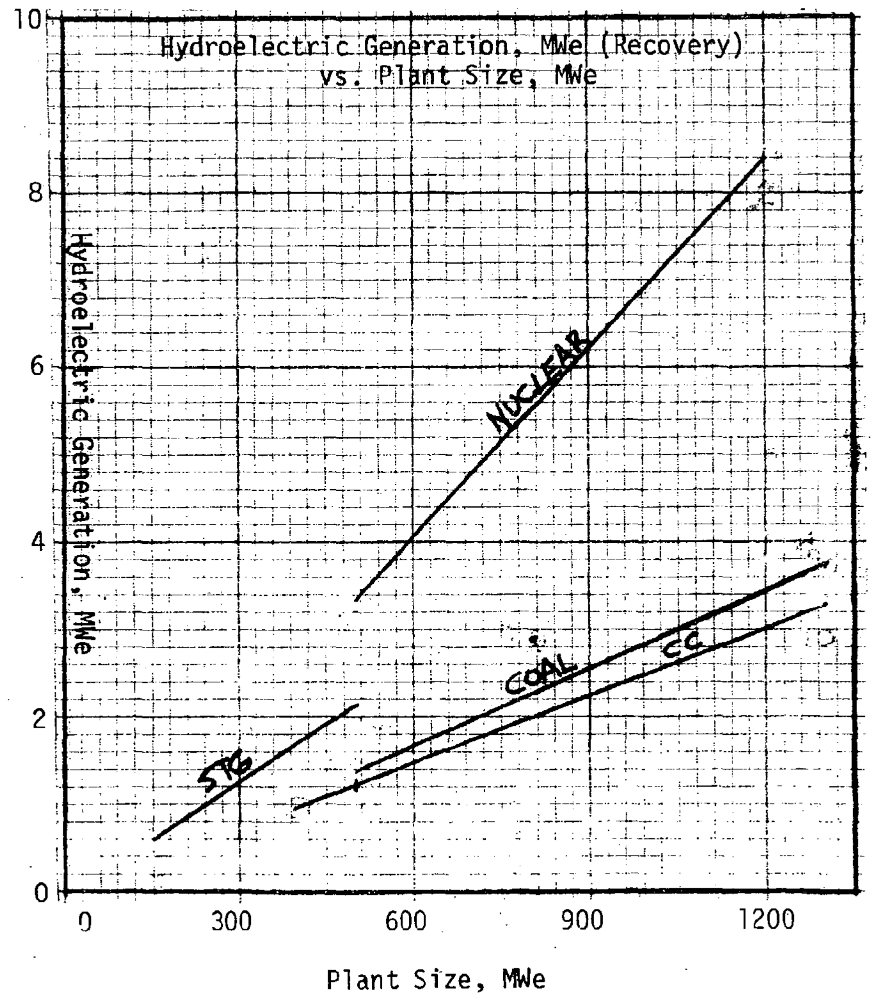
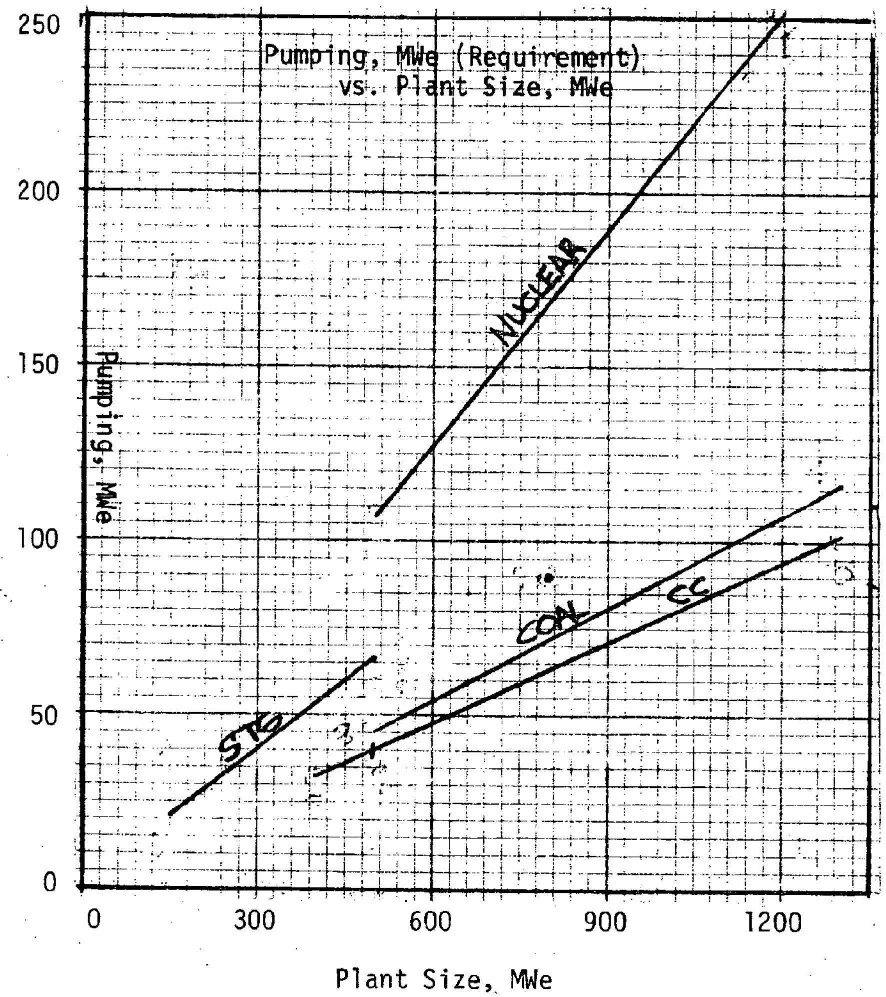


Figure E-2

Megawatts (Pumping & Hydroelectric Generation) vs. Plant Size at 1000' Height and 27000' Setback



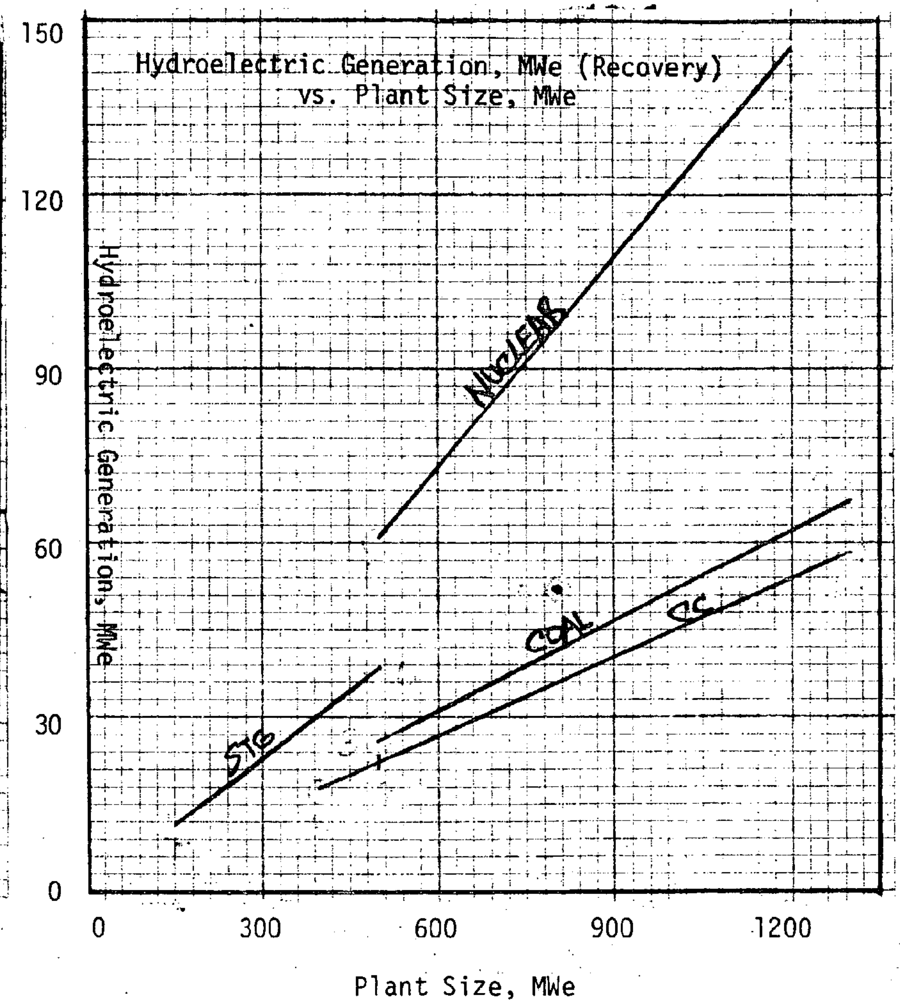
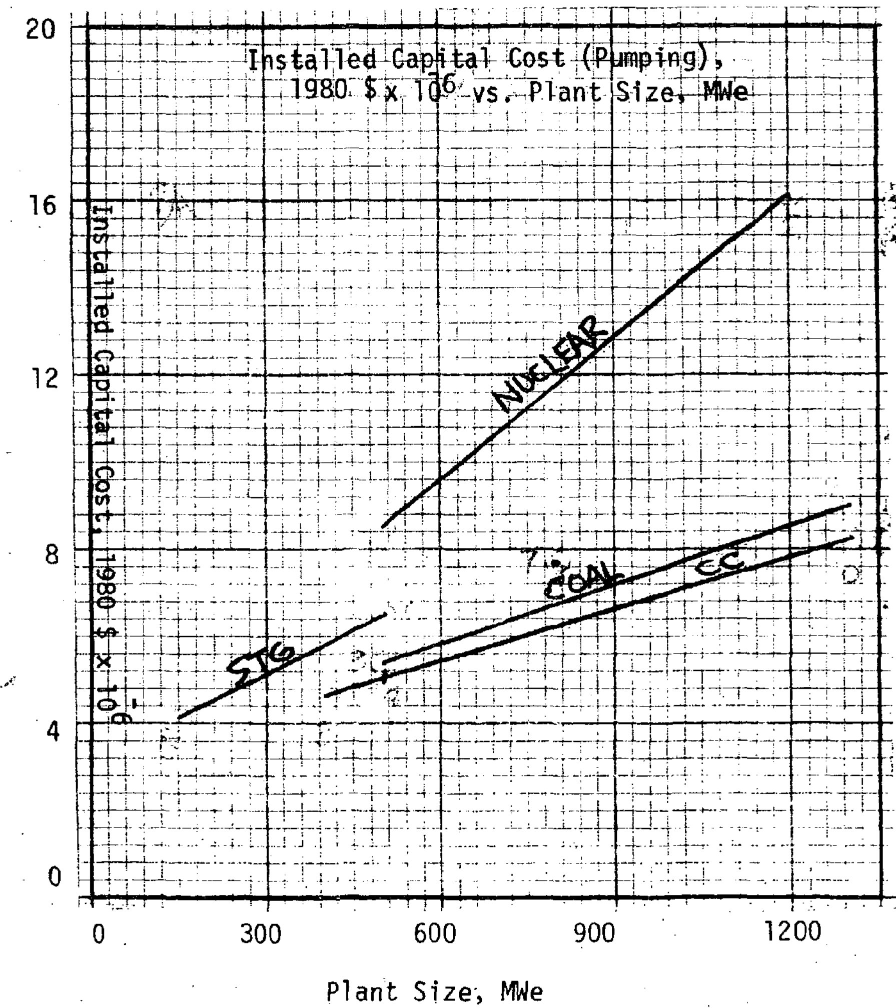


Figure E-3

Installed Capital Cost (Pumping & Hydroelectric Generation) vs. Plant Size at 50' Height and 100' Setback



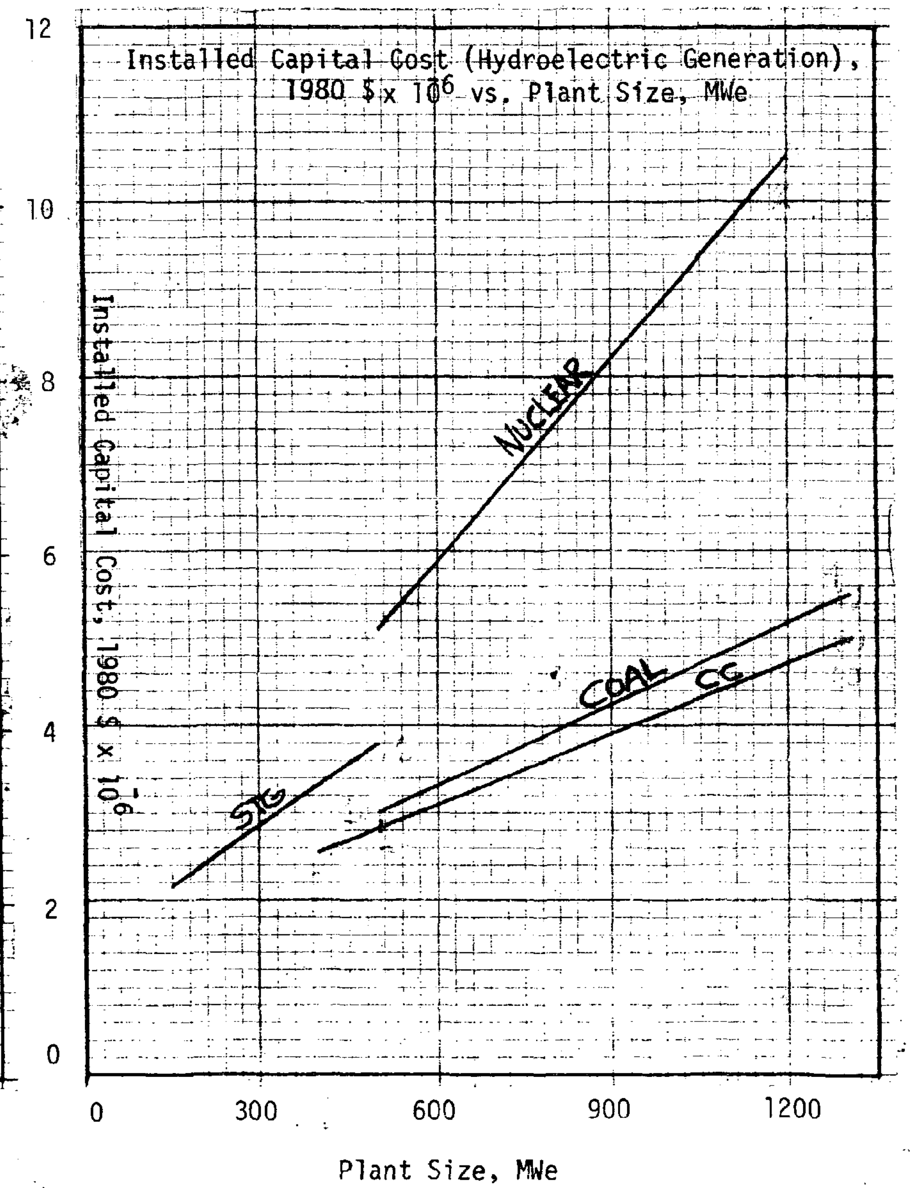
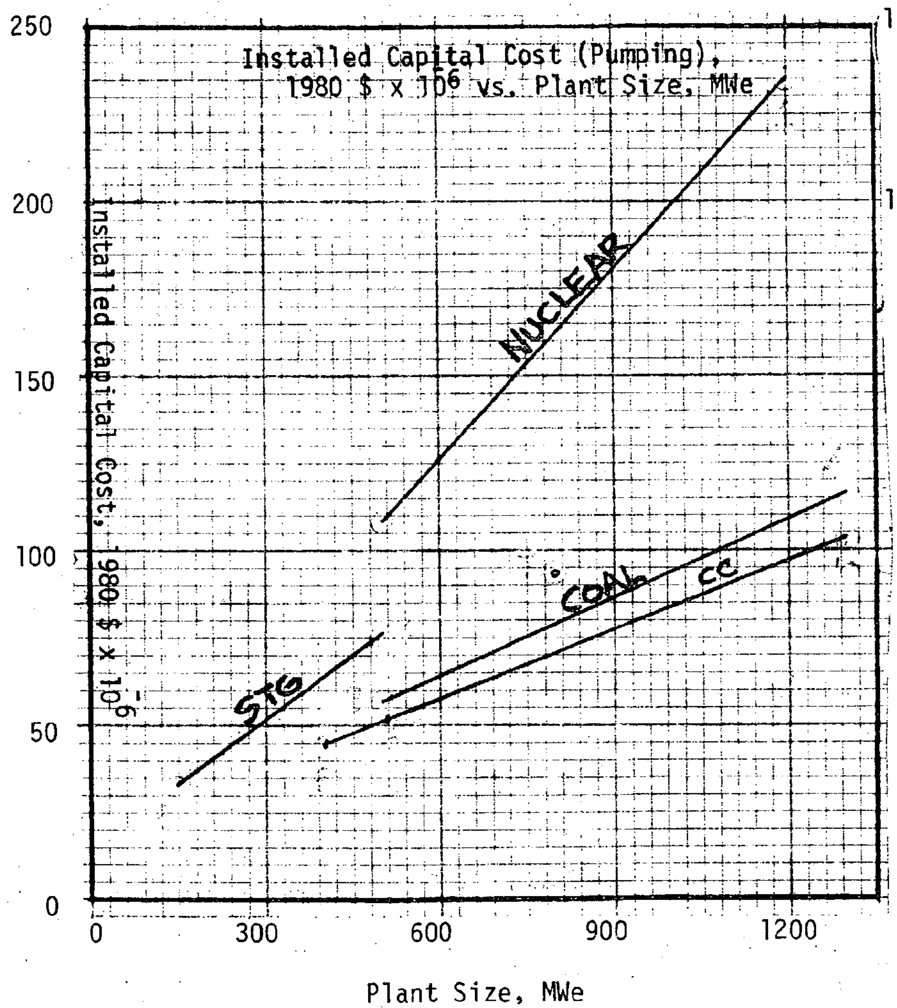


Figure E-4

Installed Capital Cost (Pumping & Hydroelectric Generation) vs. Plant Size at 1000' Height and 27000' Setback



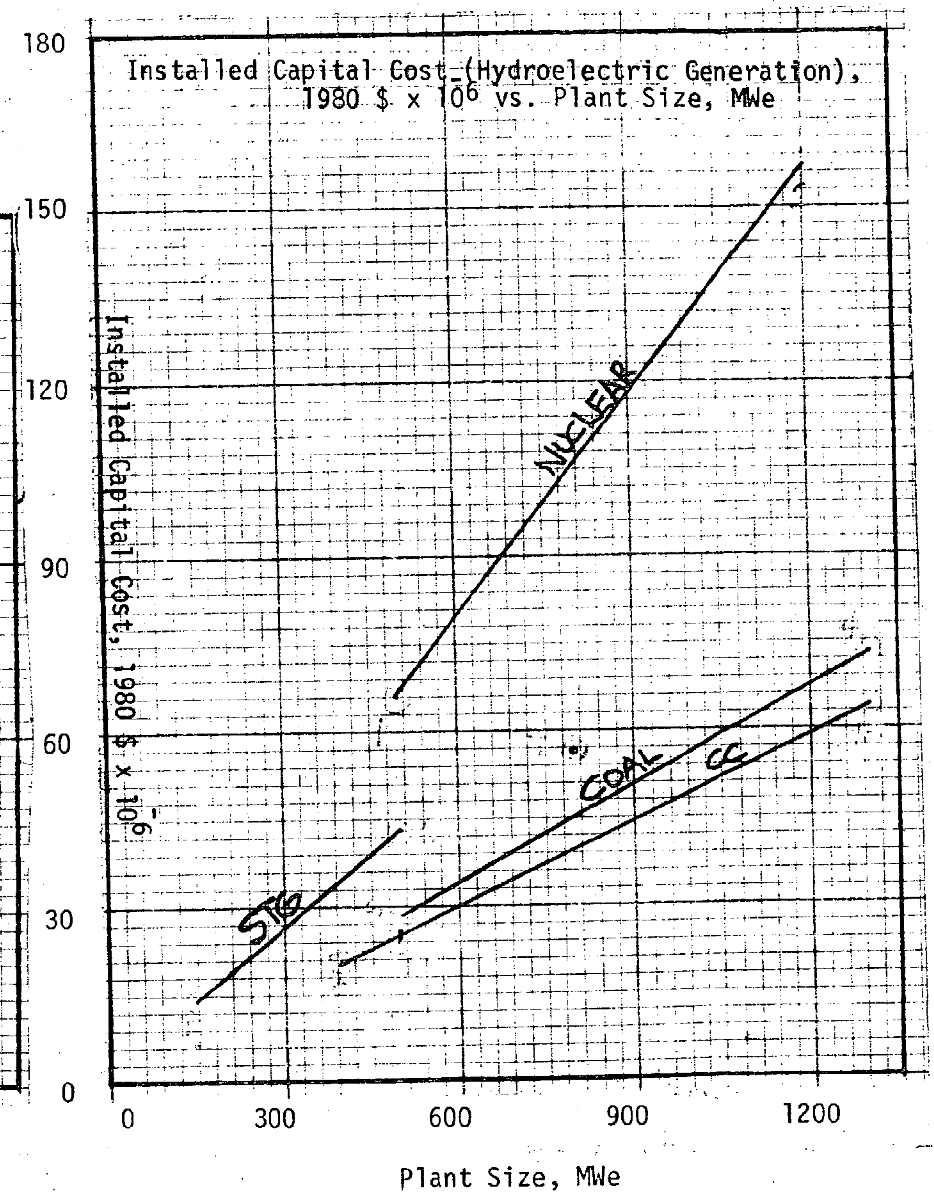


FIGURE E-5

Annual Operating & Maintenance Cost (1980 $ x 10^{6}) vs. Plant Size

(Net Including Energy Recovery by Hydroelectric Generation)

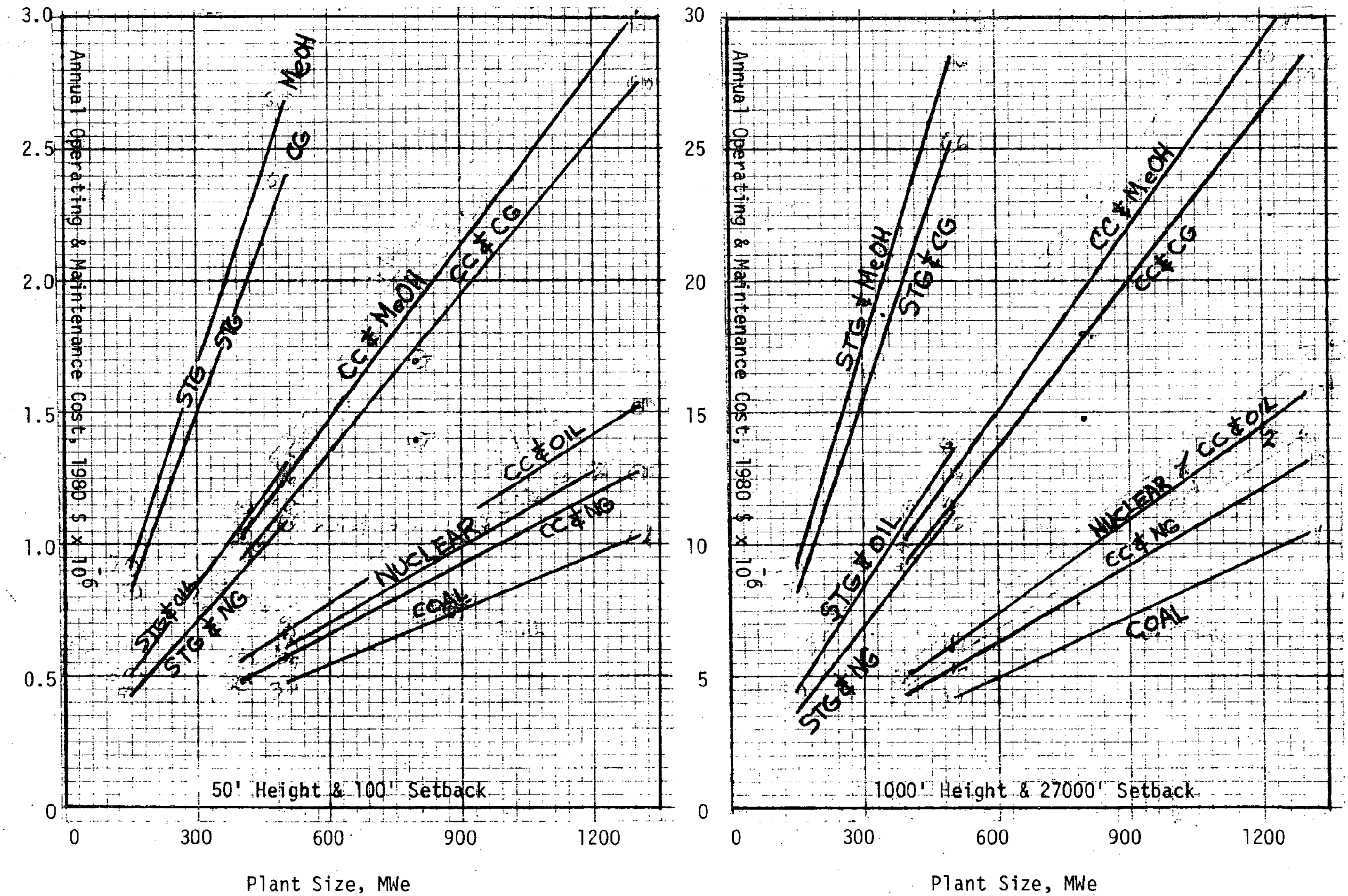


FIGURE E-6

Total Annual Cost (1980 $ x 10^6) vs. Plant Size

(Net Including Energy Recovery by Hydroelectric Generation)

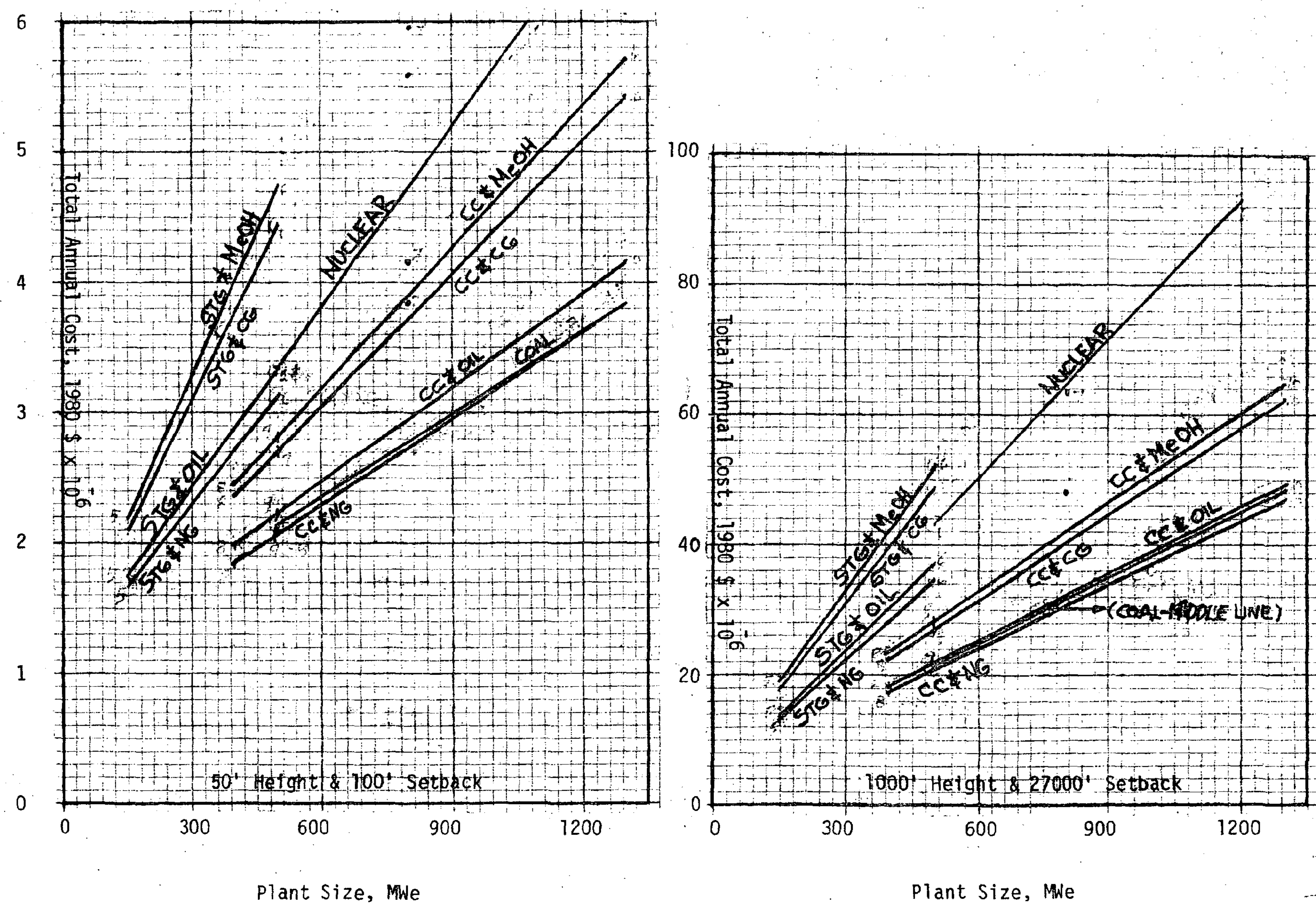


Figure E-7

Installed Capital Cost (Hydroelectric Generation), 1980 $/KW vs. Plant Size

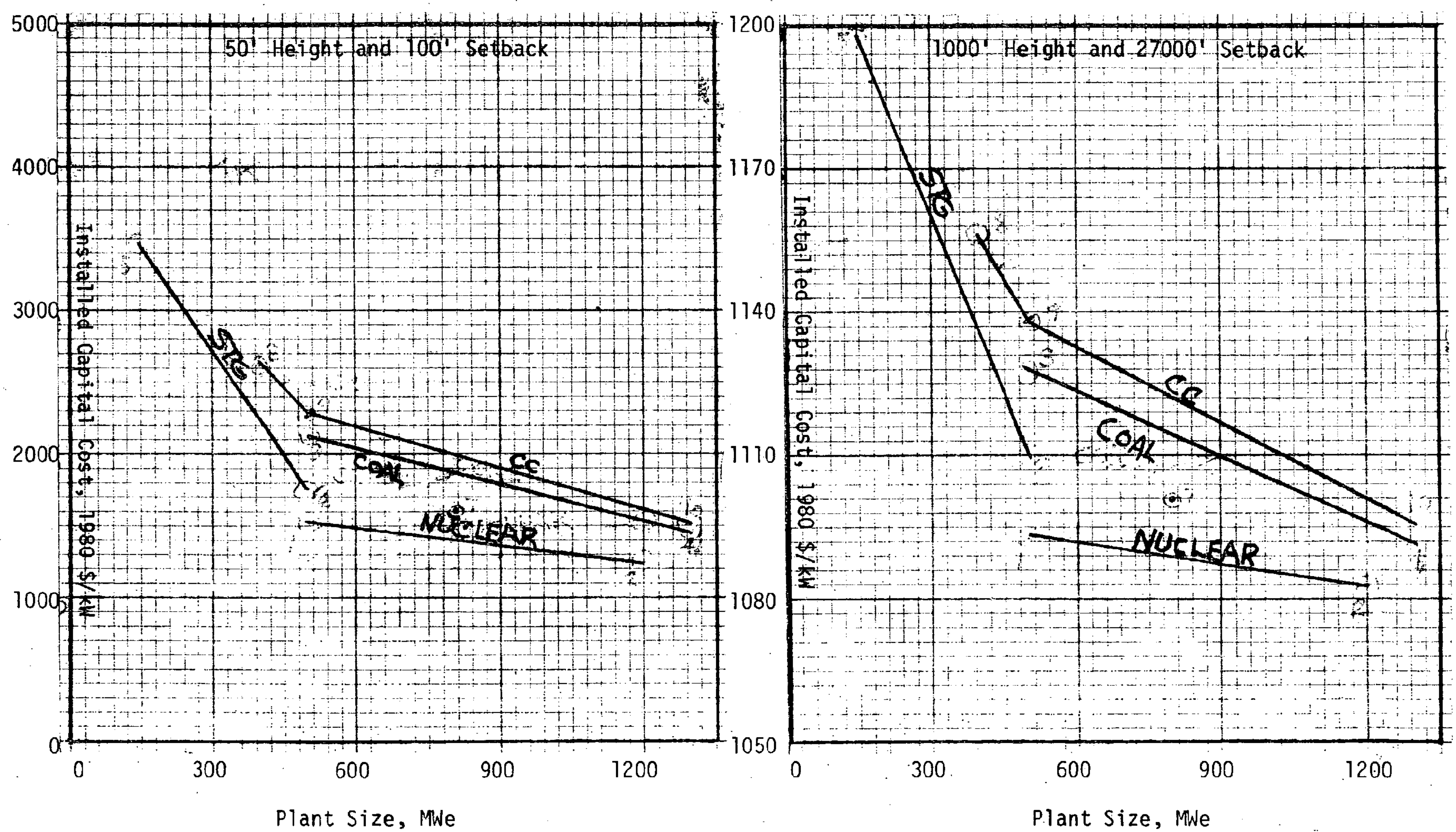


Figure E-8

Annual KWh x 10^{-6} (Hydroelectric Generation) vs. Plant Size

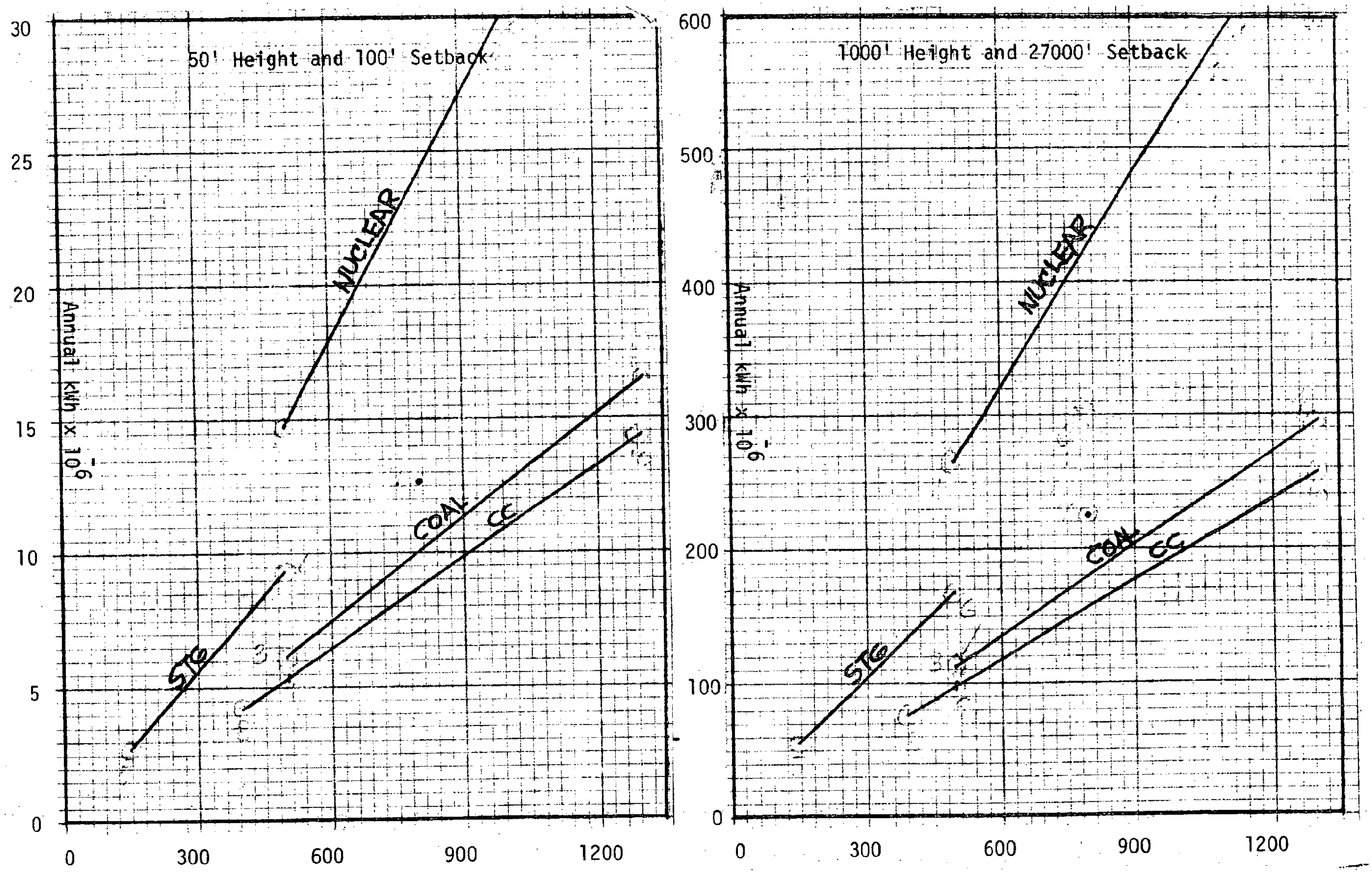


FIGURE E-9

Breakeven Price of Power Produced and Sold, mils/KWh (Hydroelectric Generation) vs. Plant Size

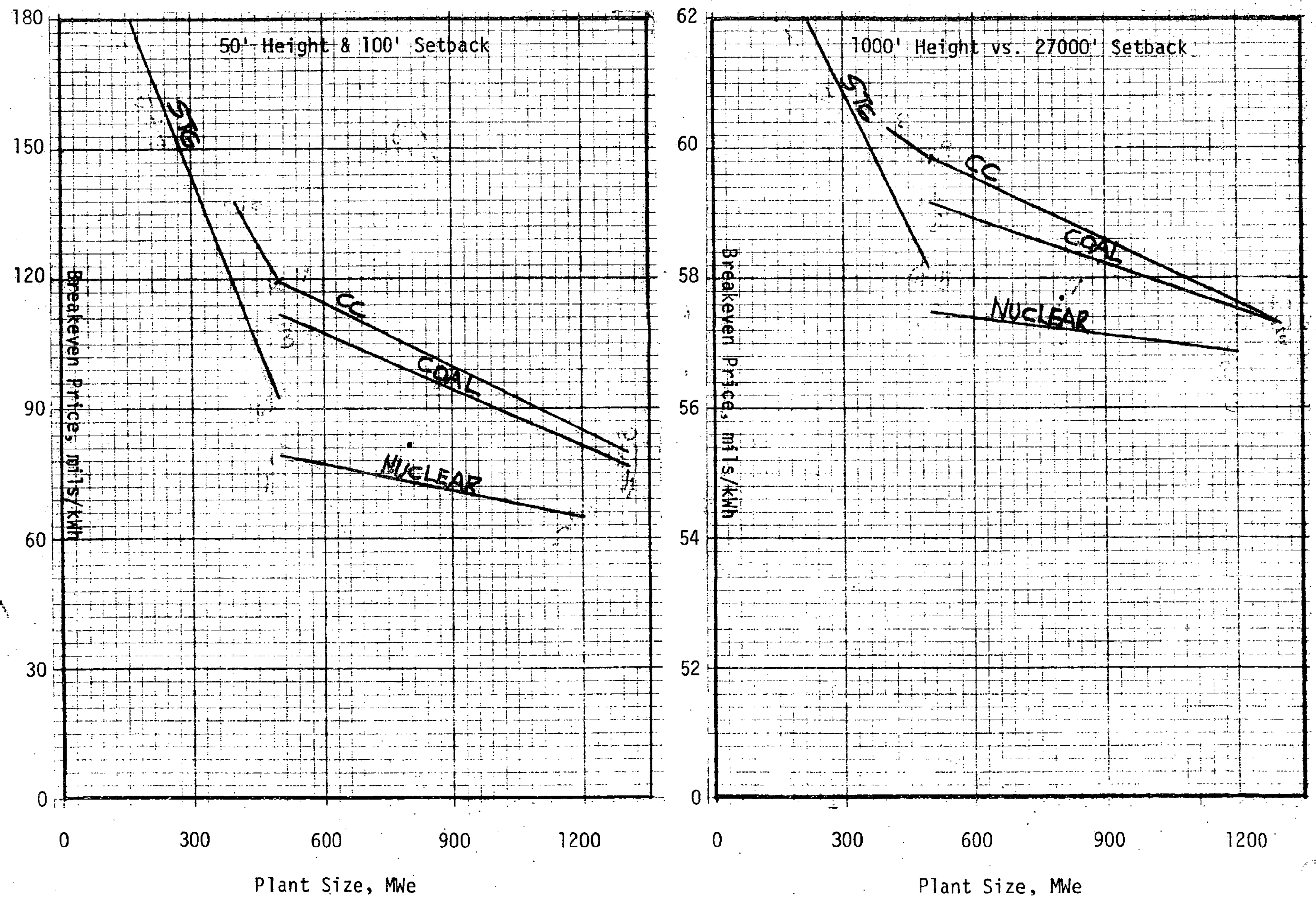
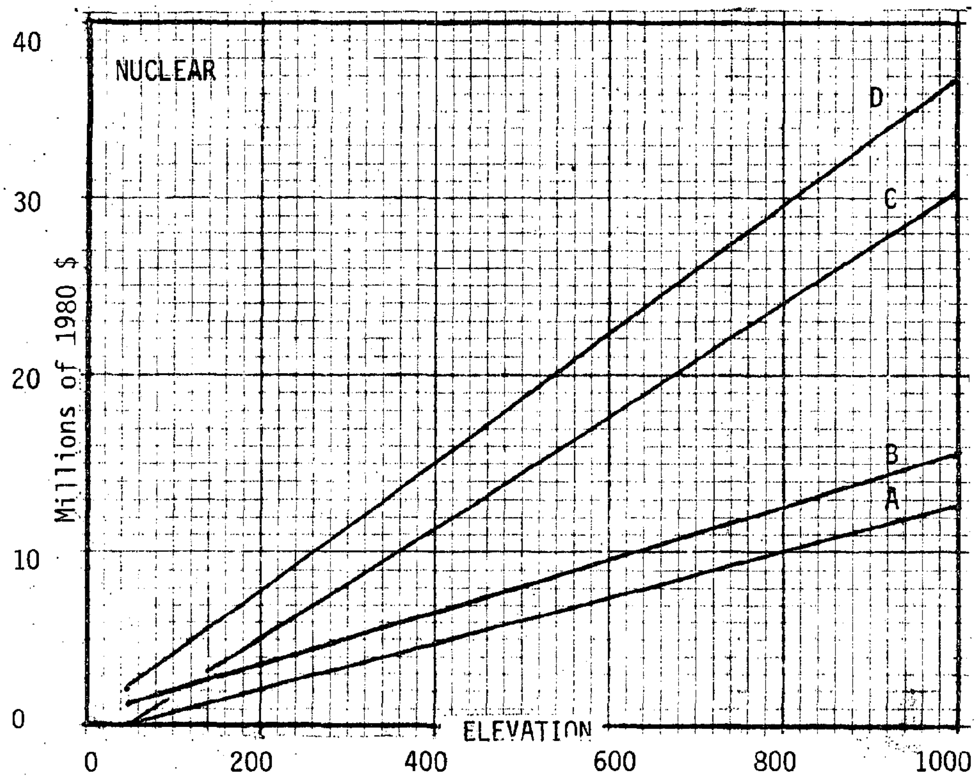
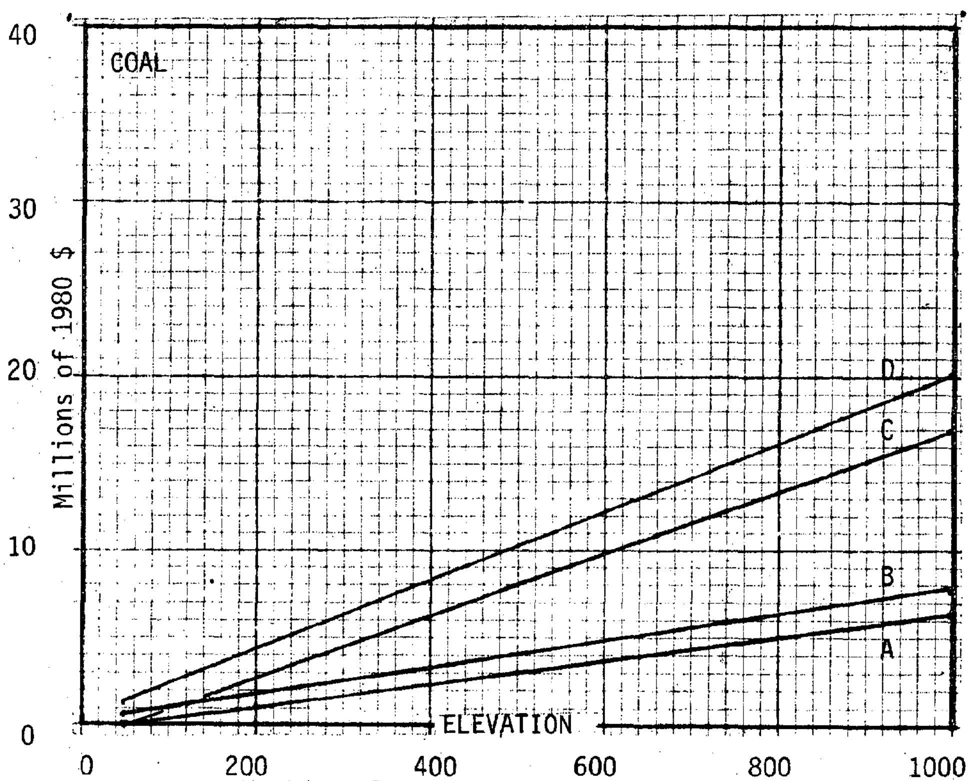


FIGURE E-10

Once-Through Saltwater Cooling System Net Cost Penalty
(Market Value of Net Power Consumed is 60 mils/KWh)



A = 500 MWe Nuclear, 100' Setback C = 1200 MWe Nuclear, 100' Setback
B = 500 MWe Nuclear, 27000' Setback D = 1200 MWe Nuclear, 27000' Setback

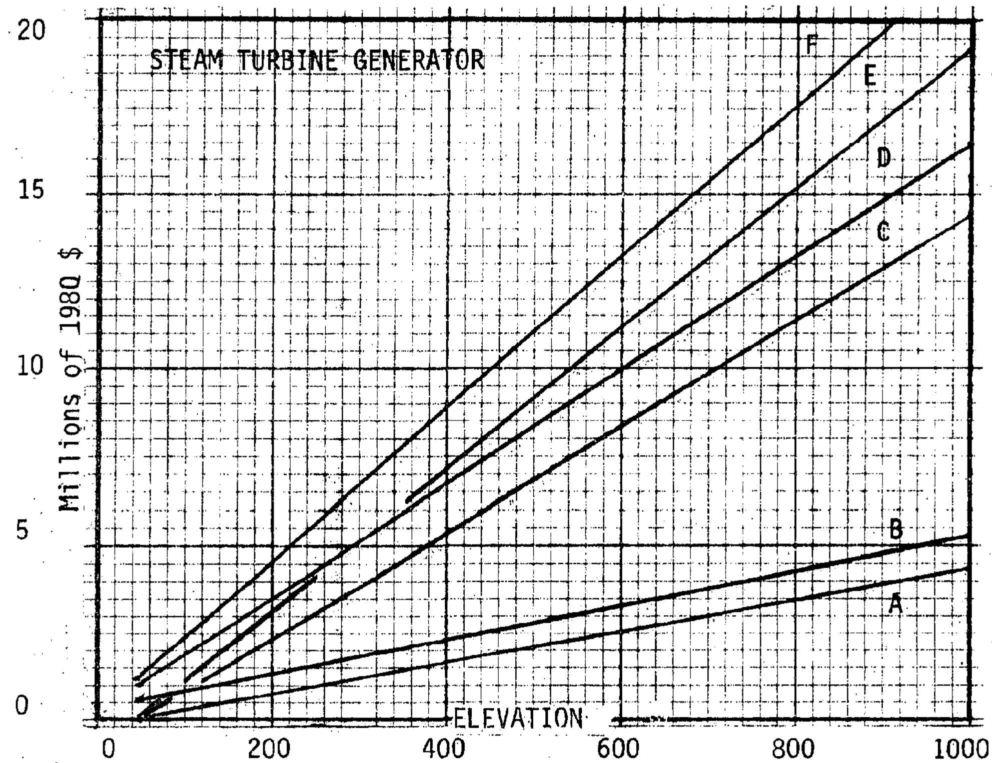


A = 500 MWe Coal, 100' Setback C = 1300 MWe Coal, 100' Setback
B = 500 MWe Coal, 27000' Setback D = 1300 MWe Coal, 27000' Setback

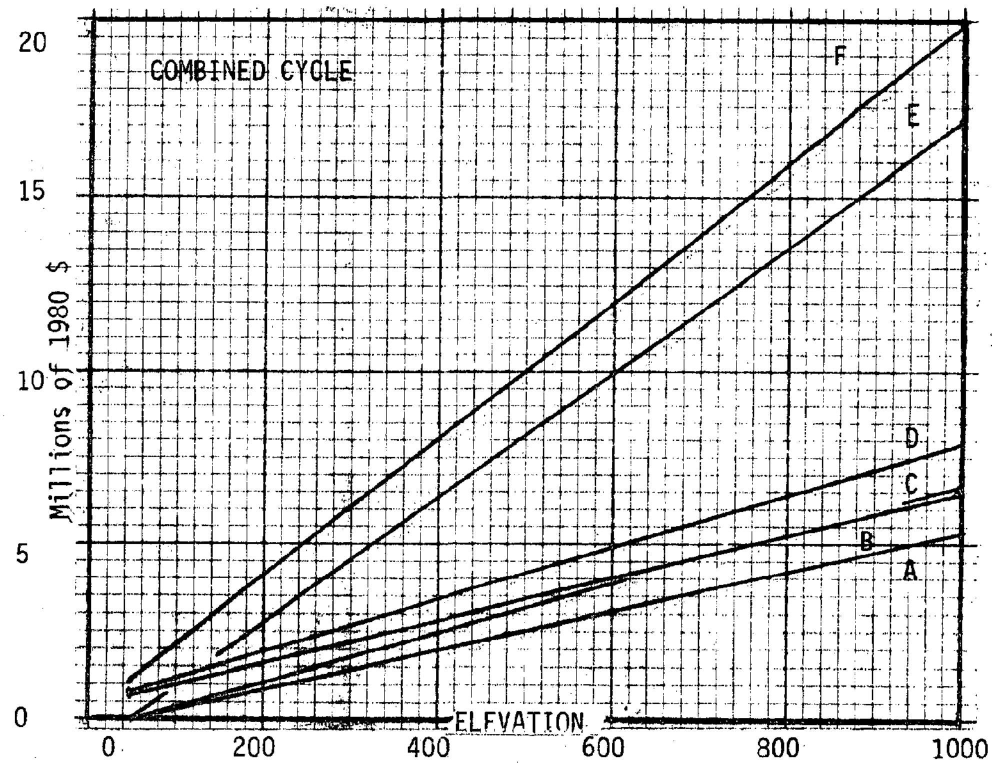
FIGURE E-11

Once-Through Saltwater Cooling System Net Cost Penalty

(Market Value of Net Power Consumed is 60 mils/KWh)



A = 150 MWe STG, 100' Setback
B = 150 MWe STG, 27000' Setback
C = 500 MWe STG, 100' Setback
D = 500 MWe STG, 27000' Setback
E = 800 MWe STG, 100' Setback
F = 800 MWe STG, 27000' Setback



A = 400 MWe CC, 100' Setback
B = 400 MWe CC, 27000' Setback
C = 500 MWe CC, 100' Setback
D = 500 MWe CC, 27000' Setback
E = 1300 MWe CC, 100' Setback
F = 1300 MWe CC, 27000' Setbac

Figure E-12 (Preliminary Results)

BREAKEVEN COST (TOTAL ANNUAL COST IN 1980$) FOR ONCE-THROUGH COOLING VS. COOLING TOWER SYSTEMS AS A FUNCTION OF PLANT ELEVATION AND SETBACK DISTANCE (BELOW CURVE, ONCE-THROUGH COOLING COSTS LESS THAN A COOLING TOWER SYSTEM)

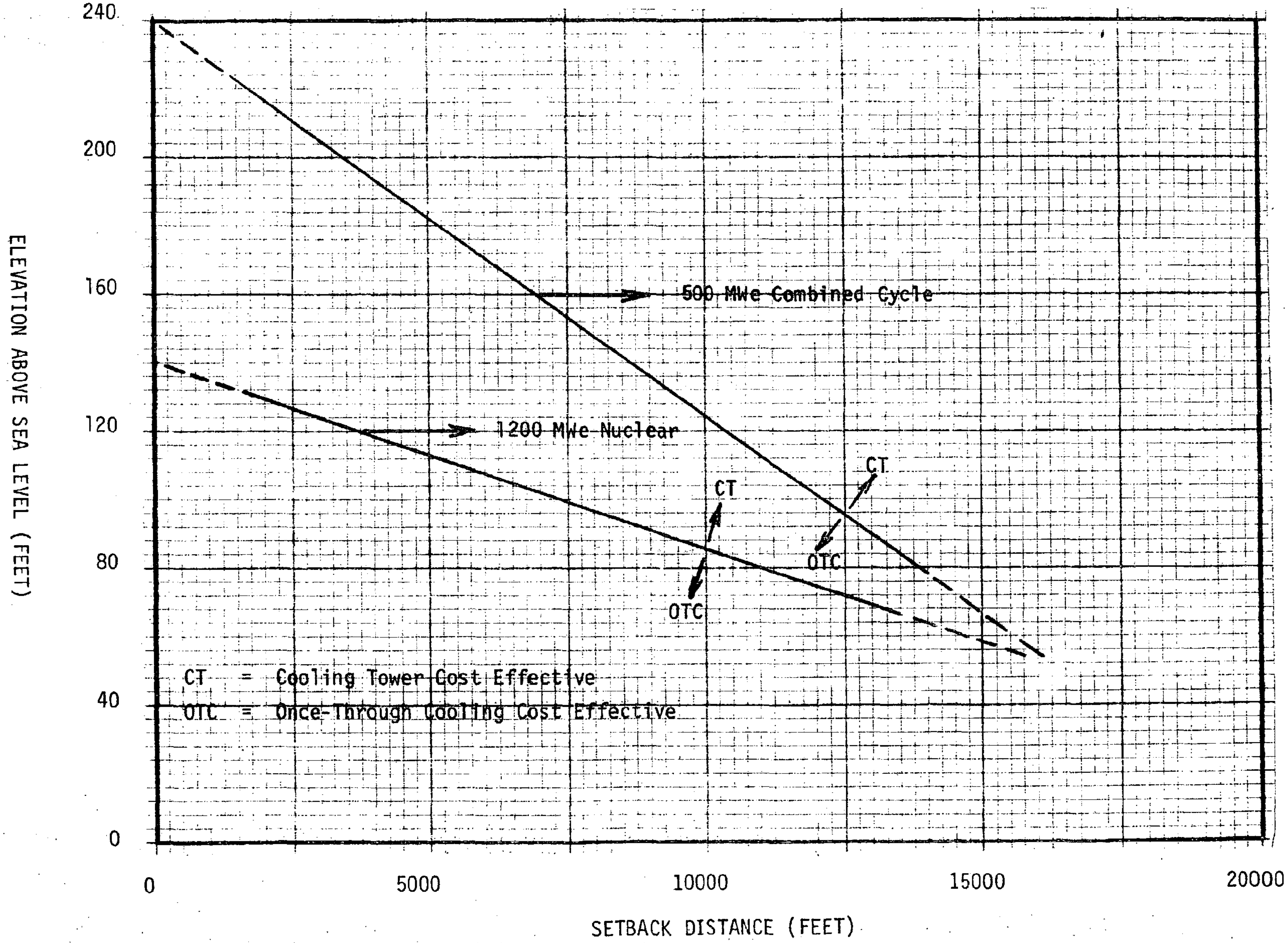


FIGURE E-13

ANNUAL OPERATING COST PENALTY IN MILLIONS OF DOLLARS 500 MWe COMBINED CYCLE POWER PLANT USING A COOLING TOWER SYSTEM AS A FUNCTION OF ELEVATION AND SETBACK DISTANCE.

*Pumping costs include make-up water pumping and cooling tower coolant pumping.

A,A' Base line cost at 50 elevation and 100' setback
B,B' 50' elevation and 27,000' setback
C,C' 1000' elevation and 100' setback
D,D' 1000' elevation and 27,000' setback

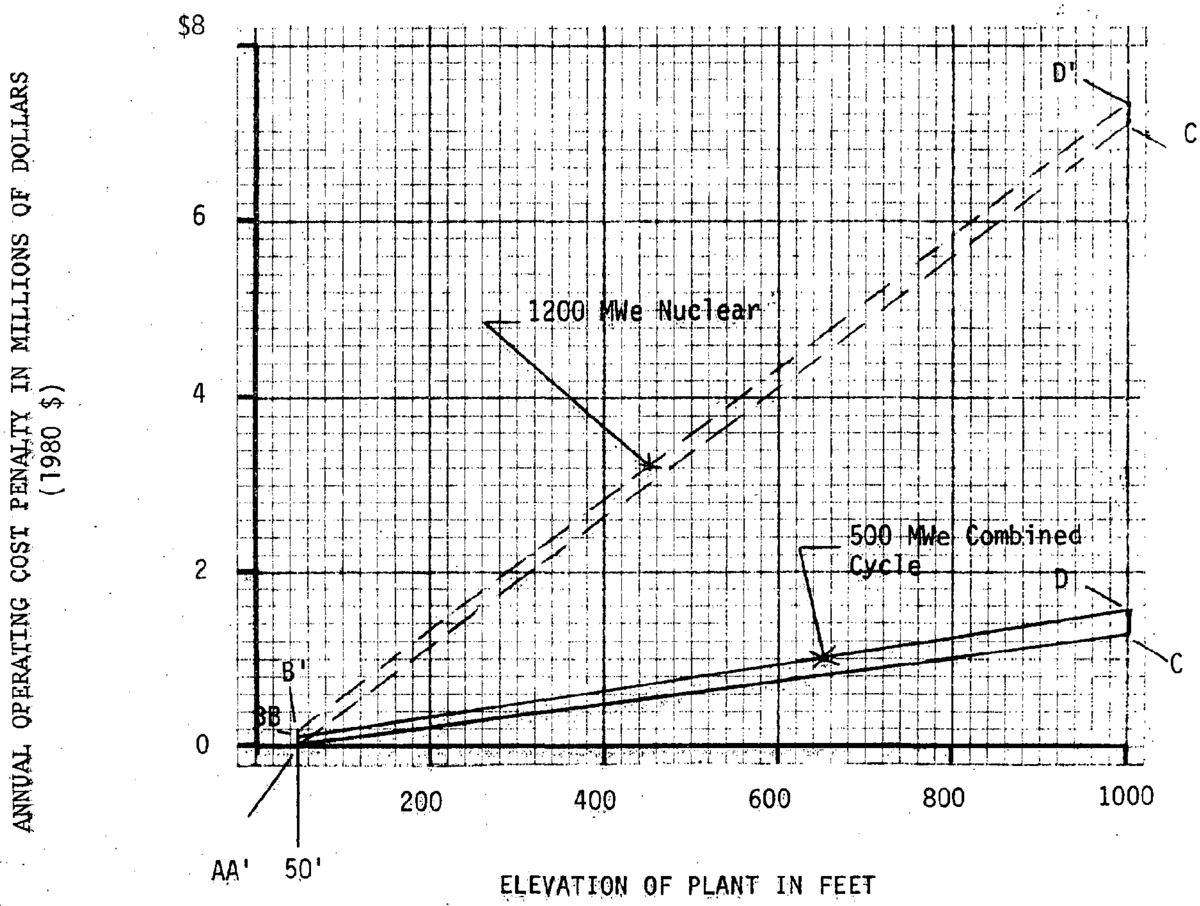
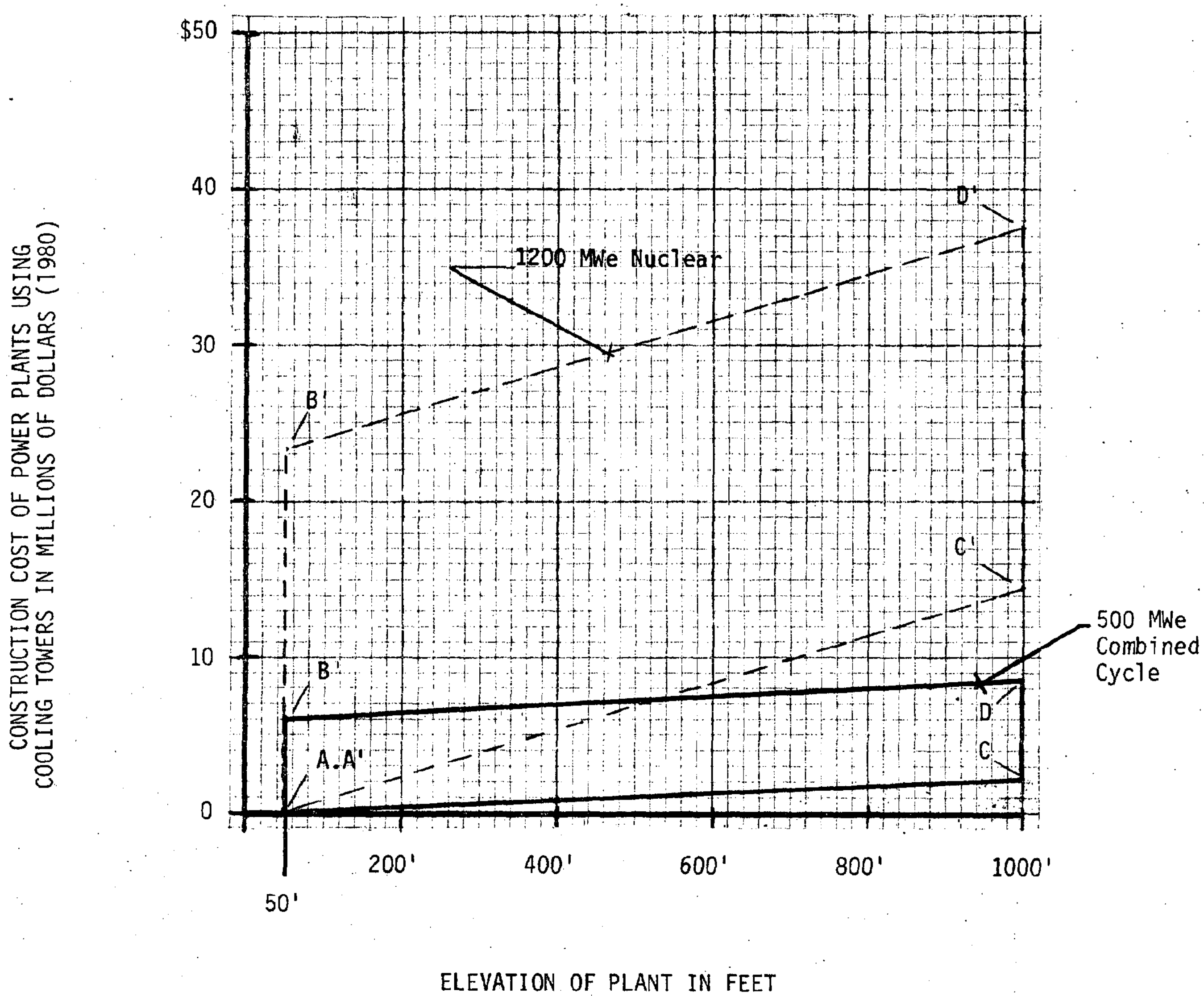


Figure E-14 CONSTRUCTION COST PENALTIES* OF A 1200 MWe NUCLEAR AND A 500 MWe COMBINED CYCLE POWER PLANT USING A COOLING TOWER SYSTEM AS A FUNCTION OF PLANT ELEVATION AND SETBACK DISTANCE.

*Based on costs of pumping facility, piping and cooling towers.

A,A' Base line cost at 50 elevation and 100' setback
B,B' 50' elevation and 27,000' setback
C,C' 1000' elevation and 100' setback
D,D' 1000' elevation and 27,000' setback



APPENDIX F

TRANSMISSION CORRIDOR ANALYSIS

Introduction

The purpose of this analysis is to investigate and evaluate the viability of siting transmission facilities for possible new power plants in selected undesignated areas of the California Coastal Commission (CCC) coastal zones which do not presently contain existing power plants. The five areas selected for this analysis have been extensively screened by the CEC staff from the standpoint of environmental criteria other than transmission outlet corridors. BCDC UAs are not included in this analysis due to the ready availability of known transmission corridors in the Bay Area.

This analysis does not necessarily give a definitive final transmission facility or corridor selection but does indicate the relative availability and mertis of transmission outlets with probable corridor alignments and interconnected system terminations. An assessment of appropriate transmission voltage levels, transmission line configurations, salient system modifications required, and general system cost estimates are included. In addition, any major impediments to transmission line routings are tentatively identified for further review.

Due to the "broad brush" scope of this study, a more extensive and detailed analysis of each specific plant site will be required. At that time, with the aid of system load flows, stability studies, and on-site inspections, more refined assumptions, facility identification, and corridor selections can be made.

Summary

Based on the following detailed Siting Study Analysis, all UAs as proposed by the CEC staff provide suitable opportunity for transmission corridors required for exporting generation from power plants in all 3 size ranges under consideration: (a) small, 100 - 150 MW; (b) medium, 400 - 500 MW; and (c) large, 800 - 1,300 MW. From a transmission line requirement perspective, the type of technology used for the power plant is of no consequence, with the exception of nuclear, which maybe required to meet additional reliability criteria for plant safety. However, with the transmission line proposals given in this study, there should be no problems with outlet reliability.

In general, from an engineering and construction perspective, transmission lines may be designed and constructed for routing through any of the study areas, with cost being the primary impediment to be considered. Realistically, however, other cultural and social constraints dictate whether trnasmission line corridors are acceptable.

Basis For Analysis

For the purpose of transmission system planning (i.e., selection of voltage level, conductor size, and terminal substation), the size ranges of the various power plants (irregardless of technological type) were grouped as follows:

* Small: 100 - 150 MW
* Medium: 400 - 500 MW
* Large: 800 - 1,300 MW

In the large plant category, the 800 MW unit size may, in certain instances, be treated in a manner similar to the medium size plant. Transmission system voltage levels are selected primarily based on the prevailing interconnected system voltages and on the total power transfer requirements (i.e., magnitude of generation and distance from the interconnected system). Minimum conductor sizes are subsequently chosen based on thermal and economic considerations, single contingency outage conditions, and standard construction practices of the power utility in the area. Detailed system load flows, which are beyond the scope of this study, should be performed on a site specific basis to determine if transmission losses and transmission design costs have been optimized, using the proposed plant capacity factor and power values of the electric utility system under consideration.

When required, the amount of series compensation for transmission lines has been selected based on steady state stability conditions, with a power transfer angle less than 70'. For some sites dynamic stability studies should be performed; however, this is beyond the scope of this study. Series compensation is used to reduce the total transmission line impedance from the source (power plant) to the load and is accomplished with power capacitors installed in series with the transmission line at both the source and receiving (load) terminations.

Interconnected system termination points (substation, switchyard, line loops, etc.) are selected based on proximity and available capability for the required power transfer. Any obvious problems created at the terminating substation or on the interconnected transmission system have been identified, with possible solutions given. A detailed load flow study of each outlet would have to be conducted to ensure that no normal or contingency conditions exist that would result in overload or overstressed equipment. If any specific study area exhibits an obvious stability or reliability problem, these will be identified and possible mitigating efforts detailed if appropriate. In general, however, with the transmission outlets proposed for each site in this study, there are no steady state stability problems, and the reliability of local and interconnected systems would be increased by addition of the new generation sources.

Substation cost estimates (1983 $) are based on breaker-and-a-half configuration for 500 kilovolt (kV) and 230 kV systems, with double-bus 115 kV design. Transmission line cost estimates (1983 $) are based on self-supporting lattice tower designs, with shield wires, meeting or exceeding the California Public Utilities Commission GO-95 requirements as a minimum. In addition, estimated costs are based on only one project.

<u>Area Analysis</u>

<u>Crescent City--UA 1A and 1B</u>

UA 1A is located due north of Crescent City, and 1B is located to the southeast of Crescent City.

1. Small Plant

Generation from this size plant would be used to serve local loads, with any excess generation being exported on existing Pacific Power and Light (PP&L) 115 kV transmission lines into Southern Oregon. For normal system operation, the local generation source will eliminate the present transmission line losses associated with imported power required for local area loads, and increase local area realiability as well.

The proposed transmission line is a 115 kV double circuit tower line (DCTL) with 1-1113 thousand of circular mils (Kcmil) all aluminum (AAL) or aluminum conductor steel reinforced (ACSR) conductor, routed within the CCC undesignated areas for approximately 2 - 4 miles from either plant site, and terminated at the existing PP&L Belmont Substation (Site 1A) or Northcrest Substation (Site 1B). The lines may parallel existing roadways, streets,or transmission lines for much of their length. No major problems are foreseen for engineering or construction of the proposed transmission.

Substation and transmission line estimated costs are $2,000,000.

2. Medium Plant

Local loads cannot utilize a significant portion of the plant generation, and the existing PP&L 115 kV transmission line is inadequate to accommodate the excess generation; therefore, new transmission facilities are required for both sites. The proposed 230 kV DCTL with 2-1113 Kcmil ACSR conductors (bundled) may be routed south and east through undesignated areas to the CCC boundary, and thence along an approximate 145 mile route to the PGandE Cottonwood Substation near Red Bluff. The route avoids two primary constraint areas that are readily identifiable: the Hoopa Valley Indian Reservation and the Salmon-Trinity Alps Primitive Area. At a point near Big Bar on the Trinity River the route begins to parallel the existing Cottonwood-Humboldt 115 kV transmission lines. No major engineering or construction problems, other than probable helicopter erection due to inaccessible terrain, are anticipated. Construction costs have been estimated accordingly, using a 1.4 multiplier.

Total estimated substation and transmission line costs are $93,000,000. This cost includes 70 percent series compensation for steady state stability of the 230 kV transmission line under the power transfers and distances considered. Use of series transmission line compensation may require that special consideration be given to the generator design and possibly frequency filter installation in the plant switchyard to preclude subsynchronous resonance and damage to turbine units. The previously proposed 115 kV transmission line for small size plants is also recommended as an option for this proposal to enable local loads to be served more directly, with concomitant reduction in transmission line losses for imported power. Further system analysis would be required to determine viability of this proposal.

This arrangement would require an additional winding on the generator step-up transformer for the 115 kV service, as well as a 115 kV switch- at the plant. These additional costs are not included in the above cost estimate, but the 115 kV transmission line and PP&L Substation improve- are included.

An alternate route for a 230 kV DCTL to Grants Pass, Oregon, is following the existing 115 kV transmission line. However, for purposes of this study, the costs as given above should be representative of both routes.

3. Large Plants

Again, as for medium size plants, local loads and existing 115 kV transmission line capacity cannot utilize or export a significant portion of the plant generation. Also, from both an economic and system planning perspective, 230 kV voltage levels are not suitable for power transfers of this magnitude over the distances required. The proposed transmission therefore is at 500 kV, with two 145 mile single circuit tower lines (SCTLs) using 2-1852 Kcmil ACSR or 2-2300 Kcmil AAL conductors, terminating at Pacific Gas and Electric Co. (PGandE's) Round Mountain Substation northeast of Redding.

The total estimated substation and transmission line costs are $156,000,000. This cost includes $5,000,000 for 50 percent series compensation of the 500 kV transmission line and $2,000,000 for the previously proposed local 115 kV system additions at Crescent City.

The input of this generation at Round Mountain Substation will require additional "ancillary" system improvements to transport the power into the PGandE interconnected system without overloading exssting facilities.

These additional system improvements are as follows:

(1)	Round Mountain-Table Mountain 500 kV SCTL, 2-1852 Kcmil ACSR bundled, 89 miles total length, with 71 percent series compensation	
(2)	Table Mountain Tesla 500 kV SCTL, 22300 Kcmil AAL bundled, 135 miles total length, with 70 percent series compensation	$50,540,000
(3)	1-500 kV Breaker bay position at Round Mountain	$1,800,000
	2-500 kV Breaker bay position at Table Mountain	$3,000,000
	2-500 kV Breaker bay position at Tesla	$3,000,000
(4)	1-500/230 kV, 1,000 MVA transformer at Tesla	$6,800,000
(5)	1-230 kV Breaker by position at Tesla	$1,250,000

The total estimated aggregate substation and transmission line costs for this size plant is $256,000,000, including all ancillary system improvements.

The proposed transmission facilities are considered feasible from an engineering and construction perspective, and no major problems are anticipated other than construction costs due to the rugged terrain traversed between Crescent City and Round Mountain Substation (1.4 x average terrain costs used). The subsequent transmission line route to Table Mountain, and Tesla Substations are not considered to be as difficult. Series transmission line compensation considerations must again be addressed in generator and plant design.

Samoa Spit--UA 2

UA 2 is northwest of Eureka, across Humboldt Bay on the Samoa Peninsula.

1. Small Plant

   As for UAs 1A and 1B, generation from this plant size would be used to serve local area loads, with any excess generation being exported on PGandE's existing Cottonwood-Humboldt 115 kV transmission lines. The same transmission line loss reduction and local area system reliability increase would be expected, as previously described.

   The proposed transmission line would be a 115 kV DCTL, with 1-1113 Kcmil AAL conductor, 10 - 15 miles in length, and terminating at PGandE's Humboldt Substation East of Eureka (Section 33, T4N, RIE). However, since UA 2 is surrounded by CCC designated areas, and allowable transmission line construction technology in this area is not known at this time, transmission costs will be based on overhead construction. Engineering and construction of transmission outlets should not prove impractical or difficult if allowed by other considerations.

   Substation and transmission line estimated costs are $3,000,000 to $4,000,000.

2. Medium Plant

   The same analysis applies as for UAs 1A and 1B where local loads cannot utilize a significant portion of the plant generation, and the existing PGandE 115 kV transmission lines are inadequate to handle the excess generation; therefore, new transmission facilities are required for both plant sites. The proposed 230 kV DCTL with 2-1113 Kcmil AAL conductors would parallel the Cottonwood-Humboldt 115 kV lines the entire 110 mile route from a point near Humboldt Substation to the Cottonwood Substation termination. Again, due to the designated area status of these sites, it is not known if a corridor out of the Samoa Peninsula would be possible, even though feasible from an engineering and construction standpoint. Substation and transmission line estimated costs are $60,000,000 to $61,000,000. This cost includes 50 percent series compensation for the 230 kV line, a 1.2 multiplier for construction costs due to terrain, and the Eureka local area 115 KV system improvements as described under small plants above. As for UAs 1A and 1B, detailed system load flows would be required to ascertain viability of paralleling the existing 115 kV system with the proposed 230 kV system.

3. Large Plant

Again, the same analysis applies as for UAs 1A and 1B where local loads and existing 115 kV transmission line capacity cannot utilize or export a significant portion of the plant generation, and from both an economic and system planning perspective, 230 kV voltage levels are not suitable for power transfers of this magnitude over the distances required. The proposed transmission is at 500 kV with either 2 SCTLs or 1 DCTL, 190 miles in length, using 2-1852 Kcmil ACSR or 2-2300 Kcmil AAL conductors, terminating at PGandE's Table Mountain Substation. The "ancillary" system improvements are required as for sites 1A and 1B from Table Mountain Substation to Tesla Substation, i.e., 135 mile 500 kV SCTL, 2-2300 Kcmil AAL bundled, with 70 percent series compensation, a total of 3-500 kV Breaker bay positions at Table Mountain and Tesla, 1-500/230 kV 100 mega-volt amps (MVA) transformer and 1-230 kV Breaker bay position at Tesla Substation.

The total aggregate substation and transmission line estimated costs are $241,000,000. This cost includes 50 percent series compensation and 1.2 multiplier for construction costs on the Eureka-Table Mountain 500 kV transmission line, and the Eureka local area 115 kV system, and all other ancillary system improvements as described previously.

The proposed transmission facilities are considered reasonable and appropriate, and no major problems are anticipated if a suitable route is found through the CCC designated areas. Special consideration must again be given to the generator and plant design due to the required series transmission line compensation.

Salinas River--UA 3A and 3B

These sites are located near Fort Ord, and approximately 10 miles south of PGandE's Moss Landing power plant site.

1. Small Plant

The proposed transmission is a 230 kV DCTL with 1-113 Kcmil AAL, routed approximately 10 miles over relatively easy terrain, through CCC undesignated areas and outside of CCC boundary lines, and terminated at the Moss Landing 230 kV Switching Station.

Substation and transmission line estimated costs are $5,000,000.

2. Medium Plant

Same as small size plant except 2-113 Kcmil AAL conductors for the 230 kV DCTL.

Substation and transmission line estimated costs are $6,000,000.

Large Plant

Due to the large power block to be transferred and limited 230/500 kV transformation capacity at Moss Landing (including local loads) the proposed transmission loops the Moss Landing-Los Banos 500 kV SCTL approximately 10 miles into the new plant site, with 2-2300 Kcmil AAL conductors and terminating at Moss Landing 500 kV switchyard. Existing 500 kV transmission lines could possibly be looped into the proposed plant site, but overall costs would be essentially the same as new transmission to Moss Landing. There appears to be sufficient 500 kV transmission capacity beyond the Moss Landing termination to accommodate the additional generation into the system.

Substation and transmission line estimated costs are $7,000,000.

No major engineering or construction problems are anticipated in accomplishing the proposed facilities installation, except service continuity during the line looping construction phase. Also, depending on location of the plant site, the Fort Ord installaion may present routing problems for transmission outlets.

Santa Maria River--UA 4A and 4B

These sites are located near Oceano, approximately 15 - 20 miles south of San Louis Obispo, 15 - 20 miles southeast of PGandE's Diablo Canyon power plant, and 25 - 30 miles Southeast of PGandE's Morro Bay power plant.

1. Small Plant

   The proposed transmission is to loop 1 circuit of the existing Morro Bay-Mesa Substation 230 kV transmission line into the new site, (one 230 kV DCTL) with 1-1113 Kcmil AAL, a distance of approximately 6 miles. No major impediments are foreseen for transmission line routing, with both site corridors following the Santa Maria Valley inland to the existing transmission line.

   Substation and transmission line estimated costs are $2,000,000.

2. Medium Plant

   Same as small size, except loop both circuits of the Morro Bay-Mesa 230 kV transmission line into the plant site, giving two 230 kV DCTLs with 1-1113 Kcmil AAL.

   Substation and transmission line estimated costs are $4,000,000.

3. Large Plant

   Due to the large block of generation for this plant size, it is proposed to loop 1 of the Diablo Canyon-Midway 500 kV transmission lines into the new plant, (two 500 KV SCTLs) with 2-2300 Kcmil AAL for approximately 13 miles. Again, no major problems are foreseen for transmission line routings as previously proposed, from an engineering and construction perspective.

   Substation and transmission line estimated costs are $10,000,000.

Due to SDG&E's radial 230 kV system, possible scheduling problems could arise with this size plant. However, those are considerations which are beyond the scope of this study and are pointed out for future reference only.

Tijuana River--UA 5

UA 5 is located south of Chula Vista on the California/Mexico border, approximately 5 miles south of San Diego Gas and Electric Company (SDG&E's) South Bay Power Plant. Transmission lines will be routed south/east/and northwest to avoid CCC designated area.

1. Small Plant

   Proposed transmission is 138 kV DCTL, 1-636 Kcmil ACSR, terminated at SDG&E's South Bay Power Plant Switchyard.

   Substation and transmission line estimated costs are $2,000,000 to $4,000,000.

2. Medium Plant

   Proposed transmission is a 138 kV DCTL, 2-954 Kcmil ACSR, terminated at SDG&E's South Bay Power Plant Switchyard.

   Substation and transmission line estimated costs are $2,000,000 to $4,000,000.

3. Large Plant

   Proposed transmission is a 138 kV, two DCTLs 2-954 Kcmil ACSR, terminated at SDG&E's South Bay Power Plant Switchyard. Possible system reinforcement may be required between South Bay and Miguel, and South Bay and Main St. Substation. These system improvements are most likely to be made by SDG&E as a part of their system expansion plans when possible 500 kV transmission from the east is terminated at Miguel Substation and if 230 KV transmission from Mexico is terminated at South Bay Power Plant Switchyard. If these future 230 kV transmission lines from Mexico are scheduled for service prior to, or coincident with, plant sitings, the proposed transmission lines should be changed to 230 kV and integrated into the overall system expansion plan.

   Substation and transmission line estimated costs are $5,000,000 to $10,000,000.

APPENDIX G

OPPORTUNITIES TO EXPAND COASTAL POWER PLANTS IN CALIFORNIA

EXECUTIVE SUMMARY
CONCLUSION

Areas "designated" by the California Coastal Commission (CCC) and the San Francisco Bay Conservation and Development Commission (BCDC) do not preclude opportunities for the reasonable expansion of existing coastal zone power plants. The most serious constraints to the expansion of these plants are the lack of sufficient available land, air quality "trade-offs," and restrictions on the future use of the ocean for "once-through" cooling water supplies. The combined effect of these factors poses the most significant constraints to the expansion of oil- and gas-fired power plants. Based on these results, the California Energy Commission (CEC) staff does not recommend any changes to the CCC and BCDC designations to accommodate the expansion of the noted power plants.

Project Description

This study examines opportunities to expand existing coastal zone power plants in California. It was conducted by the CEC in conjunction with the CCC and the BCDC to determine the effects of CCC and BCDC designated areas on reasonable expansion opportunities. It is a response to the mandates in Public Resources Code (PRC) Section 30413 and Government Code (GC) Section 66654. These legal mandates require the CCC and the BCDC to "designate" areas of their respective coastal zone jurisdictions where the location of a power plant of 50 MW or greater would prevent achievement of coastal resource protection objectives. These laws also require that existing power plants be provided with "reasonable" expansion opportunities.

Designated areas limit the siting opportunities of new electrical generating power plants in the state's coastal zone and, thereby, put a premium on the expansion of the existing coastal power plants. Information from this study is being used by the CCC and the BCDC in the biennial revisions of their designated areas and by the CEC in its continuing planning for the state's electrical-generating supply needs.

THIS STUDY IS A PRELIMINARY ANALYSIS OF EXISTING POWER PLANT EXPANSION OPPORTUNITIES; IT DOES NOT IDENTIFY OR SELECT SITES FOR EXPANSION. ACTUAL EXPANSION OF THE ELECTRICAL-GENERATING CAPACITY AT ANY OF THE EXISTING SITES WOULD REQUIRED ADDITIONAL DETAILED STUDIES AND REVIEW BY THE CEC FOR CERTIFICATION TO CONSTRUCT AND OPERATE.

The study examines expansion opportunities at 25 coastal zone power plant sites. Eighteen of the sites are in CCC jurisdiction, five in that of the BCDC, and two lie just outside the legally-defined coastal zone lines. The effects on expansion opportunities of 27 environmental and technical siting factors and three institutional factors--the Federal Power Plant and Industrial Fuel Use Act (PIFUA), the CEC 1979 Biennial Report (BR) supply criteria, and state nuclear waste disposal requirements (PRC Section 25524.2)--are analyzed to determine their impact on the study's results.

Five types of plants--nuclear, direct-fired coal, oil- or gas-fired steam turbine, combined cycle, and combustion turbine--are examined in conjunction with six fuel types--uranium, coal, oil, natural gas, methanol, and coal gas.

Three plants sizes are considered for each type of plant: small (70 - 400 MW), medium (500 - 800 MW), and large (1,200 - 1,300 MW). The study does not include an economic analysis in its examination of expansion opportunities.

Results

Expansion opportunities for various combinations of plant types to exist at 20 of the 25 sites. In many cases, the existence of natural or manmade constraints will require trade-offs or mitigation to offset the effects of adverse impacts. Expansion opportunities do not exist at five sites. These results are summarized in Table 1 on the following page, and in Table 12 on page 101.

Overall, the most consistently severe constraint to expansion opportunities is the lack of available land. Twenty-one of the 25 sites are severely constrained by the impingement of adjacent residential and industrial development, although expansion opportunities still exist at these sites. The exceptions to this constraint are sites located in predominantly rural areas where large amounts of undeveloped land are contiguous to the site boundaries.

The lack of air quality trade-offs is also a significant constraint to expansion opportunities. Ambient air quality standards are generally violated more often in urban than in rural areas. Expansion opportunities are further limited in urban areas since fewer trade-offs are available due to recent efforts to reduce pollution from existing sources.

Availability of once-through cooling water supplies from the ocean is a primary consideration in siting power plants on the coast. Fourteen of the 25 sites are located on enclosed bodies of water where expansion using once-through cooling processes are constrained or precluded due to thermal effects of discharge. Since only eleven of the sites are located to permit convenient use of ocean water for once-through cooling, this constraint is a notable limitation to coastal zone expansion opportunities. The potential to augment cooling water sources with municipal waste water supplies is limited by the volumes available, the level of treatment and the potential health impacts. The lack of available land becomes even more important at many sites when land intensive closed-loop cooling systems and air quality control technology systems are added. More space would be required for control systems on sites where space for normal expansion is already severely constrained.

Expansion opportunities for nuclear power plants are limited to the Diablo Canyon site. Maximum credible rock acceleration of .75g at this site indicates that, technically, nuclear expansion opportunities exist. However, the actual determination of expansion at the site is dependent on further review of off-shore fault hazards by the Nuclear Regulatory Commission (NRC). This study's conclusion of the existence of nuclear expansion opportunities at Diablo Canyon neither advocates nor disfavors licensing or expansion. Such an action will require more extensive engineering and economic analyses which are not within the scope of this study. Nuclear expansion opportunities are foreclosed at all other sites, including Humboldt Bay and San Onofre, by a combination of geological hazards and population influence zone density criteria.

The limitations of PIFUA on oil and gas fuels used in power plants will further limit expansion opportunities of steam turbine and combined cycle plants until interpretation, but is rather intended as a practical planning tool. The definition is clearly subject to revision upon further clarification of the statewide demand for electrical-energy generating capacity, and of regional equities.

METHODOLOGY

Design

This study uses a process of geographic focusing or screening to introduce a practical element into the review of expansion opportunities. The effects of a variety of technical expansion factors are examined at each site so that the true effects of the CCC and the BCDC designations, if any, can be determined. This geographic scoping process uses certain factors--air quality and geology--to review opportunities for expansion based on possible effects on a regional basis, and other factors--public facilities and natural resources--to review effects on a site-specific basis. Initial review is accomplished with regional analysis factors to identify effects of expansion which might be prohibitive or constraining to an unacceptable degree. If this initial regional review does not eliminate a site, the site-specific factors are applied and analyzed for similar levels of expansion constraint. The application of this screening process to this study differs from the usual site-screening process in so far as the foci of the screening are predetermined, that is, the existing power plant sites. The factor analyses, therefore, are used to predict effects generating from specific known locations rather than selecting sites, per se. The effectiveness of this process is adequate to meet the requirements of the preliminary level of analysis involved.

The study uses a limited number of site-screening factors which are applied only to a preliminary level of analyses sufficient to examine the effects of the CCC and BCDC designations. The results and conclusions of the study are therefore not conclusive, but are sufficiently detailed to meet the intent of the study.

Determinations of availability of expansion opportunities are thus, of necessity, based on the "null hypothesis" principle. If a clear prohibition to expansion opportunity has not developed upon completion of the screening process, a positive availability of expansion opportunity is assumed to exist <u>within the limits of the study's level of analysis.</u> This level of analysis, as previously noted, is not intended to result in site selection.

Scope

This study examines opportunities for expanding existing power plants located in, or adjacent to, California's coastal zone areas. The study is limited in geographic scope, due to the jurisdictions of the CCC and the BCDC, to the state's coastal zone areas. The plants are located, in the case of the CCC jurisdiction, along the 1,100 mile Pacific Ocean coast, and in the case of the BCDC jurisdiction, along the 300 mile shoreline of the San Francisco and Suisun Bays (see Figure 1).

The study's scope is limited to an examination of the adequacy of the CCC and BCDC coastal resource protection designations in providing, or maintaining, reasonable expansion opportunities at existing coastal zone power plants.

APPENDIX H

Area Prohibition Criteria

Of approximately 141 California Coastal Commission (CCC) undesignated areas (UAs), 136 were eliminated because they could not meet the evaluation criteria listed in Table 2 and defined in Appendix C. Figure H-1 identifies the location of all UAs examined. Table H-1 lists all the UAs and summarizes the evaluation results for each UA. Table H-1 provides the following information:

- o Column 1 contains the CCC UA number;
- o Column 2 contains the map numbers of the CCC coastal zone boundary and designation maps (161 7.5 minute quadrangle topographical maps).
- o Column 3 contains the evaluation factor that eliminated the area from the study results.
- o Column 4 contains the five UAs identified in the study results (they are renumbered for simplicity).

The evaluation factors defined in Appendix C are applied as described in Chapter 2, Project Description. The following definitions are given to provide the factor which eliminated an area from further review. The definitions are not to conflict with those used in the chapters of the text. They are used, however, to provide the reader with the limiting factors that prohibited an area from further study.

<u>Air Quality</u>

- o Could not meet Air Quality Criteria--Primary Screening.
- o Lacked Sufficient Air Quality Trade-Off--Secondary Screening.

<u>Terrain</u>

- o Terrain Difficulty--Sloping terrain that could not support power plant development.

<u>Land Use</u>

- o Incompatible Land Use--Existing or adjacent development that precludes power plant development (i.e., residential development/federal wildlife refuge).
- o Lack of Available Land--Parcel size too small for power plant development.

APPENDIX I

Public Participation Workshops and Written Comments

The draft report on this study entitled "Opportunities for New Coastal Zone Power Plants" was issued for public review in January 1981. Four public workshops were conducted by CEC staff at:

Eureka	March 9, 1981	7:00 p.m. - 9:00 p.m.
San Francisco	February 17, 1981	1:30 p.m. - 4:00 p.m.
San Luis Obispo	February 11, 1981	1:30 p.m. - 4:00 p.m.
San Diego	February 10, 1981	1:30 p.m. - 4:00 p.m.

Following the public workshops and comment period, changes to the draft report were made for the final report. The changes are as follows:

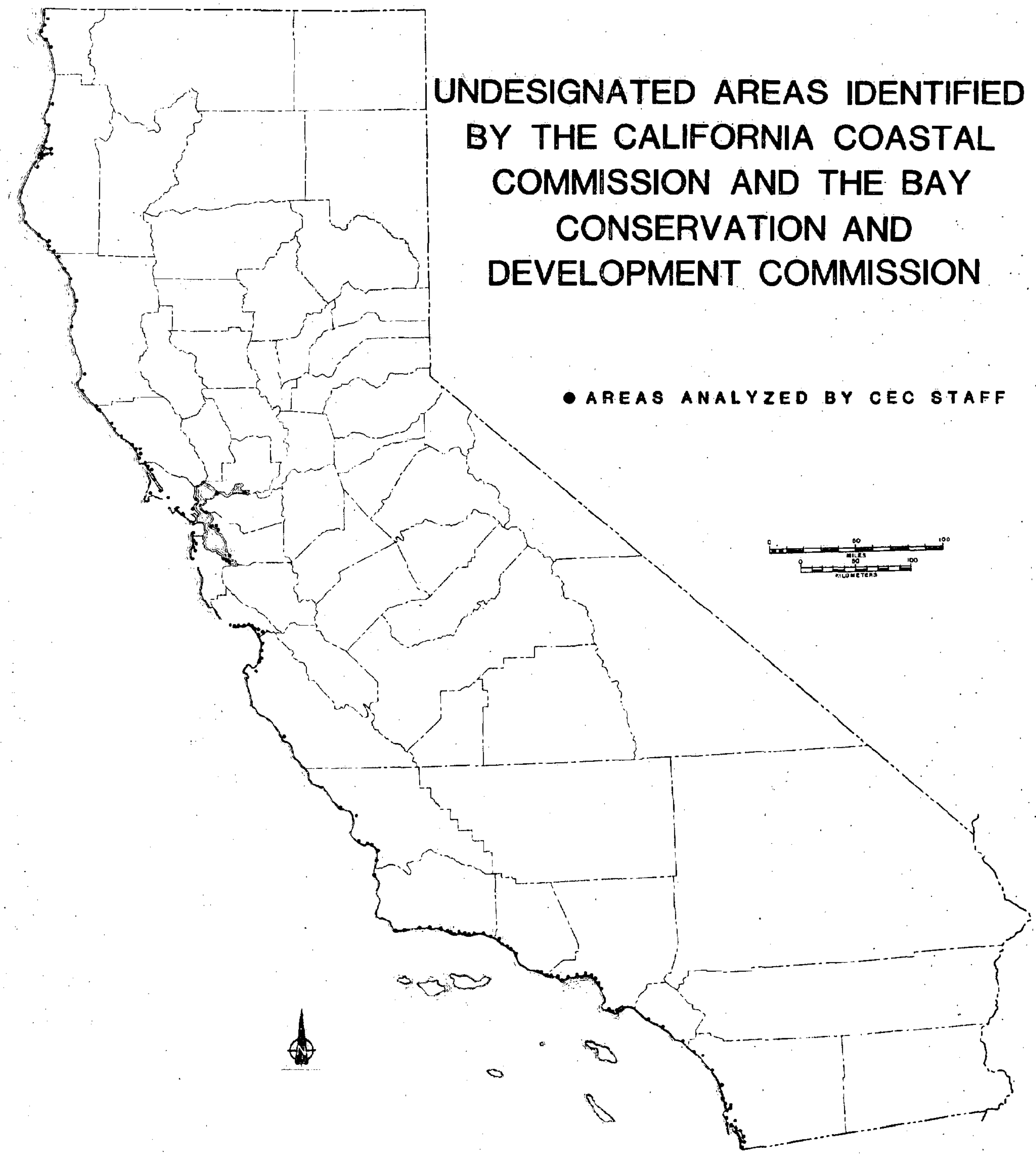
- o Deletion of Villa Creek (draft report Map 4) due to the prohibition of air quality on rugged coastal terrain;
- o Deletion of San Rafael, Richmond, and Golden Gate (draft report Maps 9, 10, and 11) due to the lack of available land and prohibitions associated with incompatible land uses;
- o Deletion of Tijuana River north and south (draft report Map 6A) because of prohibitions on endangered species habitat and incompatible land uses;
- o Inclusion of updated institutional factors to reflect the CEC 1981 Biennial Report (BR), and deletion of the discussion of the CEC 1979 Biennial Report and CEC 1981 Preliminary Report to the BR;
- o Inclusion of additional recommendations stating the CCC should adopt regulations that allow power plant access to ocean waters for once-through cooling, and that procedures be developed to accommodate the need for development at such time when they are required.
- o Completion of the discussion of setback criteria and analysis in the text and the appendix;
- o Correction of maps for clarification as required; and
- o Inclusion of additional up-to-date information to various sections throughout the report to reflect public comments and further technical analyses.

Comments at these workshops numbered approximately 11 and generally reflected the written comments. Fifteen letters were received with a total of 66 separate comments. Letters were received from:

1. Natural Resources Defense Council, Inc., dated February 3, 1981, signed Ann Notthoff and Laura King.

2. Target Technology Ltd., dated February 17, 1981, signed John Rodosevich.

FIGURE H-1



CALIFORNIA ENERGY COMMISSION

1981

Column 1 CCC UAs	Column 2 CCC Map #	Column 3 Reason for Elimination	Column 4 Selected UAs
1	1	Could not meet Air Quality Criteria	
2	1	Could not meet Air Quality Criteria	
3	2	Could not meet Air Quality Criteria	
4	2	Could not meet Air Quality Criteria	
5	2-3		UA 1A
6	2		UA 1B
7	8-10	Could not meet Air Quality Criteria	
8	12	Could not meet Air Quality Criteria	
9	13	Could not meet Air Quality Criteria	
10	14	Could not meet Air Quality Criteria	
11	13	Could not meet Land Use Criteria	
12	14	Could not meet Land Use Criteria	
13	14		UA 2
14	14	Could not meet Air Quality Criteria	
15	14	Could not meet Air Quality Criteria	
16	14	Could not meet Air Quality Criteria	
17	17 and 16	Could not meet Air Quality Criteria	
18	21-22	Could not meet Air Quality Criteria	
19	22-23	Could not meet Air Quality Criteria	
20	24	Could not meet Air Quality Criteria	
21	24	Could not meet Air Quality Criteria	
22	24	Could not meet Air Quality Criteria	
23	24-25	Could not meet Air Quality Criteria	
24	27-28	Could not meet Air Quality Criteria	
25	28	Could not meet Air Quality Criteria	
26	28	Could not meet Air Quality Criteria	
27	31	Could not meet Air Quality Criteria	
28	36-37	Could not meet Air Quality Criteria	
29	37-40	Could not meet Air Quality Criteria	
30	40-43	Could not meet Air Quality Criteria	
31	43	Could not meet Air Quality Criteria	
32	44	Could not meet Air Quality Criteria	
33	44	Could not meet Air Quality Criteria	
34	44	Could not meet Air Quality Criteria	
34	45-46	Could not meet Air Quality Criteria	
36	46-47	Could not meet Air Quality Criteria	
37	47	Could not meet Air Quality Criteria	
38	47	Could not meet Air Quality Criteria	
39	47 and 49	Could not meet Air Quality Criteria	
40	50	Could not meet Air Quality Criteria	
41	50-51	Could not meet Air Quality Criteria	
42	51	Could not meet Air Quality Criteria	
43	51,53-56	Could not meet Air Quality Criteria	
44	53-54	Could not meet Air Quality Criteria	
45	54	Could not meet Air Quality Criteria	
46	55-56	Could not meet Air Quality Criteria	
47	56-58	Could not meet Air Quality Criteria	
48	58-60	Could not meet Air Quality Criteria	
49	60	Could not meet Air Quality Criteria	
50	60	Could not meet Air Quality Criteria	

Column 1 CCC UAs	Column 2 CCC Map #	Column 3 Reason for Elimination	Column 4 Selected UAs
51	61	Could not meet Air Quality Criteria	
52	61	Could not meet Air Quality Criteria	
53	61-62	Could not meet Air Quality Criteria	
54	72	Could not meet Air Quality Criteria	
55	72	Could not meet Air Quality Criteria	
56	72	Could not meet Air Quality Criteria	
57	73	Could not meet Air Quality Criteria	
58	73	Could not meet Air Quality Criteria	
59	73	Could not meet Air Quality Criteria	
60	73	Could not meet Air Quality Criteria	
61	73-74	Could not meet Air Quality Criteria	
62	74	Could not meet Air Quality Criteria	
63	75-76	Existing Power Plant Identified in Power Plant Expansion Report	
64	78		UA 3A
65	78		UA 3B
66	79	Could not meet Air Quality Criteria	
67	84	Could not meet Air Quality Criteria	
68	86,88,90,93	Could not meet Air Quality Criteria	
69	99,101,102,104	Could not meet Air Quality Criteria	
70	104	Could not meet Air Quality Criteria	
71	106	Could not meet Air Quality Criteria	
72	107	Could not meet Air Quality Criteria	
73	107	Could not meet Air Quality Criteria	
74	109		UA 4A
75	110-111		UA 4B
76	112-115	Could not meet Air Quality Criteria	
77	119	Could not meet Air Quality Criteria	
78	121	Could not meet Air Quality Criteria	
79	121	Could not meet Air Quality Criteria	
80	121-122	Could not meet Air Quality Criteria	
81	121-122	Could not meet Air Quality Critiera	
82	122-123	Could not meet Air Quality Criteria	
83	123	Could not meet Air Quality Criteria	
84	123-124	Lacked sufficient Air Quality Trade Off	
85	124	Could not meet Air Quality Criteria	
86	124-125	Could not meet Air Quality Criteria	
87	125	Could not meet Air Quality Criteria	
88	125-126	Could not meet Air Quality Criteria	
89	126	Could not meet Air Quality Criteria	
90	126	Could not meet Air Quality Criteria	
91	126-127	Could not meet Air Quality Criteria	
92	127	Could not meet Air Quality Criteria	
93	127	Could not meet Air Quality Criteria	
94	127-129	Could not meet Air Quality Criteria	
95	129	Could not meet Air Quality Criteria	
96	131	Lacked Sufficient Air Quality Trade Offs	
97	131-132	Lacked Sufficient Air Quality Trade Offs	
98	132-133	Could not meet Air Quality Criteria	
99	133	Terrain Difficulty and Incompatible Land Use	
100	133	Terrain Difficulty and Incompatible Land Use	

Column 1 CCC UAs	Column 2 CCC Map #	Column 3 Reason for Elimination	Column 4 Selected UAs
101	133-134	Terrain Difficulty and Incompatible Land Use	
102	134	Terrain Difficulty and Incompatible Land Use	
103	134	Terrain Difficulty and Incompatible Land Use	
104	134	Terrain Difficulty and Incompatible Land Use	
105	134-135	Terrain Difficulty and Incompatible Land Use	
106	135	Terrain Difficulty and Incompatible Land Use	
107	135-136	Terrain Difficulty and Incompatible Land Use	
108	135	Terrain Difficulty and Incompatible Land Use	
109	136	Terrain Difficulty and Incompatible Land Use	
110	136-138	Terrain Difficulty and Incompatible Land Use	
111	138	Could not meet Air Quality Criteria	
112	138	Lack of Available Land (parcel size)	
113	138-139	Could not meet Air Quality Criteria	
114	141-145	Lack of Available Land (parcel size)	
115	145	Could not meet Air Quality Criteria	
116	145	Could not meet Air Quality Criteria	
117	147	Could not meet Air Quality Criteria	
118	147-150	Could not meet Air Quality Criteria	
119	150-153	Could not meet Air Quality Criteria	
120	153-154	Could not meet Air Quality Criteria	
121	154	Could not meet Air Quality Criteria	
122	154	Incompatible Land Use	
123	154	Could not meet Air Quality Criteria	
124	155	Could not meet Air Quality Criteria	
125	155	Could not meet Air Quality Criteria	
126	155	Could not meet Air Quality Criteria	
127	155,157	Could not meet Air Quality Criteria	
128	156	Could not meet Air Quality Criteria	
129	156	Could not meet Air Quality Criteria	
130	158	Could not meet Air Quality Criteria	
131	158	Could not meet Air Quality Criteria	
132	158	Could not meet Air Quality Criteria	
133	158-160	Could not meet Air Quality Criteria	
134	159	Incompatible Land Use, U.S. Naval Air Station	
135	159	Incompatible Land Use (Residential)	
136	159	Incompatible Land Use (Residential)	
137	160	Incompatible Land Use (Residential)	
138	160-161	Incompatible Land Use (Residential)	
139	161	Incompatible Land Use	
140	161	Incompatible Land Use	UA 5
141	161	Could not meet Air Quality Criteria	

3. Alexander Marine Research Facility, dated February 18, 1981, signed John A. Alexander PhD.

4. County of San Luis Obispo, Air Pollution Control District, dated February 18, 1981, signed Robert W. Carr.

5. San Diego Voice of Energy, dated February 19, 1981, signed Christine Worshom.

6. Environmental Center of San Luis Obispo, dated February 19, 1981, signed Kristie Wells.

7. California Central Coast Regional Commission, dated February 20, 1981, signed Steven Maki.

8. County of Del Norte, Planning Department, dated February 20, 1981, signed Diane Mutchie.

9. Cynthia Kesinger, dated February 20, 1981, signed Cynthia Kesinger.

10. Elaine S. Gorman, dated February 21, 1981, signed Elaine S. Gorman.

11. California Roadside Council, dated February 23, 1981, signed Yale Maxon PhD.

12. Pacific Gas and Electric Company, dated February 24, 1981, signed Nolan H. Daines.

13. County of San Luis Obispo, Planning Department, dated February 24, 1981, signed Paul C. Crawford.

14. Monterey County, Planning Department, dated March 3, 1981, signed D.W. DeMars.

15. Southern California Edison, dated April 3, 1981, signed Ronald R. Schroeder.

Natural Resources Defense Council (NRDC) - February 13, 1981

COMMENT: NRDC has done extensive research and has determined that California will need very little expansion of the existing electric supply system over the next fifteen years. The 1981 Biennial Report, Electricity Tomorrow, reaches a similar conclusion. This draft report is, therefore, irrelevent and we are opposed to the sacrifice of sensitive coastal resources to accommodate superfluous energy facilities.

RESPONSE: As indicated, the study is designed to evaluate the impact of CCC and BCDC designations on coastal zone power plant development. The study is not a site selection study and should not be interpreted as such. The study, based upon a limited preliminary analysis, shows that power plant development could be developed in areas that are not considered environmentally sensitive (undesignated areas per se). In addition, the areas identified are presented to show:

1. There are places in the coastal zone suitable for power plant development (if required).

2. There are environmental considerations that must be taken into account (if power plant development is pursued).

3. There are environmental constraints/prohibitions in the areas identified as suitable for power plant development.

The study does not supplant the regulatory requirements of the Public Resources Code 25000 et seq. To this extent, a further detailed, technical engineering and economic evaluation must be performed prior to the development of any coastal zone site. However, this work is valuable in that it identifies feasible options for development of conventional power plants as a contingency measure.

Target Technology Ltd. - February 17, 1981

COMMENT: An economic analysis was used in the evaluation of setback sites, however, the cost of building various plant types and operating various plant types was woefully neglected.

RESPONSE: Economic factors were used in the study in defining the various plant types, sizes and fuel types. It must be noted, however, further studies by utilities would cover economic factors in precise detail as part of the CEC's NOI/AFC process. The study makes this clear in different sections of the report.

COMMENT: A question asked about the probability of using various alternative technologies, filling the energy generation gap in the next twenty years.

RESPONSE: Chapter 4, Institutional Factors, discusses the California Energy Commission 1981 Biennial Report (BR) entitled "Electricity Tomorrow: Challenges and Opportunities for California." The report identifies California's preferred alternative energy future which includes such technologies as conservation, power pooling, renewable resources, geothermal, repowering existing facilities for clear fuel use, additional hydroelectric supply and coal to reduce our dependence on foreign imported oil and assist in stablizing our uncertain energy future.

COMMENT: Is capital intensive combined-cycle plants of limited size using coal gas and other synfuels, our only acceptable alternative.

RESPONSE: Our report findings show that clean fueled, 500 MW size facilities are preferable to other conventional power plant technologies.

COMMENT: Technology development and feasibility is not an issue. Economics is the only real issue in the final analysis.

RESPONSE: The report notes that further utility investigation should address economic impacts of any opportunity identified in this study. However, just as economics is a critical cost factor, various technologies are preferable to others based upon their ability to conform with strict environmental protection standards.

John D. Alexander PhD. - February 18, 1981

COMMENT: A power plant should be placed at least 5 km from a 500 foot elevation. No such condition remotely exists in the Villa Creek basin.

RESPONSE: The Villa Creek UA has been deleted from the final report.

COMMENT: San Luis Obispo County air pollution standards would not allow even the smallest of the suggested plants.

RESPONSE: CEC air quality analysis has identified sufficient emission offsets (trade-offs) to mitigate this constraint. The power plant technologies identified for this UA meet all applicable air quality standards. However, this UA has been deleted from the final report.

COMMENT: The Villa Creek site is geologically unstable for power plants.

RESPONSE: For nuclear power plants, this is a significant constraint. For this plant type further geotechnical analysis is required to find sufficient mitigation measures to reduce geologic instability.

COMMENT: Development of this coastal area would upset some of the world's most advanced efforts to stabilize the faltering supply of abalone, steelhead, clams and various other forms of sea life.

RESPONSE: These environmental concerns are addressed and identified in the report.

COMMENT: Although makeup water is not a huge factor, it would further tax an already strained water supply.

RESPONSE: This depends upon what type of water and cooling technology used. This study assumes the use of once-through ocean water cooling which will not significantly effect coastal fresh water supplies.

COMMENT: The Villa Creek site is already within sight and sound of an electrical energy generating facility.

RESPONSE: The Villa Creek UA has been deleted from the final report. However, this report considers such expansion opportunities in its conclusions and recommendations. (See Appendix G)

COMMENT: Construction of a power generating facility in such a pristine location as Villa Creek would galvanize both factions into action against the common enemy bureaucracy and the utility company involved. San Luis Obispo County residents already feel they are an energy dumping ground and certainly not in the mood to accept further blight upon their choice landscape.

RESPONSE: Villa Creek has been deleted from this final report based on a re-analysis of air quality impacts.

County of San Luis Obispo, Air Pollution Control District February 18, 1981

COMMENT: In Chapter 3, under Air Quality New Source Review section, there appears considerable discussion about possible ambient air quality standard violations because of power plant plume impingement on surrounding elevated terrain. Based upon the CEC's criteria, UA 4 should be eliminated.

RESPONSE: This opportunity has been eliminated from the final report.

COMMENT: In discussing the Santa Maria River, sites UA 5A and 5B, a statement is made regarding the fact that air quality regulations in Santa Barbara County severly restrict all power plant types and sizes. However, no similar statement is made for San Luis Obispo, even though the air quality are almost identical to that of Santa Barbara. Our district rules must be given equal consideration and be evaluated similarly.

RESPONSE: Santa Barbara County regulations are nearly similar to those in San Luis Obispo County. However, the Santa Barbara regulations prohibit power plants, where San Luis Obispo regulations do not due to the availability of trade-offs. As explained on page 17, it was assumed that a power plant could only obtain trade-offs in the same county. The difference in evaluating the two counties is based on the availability of emission offsets within the county. In this case San Luis Obispo has emission offset availability while Santa Barbara does not.

COMMENT: In Appendix D, Table D-1, page 141, labeled Emission Limitations, the emission limitations established by San Luis Obispo County APCD rules and regulations do not appear.

RESPONSE: This oversight has been corrected.

COMMENT: Table 15, page 102. District rules 403, 404, and 405 would not permit the construction of a small 50 MW oil-fired steam turbine. The "S" designation should be changed to an "O".

RESPONSE: True, the "S" designation should be changed to an "O" for the 50 MW oil-fired steam turbine. Such a plant would violate district rule 403.C.2 with respect to particulate emissions. However, the plant would comply with district rules 404 and 405.

COMMENT: Because of increased expansion of energy related industries within the county such as thermal recovery of heavy oil and offshore oil drilling cumulative impacts of air quality should be addressed and used as criteria for removing an undesignated area from further consideration.

RESPONSE: This was not done for two reasons:

1. Estimating future cumulative impacts from incompletely defined oil production activities would be extremely difficult, of dubious accuracy and beyond the scope of the study.

2. Many of the emissions resulting from increased oil production would have to be offset to comply with air quality regulations, thereby neutralizing much of the impact.

San Diego Voice of Energy - February 19, 1981

COMMENT: Agriculture also requires electricity. There should be an attempt to balance the water needs of both agriculture and power plants.

RESPONSE: This study is intended to provide information useful in balancing such regional equities.

COMMENT: We need to pursue conservation efforts while recognizing that new power plants will be needed to provide electricity.

RESPONSE: This is a major Energy Commission policy as shown in Chapter 4, Institutional Factors, 1981 Biennial Report.

COMMENT: It is better to provide a mix of all sources of electricity coal, nuclear, solar, geothermal and wind to reduce dependence on unreliable imported oil.

RESPONSE: The CEC 1981 Biennial Report is pursuing alternative supply options such as those characterized. See Chapter 4, Institutional Factors.

Environmental Center of San Luis Obispo - February 19, 1981

COMMENT: Valuable sensitive marine habitats and resources should not be disturbed. The impact of thermal pollution upon these resources (commercial and otherwide) was not given sufficient attention in the study.

RESPONSE: This study is of a preliminary nature which does not include a highly detailed engineering analysis. As stated in the Summary under recommendations: "The utilities should conduct site-specific feasibility studies ..." Further, the pollution analysis is based on federal standards.

COMMENT: To preserve the unspoiled and scenic nature of our coastline was expressed as a major concern.

RESPONSE: An underlying factor of this study was to identify any environmental constraints that would prevent the achievement and preservation of sensitive coastal resources (including visual quality).

COMMENT: A concern for the local ambient air quality, particularly in light of the fact that San Luis Obispo has a very low inversion layer and is quite close to exceeding federal ozone standards. Inasmuch as future development of potential oil resources offshore our coast is quite possible we are concerned about the cumulative impacts of oil development and additional local power plants upon our air quality.

RESPONSE: Although an evaluation of cumulative impacts is not within the scope of the study, CEC staff have determined the availability of emission offsets to maintain a balance in air pollution for existing and proposed new sources.

COMMENT: We are concerned about the impact of the construction of a new plant at the Villa Creek site upon our north coastal communities.

RESPONSE: Villa Creek has been deleted from the final report.

COMMENT: We are concerned that the rural quality of the environment of our county will be sacrificed for the sake of supplying the electrical demands of distant urban areas. San Luis Obispo County already supplies over seventy percent of the energy locally produced to other urban centers. We feel that any consideration of this issue has been sorely lacking in Energy Commission policies and studies.

RESPONSE: This is an important issue to which the CEC staff is sensitive. This study was limited in its identification of opportunities by the pre-existing location of CCC and BCDC Undesignated Areas.

Central Coast Regional Commission - February 20, 1981

COMMENT: The North Central Coast air basin is presently a nonattainment area for petro-chemical oxidant. Power plant pollutant emissions at UA 3 would exacerbate existing violation of the federal air quality standard and possibly exceed other standards presently being complied with.

RESPONSE: Chapter 3 describes necessary criteria for photochemical oxidants in nonattainment areas. Such areas have been examined based on these criteria and it has been determined that available trade-off exist to offset power plant emissions from those identified under area profiles.

COMMENT: Nuclear Regulatory Commission (NRC) geologic/seismic siting and design criteria parameters should be utilized to ascertain opportunities/constraints for non-nuclear power plant locations.

RESPONSE: The NRC criteria derive from the need for a safe shut down during and after a major earthquake (for example). The basic concern is reducing the potential for long term environmental contamination and adverse effects to human health and safety (i.e., radiation release).

Non-nuclear thermal power plants do not pose these potential problems to the surrounding environment. The need for performance during and after an earthquake or other event is related basically to plant reliability needs (power production), however, certain plant components might have a safety basis for design (e.g., no structural collapse on occupants).

COMMENT: The majority of UA 3B is within the Fort Ord military reservation within the City of Marina, utilized for military training, and is in the flight path of missile launching operations and is adjacent to military shelling areas.

RESPONSE: These constraints are identified and considered in the analysis of this UA.

COMMENT: The presence of the southern sea otter and its mandated protection under the Endangerred Species Act (16 USC 1531, et seq.) was the major factor in the U.S. Army Corps of Engineer's denial of PGandE's request to enlarge its existing Moss Landing marine oil terminal. Therefore, the statement on page 52 appears erroneous in light of precedence established by the Corps for protection of the sea otter from offshore fuel oil transportation system impacts.

RESPONSE: The preliminary nature of the study was to identify obvious environmental factors associated with developing potential site for power plant development. The report, in its identification of the southern sea otter, serves notice that it is a major environmental concern. However, a more detailed examination of this site and associated mitigation measures would be required prior to developing the area for power plant construction.

Inclusion and analysis should result in classification of UA 3A and UA 3B as designated areas where new thermal power plants or transmission lines would prevent achieving The objectives of the Coastal Act (PRC Section 3041 3(b)).

The objective of this report is to determine the effects of CCC and BCDC designations on opportunities to locate electric generation facilities in undesignated areas. The results of this study do not indicate that UA 3A and UA 3B should be reclassified as designated areas. Arguments for such reclassification should be directed to the CCC.

Del Norte County - Planning Department - February 20, 1981

COMMENT: Reference is made to the designation requirements for thermal power plants of 50 MW or greater. What requirements and/or restrictions would apply to those of lesser output?

RESPONSE: Pursuant to Public Resources Codes, Section 25108, 25120, and 25500, thermal power plants lesser than 50 MW are not under the purview of the CEC regulatory responsibility.

COMMENT: An 8 - 10 MW combustion turbine power plant may be proposed at a site within the coastal zone, but not within the UA 1 or UA 2. What impact, if any, would the report have on such a project?

RESPONSE: The report would have no effect on this project, however, it is suggested that you review the report for guidance in developing methodologies for evaluating environmental impacts of power plant development.

COMMENT: The Coastal Zone boundary is not depicted correctly on Map 1A.

RESPONSE: This oversight has been corrected.

COMMENT: Highway 101 south of the Sitka Spruce Grove (Area 9, Map 1B) and Bluff Road (also Map B) are designated as view corridors in the Visual chapter of the Local Coastal Program.

RESPONSE: This reference has been noted in the final report.

COMMENT: The boundaries for state and federal lands are not clearly defined on either map.

RESPONSE: State and federal boundaries were not considered as a part of this study. The focus of the study is on the CCC and BCDC jurisdiction and does not directly consider state and federal boundaries.

Elaine Gorman - February 21, 1981

COMMENT: This comment suggested that such nongeneration technologies as conservation be used to reduce energy consumption. Renewable resources such as solar, wind, agriculture waste and wood should be further studied and used for energy production. It seems that government and industries are looking more toward synfuel development, rather than, looking at solar and wind to produce electricity. The latter has been used for centuries and are proven to be reliable and safe.

RESPONSE: Chapter 4, Institutional Factors, identifies the policies of the 1981 CEC Biennial Report. These policies reflect your concerns.

Pacific Gas and Electric Company - February 24, 1981

COMMENT: PGandE is not encouraged by the conclusion on future coastal siting arrived at by this report. One major concern is that all by thirteen undesignated areas out of 200 have been eliminated based on highly conservative criteria.

RESPONSE: Opportunities identified in this report are based on standard power plant site characteristics. The criteria utilized were extensive and reflect current regulatory limits.

COMMENT: It is stated that this is not a site selection report and that all certification procedures must be followed. It should also not be a site elimination report based on data that the report has chosen to leave unpublished, without public hearing or reviews.

RESPONSE: All information associated with this study is available for review, and four public workshops have been conducted, after ample notification. By definition, a study which does not select sites, does not eliminate them either. This study was designed to identify general opportunites and associated environmental impacts, constraints and prohibitions.

COMMENT: A superior site may have been eliminated because of one major problem for which an engineering cost solution can be found. For example, the Samoa Spit--UA2, at Eureka was found to be unsuitable for a coal-fired plant because of the lack of land availability for waste disposal. At added cost, the wastes could be carried off site by rail to a suitable disposal area. Also, once through cooling should not be prejudged as a serious constraint. Limitations because of significant impacts of once-thorugh cooling may be solved by carefully engineered off-shore intakes and discharges for the ocean sites.

RESPONSE: As stated in the recommendations, Chapter 6, the utilities should conduct site specific feasibility studies. The study, in addition to, evaluating designated area impacts on coastal power plant development, identified environmental constraints and/or prohibitions. For example, the rail line on the Samoa Spit washes out during periods of heavy rain. If PGandE wishes to consider the investment of capital to improve the rail lines, this environmental constraint could be mitigated. It must be noted, however, the scope of the study was not designed to include a detailed economic/engineering analysis of such factors.

COMMENT: The report concludes that no nuclear facilities can be built on the coast because of the lack of positive geologic stability, and population density criteria. However, as the report states, the results of the geologic studies are not conclusive. We believe that the potential for future nuclear plants continues to exist on the coast.

RESPONSE: The report does not state "no nuclear facilities can be built on the coast," rather it states that based on an overview assessment, no opportunities could be identified for nuclear sites within one hundred and forty one UA's studied. From a geotechnical perspective, the potential for future nuclear continues to exist, however, the study did not evaluate such potentials at all possible coastal locations.

COMMENT: An air quality impact analysis was used to eliminate many of the 187 sites from further consideration. A criterion (Page 22), which assumes the worst case of very stable air (Pasquill Stability Class F) is highly conservative. A modeling study conducted for a high potential site, using actual data collected for this purpose, may show an entirely different conclusion.

RESPONSE: This may be true, however, if PGandE has site specific meteorological data for areas that were eliminated, and has performed worse case air quality impact analysis with different results than those of the CEC analysis, the CEC staff would be willing to reevaluate its results.

COMMENT: We consider the estimated range for the potential siting of 4,500 - 6,000 MW at the thirteen locations to be unrealistic. Although we believe this range could be easily obrainable, we do not think it is realistic based on the criteria used in this report. On page 93 it is stated that "real" opportunities exist only for medimum sized combined-cycle facilities fired by low air emission synthetic fuels. The "practical" definition of 4,500 MW should not take credit for opportunities which are not real. It is not practical to assume more than a fifty percent success rate with any group of sites.

RESPONSE: The megawatts in Table 16 are only given to show the range of potential power plant types and capacities in undesignated areas.

COMMENT: This report should be used by the CCC and the BCDC in biennial revisions of their designated areas, and hopefully for no other purpose. On page 3, the report suggests a third objective to reduce the duplication effort in future studies by the utilities. Unfortunately, as discussed above, because your undisclosed criteria may be too restrictive and because engineering solutions are available, we cannot be limited in our inventory of coastal and Bay Area sites to the thirteen areas reviewed in this report.

RESPONSE: The report serves its purpose in assisting the CCC and BCDC in reevaluating their designated areas. It is hopeful that utilities can build upon the results of the report, increasing the success rate in developing power plant sites and thus providing savings to utilities and rate payers. CEC staff invite further coordination with the utilities on this and similar studies.

Planning Department - San Luis Obispo - February 24, 1981

COMMENT: A question was raised on the evaluation of the ability of the area to house and provide public services and facilities for the large workforce and its accompanying population influx that would result from developing a site for a power plant.

RESPONSE: Although this area is not within the scope of this study, some housing data is captured herein for additional information.

COMMENT: Cumulative impacts of pertinent issues should also be considered (i.e., housing constraints, major planned projects and future oil exploration).

RESPONSE: The study factors are applied sequentially, and as stated in the scope of the report, cumulative impacts are not evaluated.

COMMENT: Conclusion Disclaimers. The report provides a number of significant findings and disclaimers that are not apparent in the report summary. It would further enhance the report if other conclusions were included (i.e., PIFUA impacts, power plant characteristics making small MW power plants impractical and impacts on ambient air quality standards).

RESPONSE: PIFUA is identified as an institutional factor and is given in greater detail in Chapter 4. Impractical assumptions and ambient air quality standards are not included in the summary due to the length of there examination. However, these are identified in the scope of the study and in the chapter analysis.

COMMENT: The California Energy Commission and the California Coastal Commission should jointly address the equity issue including the use of rural areas to meet the electricity demands of urban centers.

RESPONSE: The resolution of this major policy issue is not within the scope of this study.

COMMENT: Change reference from Table 4 to Table 5 on Page 3.

RESPONSE: So noted.

COMMENT: Under UA 5, Page 35; housing development for constructure of the Diablo Canyon power plant cannot be used. The reduction in work-force and resultant vacancies have been absorbed by the population growth of the region. Therefore, this statement should be corrected.

RESPONSE: The statement has been clarified to reflect the limited availability of such housing.

COMMENT: Reference to this site as the Santa Maria River is misleading. It is suggested that this site be referenced as the Nipomo Mesa Industrial area.

RESPONSE: Opportunities are identified by reference to major geographical features where possible.

COMMENT: Villa Creek - the low probability of siting an additional marine terminal to fuel this plant as the site is within the habitat of the threatened California Sea Otter.

RESPONSE: Villa Creek has been deleted from the final report.

COMMENT: Analysis used for determining pumping cost penalties appears to be inappropriate. Rather than using findings derived from the siting of a large 1,000 MW facility. This analysis should include findings for the siting of a plant of a size anticipated along the coast, 100 - 400 MW.

RESPONSE: Setback pumping analyses included all types and sizes of power plants noted in Table 1. Space permits duplication of only limited portions of this information.

COMMENT: Findings in Table 13A identify site 5A as feasible for power plant at 2 - 6,000 feet from shore, yet the potential is over 2.5 miles away (13,000 feet plus). This discrepancy should be corrected in the final report.

RESPONSE: The final report is changed to reflect the actual setback distance.

COMMENT: The following are issues/concerns that should be denoted:

- o Air quality impacts on power plant operations,
- o Limited housing and public services are available,

- Setback opportunities may not be available,
- Potential costly foundation work at site 5B due to liquefaction.

RESPONSE: Although the text is somewhat decentralized due to coordination of the variety of siting factors, the major points of this comment have been addressed.

Cynthia Kesinger - February 25, 1981 - San Luis Obispo

COMMENT: Villa Creek and the Santa Maria River deserves further studies. Santa Maria River provides habitat for the endangered Least Tern and Villa Creek is an invaluable riparian habitat. In addition, air quality is a major concern due to the severe inversion factor and the topography would contribute to worsen our air quality. All precautions should be made to ensure our air will not be degraded.

RESPONSE: The Villa Creek area has been deleted from the final report due to air quality constraints. The endangered species are identified under biological resources. San Luis Obispo has sufficient emission trade-offs available to offset projected power plant emissions.

COMMENT: Planners seem to ignore the cumulative impacts of mounting energy projects. Our county is rapidly becoming a haven for energy projects.

RESPONSE: This study was designed to evaluate opportunities in undesignated areas. Cumulative impacts are somewhat considered in the air quality analysis and will require further consideration in any site specific studies.

Monterey County Planning Department - March 3, 1981

COMMENT: UA 3A does not lie entirely west of Highway One as stated on page 51. Rather, it lies both west and east of Highway One and is bisected by the highway. Map 3A shows only the old Highway One (now Del Monte Avenue) and should be revised; the new highway is located some distance westward of the old alignment. Secondly, UA 3A is not located entirely north of the City of Marina as stated on Page 51. It lies partially within the city limits and partially within the unincorporated area. The section "Physical Characteristics" should be revised accordingly.

RESPONSE: So noted.

COMMENT: The Board of Supervisors is strongly opposed to the development of new power plants along the Monterey Coast. This opposition has been expressed in past resolutions and letters sent to the California Coastal Commission. The Energy Commission is strongly urged to classify UA 3A and 3B as "Designated Areas" for the following reasons: 1) in recognition of the high scenic, recreational, and habitat values of this portion of the North Monterey coastline; 2) in acknowledgement of the county's significant contribution to statewide power needs through the existing power facilities at Moss

Landing; and 3) in conformance with the recently adopted local coastal land use plan for North County.

RESPONSE: This study was limited in its scope by the pre-existing location of UA's identified by the CCC. It is not within the scope of the CEC's legal authority to reclassify Undesignated Areas. This power resides only with the CCC.

COMMENT: UA 3A and 3B constitute the scenic gateway to the Monterey Peninsula. Highway One parallels the shoreline between Marina and Seaside providing excellent views of the ocean and the outstanding sand dune formations. Although much of the area is now closed to public access because of Fort Ord, its continuous beaches offer exciting recreational opportunities for the future. The visual effects of future power plants would be highly detrimental to the outstanding aesthetic qualities of Monterey County's coast. In turn, this will affect public recreational enjoyment of the area, as well as tourism, a principal County industry.

RESPONSE: This study does not advocate sites for construction of power plants. It only identifies general opportunities to assist the CCC and BCDC with their biennial revision process. Any proposal to develop such sites must meet the power plant licensing and certification requirements of the CEC.

COMMENT: The information under "Natural Areas", page 52, should also be revised to reflect the environmentally sensitive habitats adjacent to UA 3A. The dunes which extend from the Salinas River mouth to the City of Marina limits are not just "less degraded and of greater habitat value" as suggested in the draft report. Rather, this dune area encompasses the most viable natural coastal strand habitat remaining along Monterey Bay. Its habitat value is indicated by both the U.S. Fish and Wildlife Service designation as a "Wildlife Area" and by the North County Local Coastal Land Use Plan designation as a "Resource Conservation Area" in which all development is restricted to protect the habitat values.

RESPONSE: This information is incorporated in the final report.

COMMENT: The California Energy Commission should also note that the recent Corps of Engineers denial of the PGandE permit for expansion of its power plant at Moss Landing was based solely on potential impacts to the threatened southern sea otter. Opportunities for siting facilities involving offshore fuel transportation systems are thus (not "may be" as stated in the report) severly limited along the Monterey Coast.

RESPONSE: This constraint has been taken into account.

COMMENT: The draft report's recommendations pertaining to UA 3A (Page 96 and 103 - 104) are in direct conflict with the adopted North County Local Coastal Land Use Plan and with the draft Moss Landing Community Plan recently approved by the Planning Commission. Together these plans prohibit any industry which would contribute to air and water pollution and allow only limited onsite expansion of the existing PGandE power plant.

RESPONSE: This conflict should be resolved by the CCC in its biennial revision process and in its LCP Certification process

California Roadside Council

COMMENT: This comment was in regard to further power plant development and the associated negative effects they have on the beauty of the California coastline.

RESPONSE: One of the many purposes of this report was to identify negative environmental impacts associated with power plant development on California's sensitive coastal zone. The scope of the study was limited by the pre-existing locations of UA's as identified by the CCC and the BCDC.

Los Angeles Department of Water and Power - March 3, 1981

COMMENT: We have reviewed this report and find that the CEC staff was not able to find any coastal siting opportunities in approximately 290 miles of coastline about the City of Los Angeles. This same stretch of coastline, however, contains some fifteen generating stations which use ocean water for cooling purposes. There appear to us two possible reasons why no additional opportunities for siting power plants were identified in this coastal area. Either the screening factors were applied too restrictively or the limited number of undesignated areas too severly restricted the scope of the study.

RESPONSE: CEC staff have previously reported on "Opportunities to Expand Existing Coastal Power Plants in California". This report identifies numerous opportunities to expand existing power plants within the area noted. However, expansion opportunities do not have thr same characteristics as opportunities for new power plants. The latter opportunities in the Los Angeles area have been constrained by the intensive urban development which has occurred since many of the fifteen power plants noted in your comment were constructed.

Further, the scope of this study was initially limited by the preexisting location and characteristics of UA's identified by the CCC. Virtually all of these UA's incorporate difficult terrain and/or complete urban development. CEC staff will be pleased to consider any opportunities for new power plants identified by LADWP staff in any of the UA's.

COMMENT: We believe your staff's use of the five levels of opportunity criteria and the availability determinations based upon the "Null Hypothesis" principle should have allowed this study to develop a larger number of possible opportunity areas for power plant siting in the California coastal zone. It was stated at the workshops that only 25 percent to 30 percent of the California coastal zone was examined by this study, as this was the amount of the coastline left undesignated as a result of the California Coastal Commission (CCC) designation process. We believe that using the results of the designation process may have too severly restricted the scope of the investigation; hence, we believe the scope of "Opportunities for New Coastal Power Plants in California" needs to be expanded to consider the designated areas.

RESPONSE: The scope of this study was dictated by the requirements of the CCC and the BCDC.

COMMENTS: Page 97 which addresses the Santa Maria River area. The first paragraph of this section states that the undesignated area 5A is "entirely separated from ocean access by a full designation." The second paragraph states that the undesignated area 5B is "set back one to two miles, with ocean access precluded by a designated area." The third paragraph states that "cooling water (ocean) supplies are available... Available land exists for all plant sizes and all cooling processes." It appears to us that a contradiction exists. A full designation precludes access for even ancillary facilities. It appears that no ocean cooling siting areas by the above statements, and hence, we believe that this area of this report should be clarified.

RESPONSE: This contradiction is clarified in the final report by noting the necessity for partially-designated areas to provide access to ocean water at such locations.

Southern California Edison (SCE) - April 3, 1981

COMMENT: SCE disagrees with the report finding that the most severe constraint to opportunities at the 13 undesignated areas is the impact of plant cooling water systems on marine biological resources. Six of SCE's 8 power plants are located on the coast, and during the past 11 years, SCE has spent in excess of $38 million to evaluate the effects of these power plants on offshore marine biological resources. Our results have shown that these effects are not significant.

RESPONSE: True, reports on thermal discharges at existing coastal power plants have not shown significant impacts to marine biological resources. However, our investigation of the undesignated areas identified in this study found that there are many species that are potentially sensitive to thermal discharges of various power plant types. Since the scope of the study is a preliminary evaluation of potential areas suitable for power plant development, the recommendations of Chapter 6 state that utilities should do further site-specific evaluations to determine appropriate mitigation measures necessary to protect such sensitive marine biological resources.

COMMENT: None of the 13 areas meeting the evaluation criteria are in SCE's coastal siting territory. We believe that there are areas within our siting territory which are suitable for power plant development that have been labeled as designated areas by the CCC.

coastal sites should be made available due to economics of construction and operation and the difficulties of acquiring inland fresh waters.

RESPONSE: The staff agrees that there may be designated areas in you service area that could possible support power plant development. It is not, however, within the scope of the report to address designated areas suitable for power plant development, nor is it within CEC regulatory authority to determine which areas of the coast are to be classified as designated, partially designated, or undesignated. This report, in addition to the previously issued Expansion Report, shows that there is potential to develop existing power plant sites and that there are undesignated areas on the coast suitable for power plant development.

APPENDIX J : POWER PLANT SITE MAPS

CCC DESIGNATED AREA FACTORS

Staff-Recommended Designations of Areas
Unsuitable for Power Plant Construction Under
Section 30413(b) of the California Coastal Act of 1976

Adopted September 5, 1978

Designation Boundary

Coastal Zone Boundary

|||||||||||||||||||| "Partial" Designation

1 - Publicly Owned Parks

2 - Other Recreation Areas

3 - Wetlands and Estuaries

4 - Marine Life Refuges and Reserves, Ecological Reserves, Areas of Special Biological Significance

5 - Marine Resources (kelp beds, rocky intertidal and subtidal areas, mouths of anadromous fish streams)

6 - Marine Mammal and Seabird Breeding and Resting Areas

7 - Environmentally Sensitive Habitat Areas

10 - Wildlife Habitat, Cultivated Agricultural Land

8 - California Natural Areas Coordinating Council Areas

9 - Forestry Special Treatment Areas

10 - Cultivated Agriculture - Special Agrarian Communities

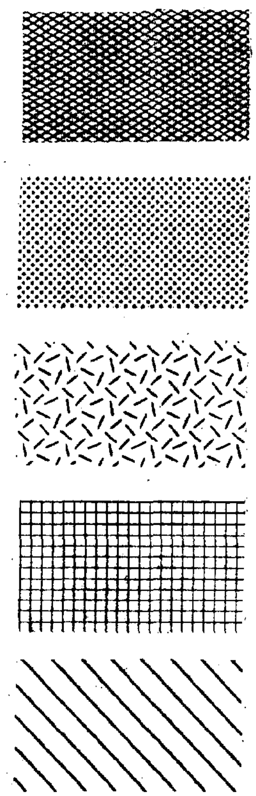
11 - View Protection

12 - Inadequate Public Services

13 - Riparian Vegetation

a - After any number indicates an area proposed for acquisition by a State Agency

CEC Natural Resource Pattern Key



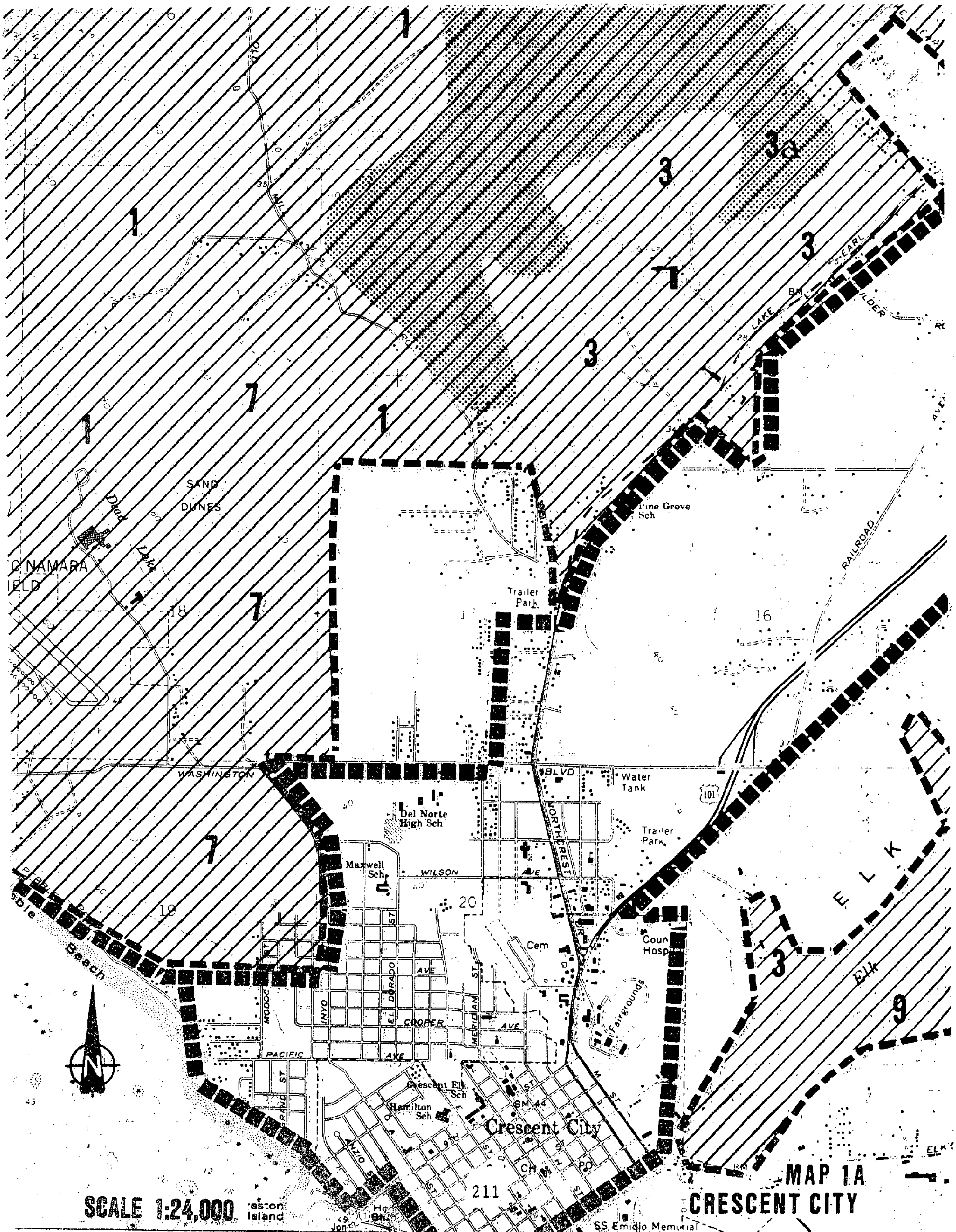
Species Habitat of Special Concern

Areas of Critical Concern

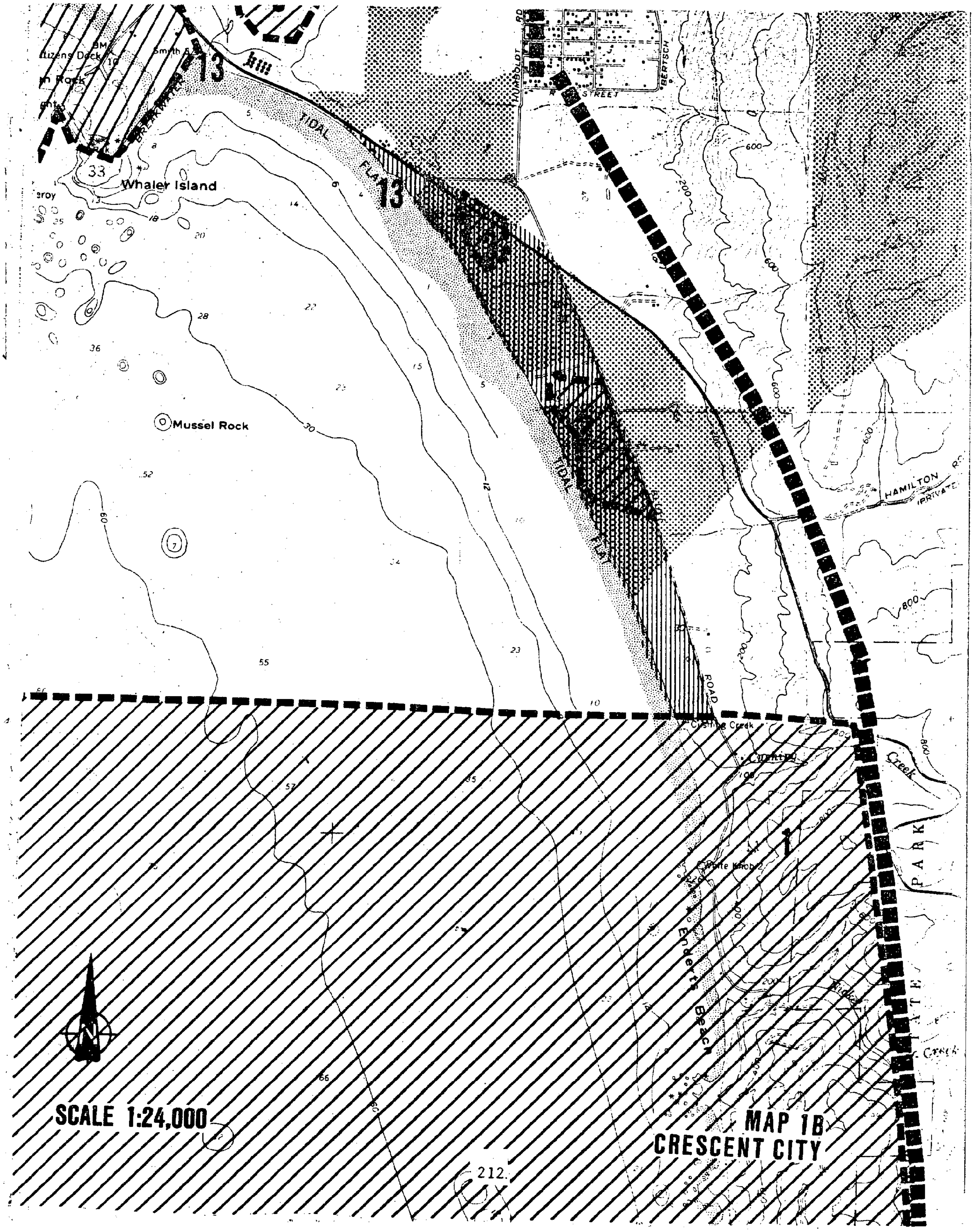
Commercial and Recreational Resources

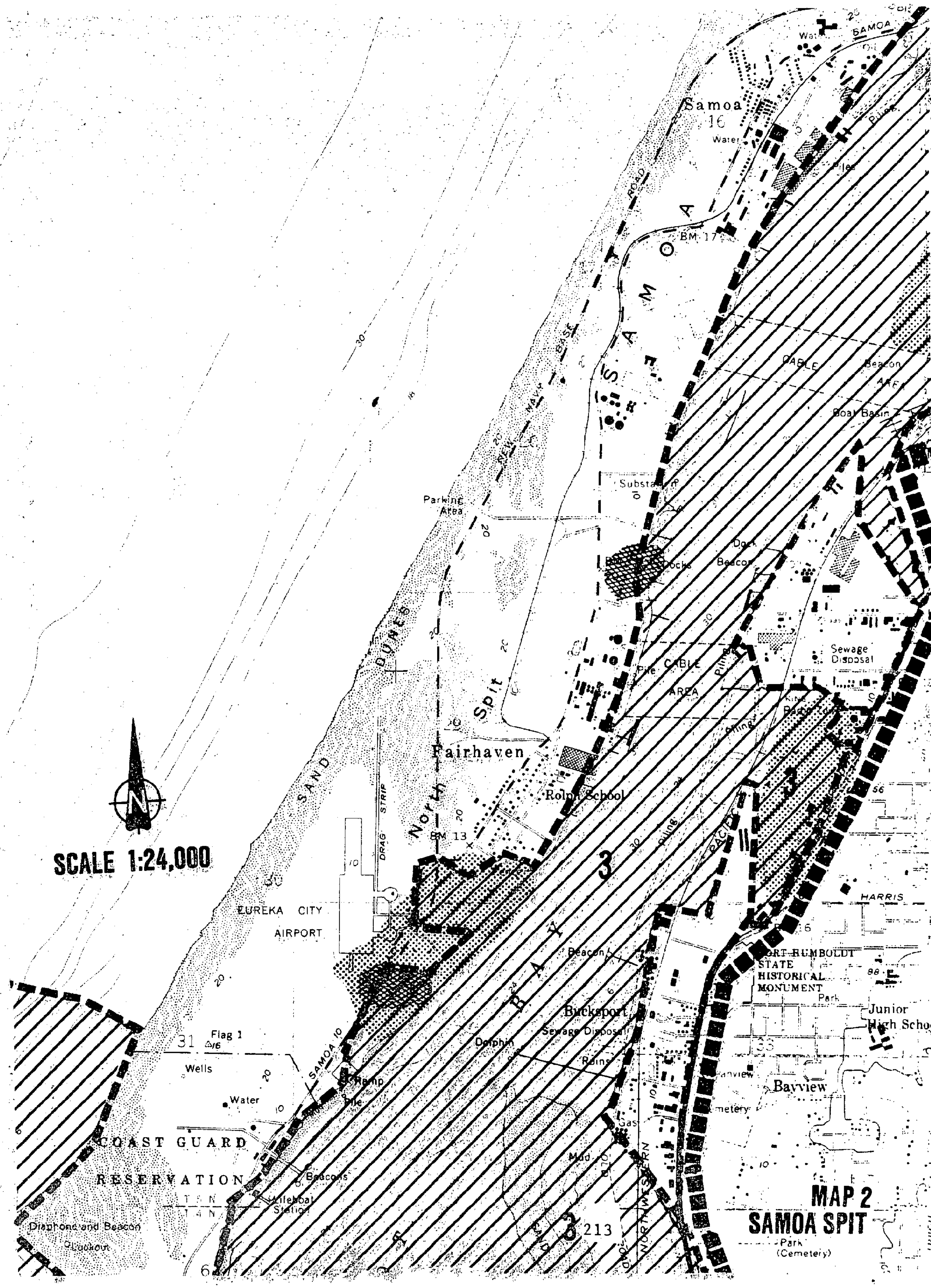
Protected Species Habitat

CCC Designated Areas

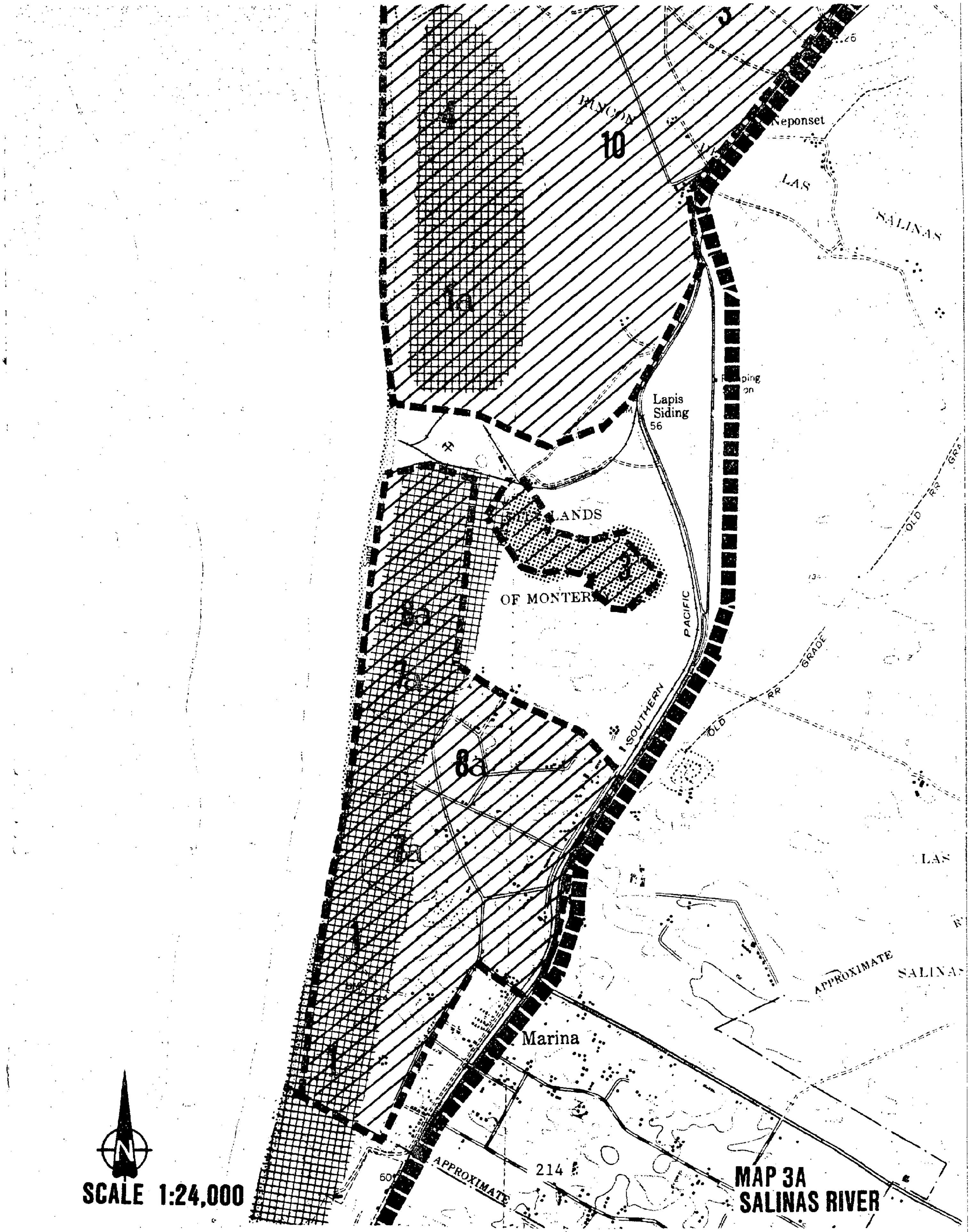


MAP 1A
CRESCENT CITY


Whaler Island
Mussel Rock
TIDAL FLAT
HUMBOLDT RD
BERTSCH
STREET
HAMILTON
ROAD
Cushing Creek
Enderts Beach
13
13
33
SCALE 1:24,000
MAP 1B
CRESCENT CITY

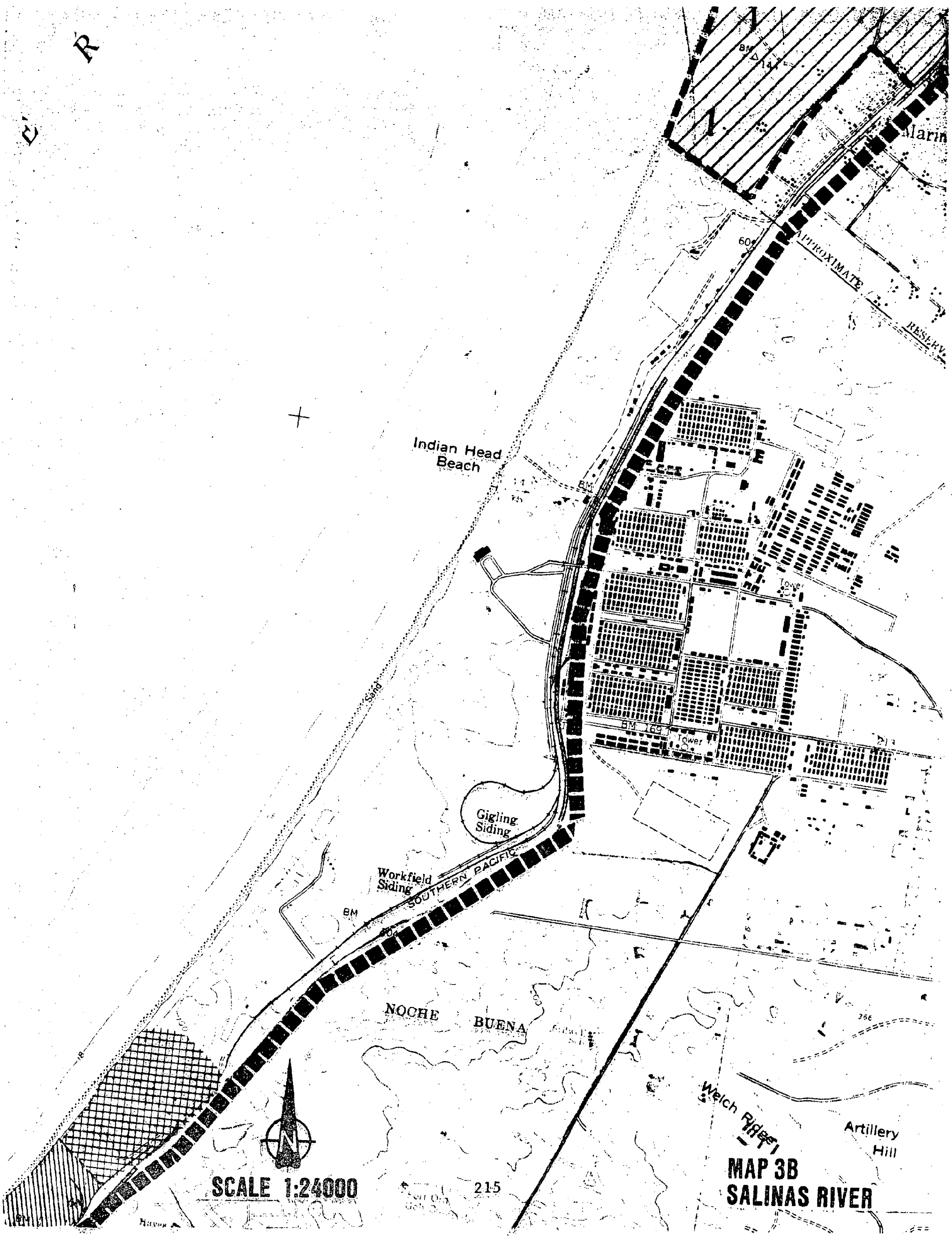


SCALE 1:24,000
MAP 2
SAMOA SPIT
Samoa
Fairhaven
Rolph School
North Spit
SAND DUNES
EUREKA CITY AIRPORT
DRAG STRIP
COAST GUARD RESERVATION
Bucksport
Bayview
FORT HUMBOLDT STATE HISTORICAL MONUMENT
Junior High Schoo
Sewage Disposal
CABLE AREA
BAY
Boat Basin
Wells
Water
Flag 1
Beacons
Lifeboat Station
Diaphone and Beacon
Lookout
Parking Area
Substation
Docks
Beacon
Dolphin
HARRIS
NORTHWESTERN
Park (Cemetery)

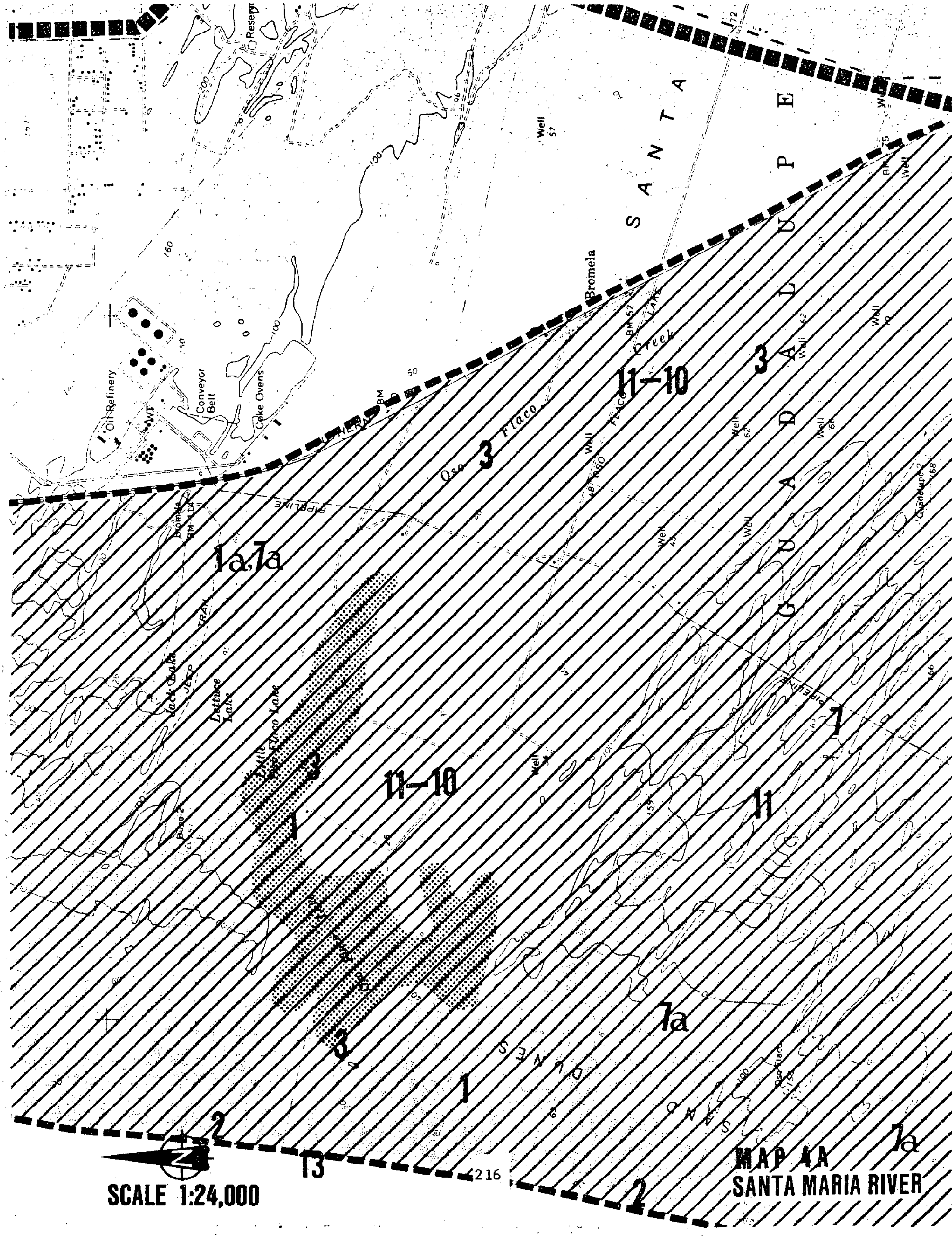


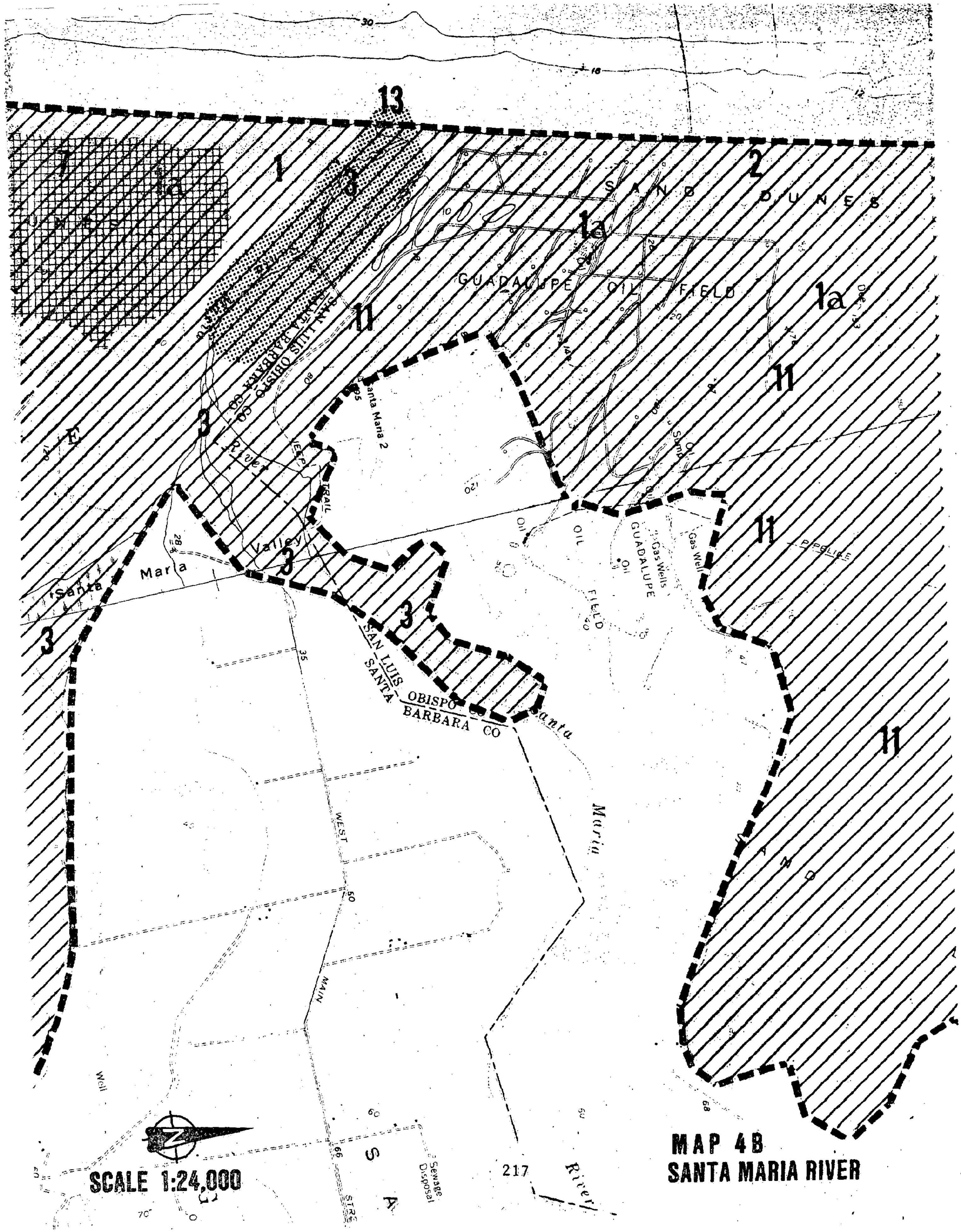
SCALE 1:24,000

MAP 3A
SALINAS RIVER

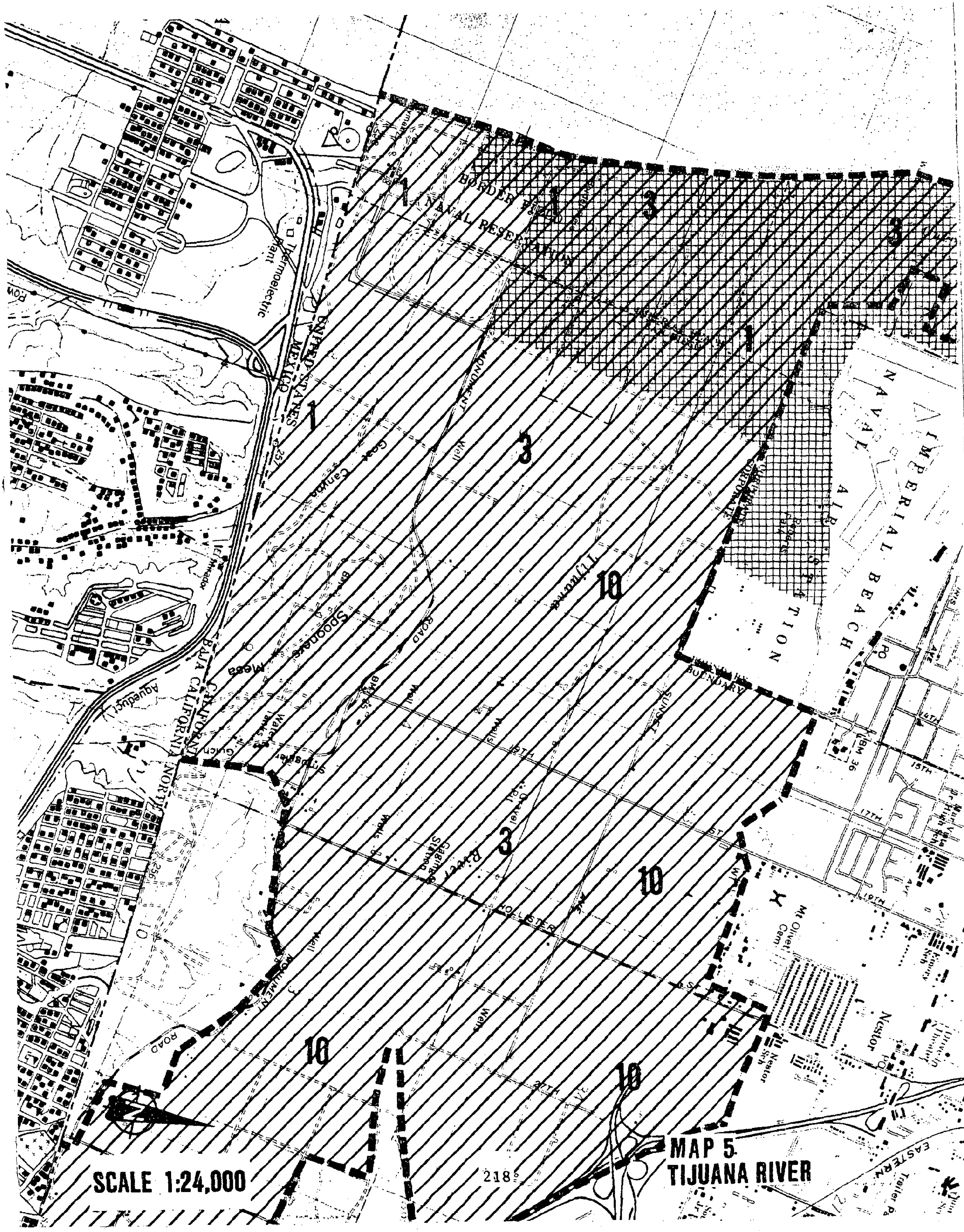


Indian Head Beach
Gigling Siding
Workfield Siding
SOUTHERN PACIFIC
NOCHE
BUENA
Welch Ridge
Artillery Hill
Tower
Tower
APPROXIMATE
Sand
SCALE 1:24000
MAP 3B
SALINAS RIVER


SANTA GUADALUPE
Oil Refinery
Conveyor Belt
Coke Ovens
Bromela
Oso Flaco Creek
Oso Flaco Lake
Little Oso Flaco Lake
Lettuce Lake
Jack Lake
PIPELINE
JEEP TRAIL
1a,7a
11–10
3
1
7
11
7a
2
13
SCALE 1:24,000
MAP 4A
SANTA MARIA RIVER

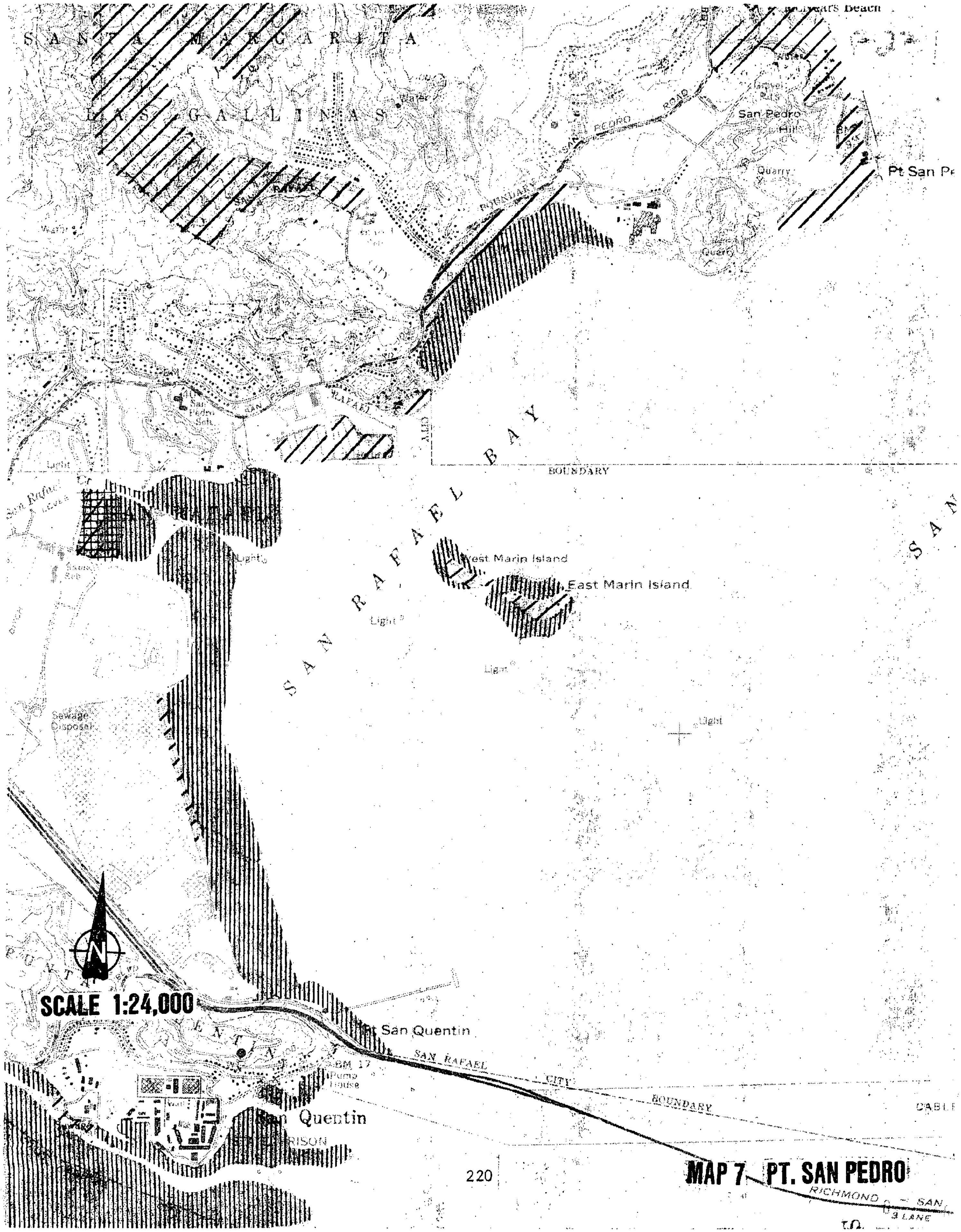


MAP 4B
SANTA MARIA RIVER

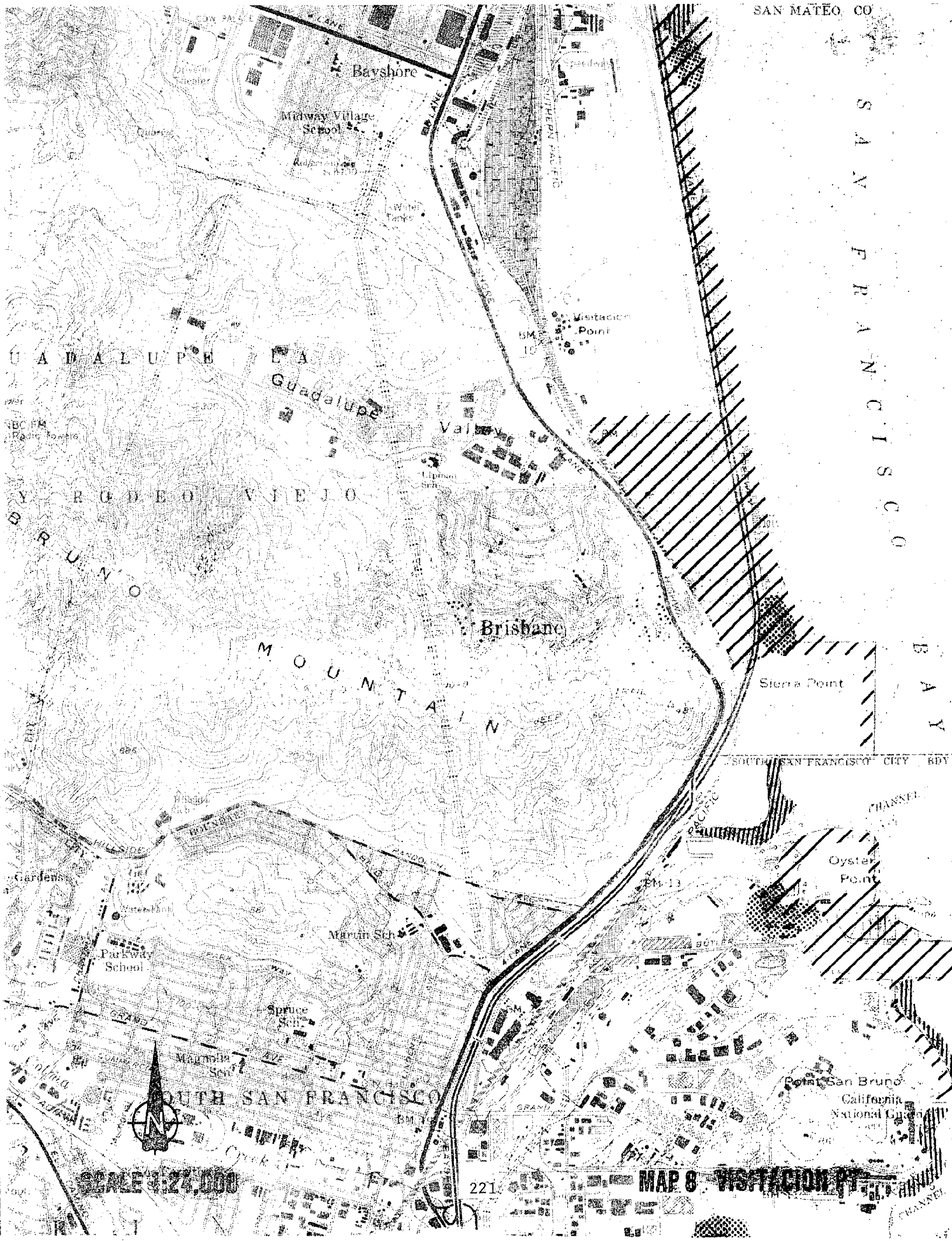


UNITED STATES
MEXICO
BAJA CALIFORNIA NORTE
CALIFORNIA
NAVAL RESERVATION
IMPERIAL BEACH
NAVAL AIR STATION
BOUNDARY
Tijuana River
Spooners Mesa
Goat Canyon
MONUMENT ROAD
Thermoelectric Plant
Aqueduct
Mt Olivet Cem
Nestor
1
3
10
SCALE 1:24,000
MAP 5
TIJUANA RIVER

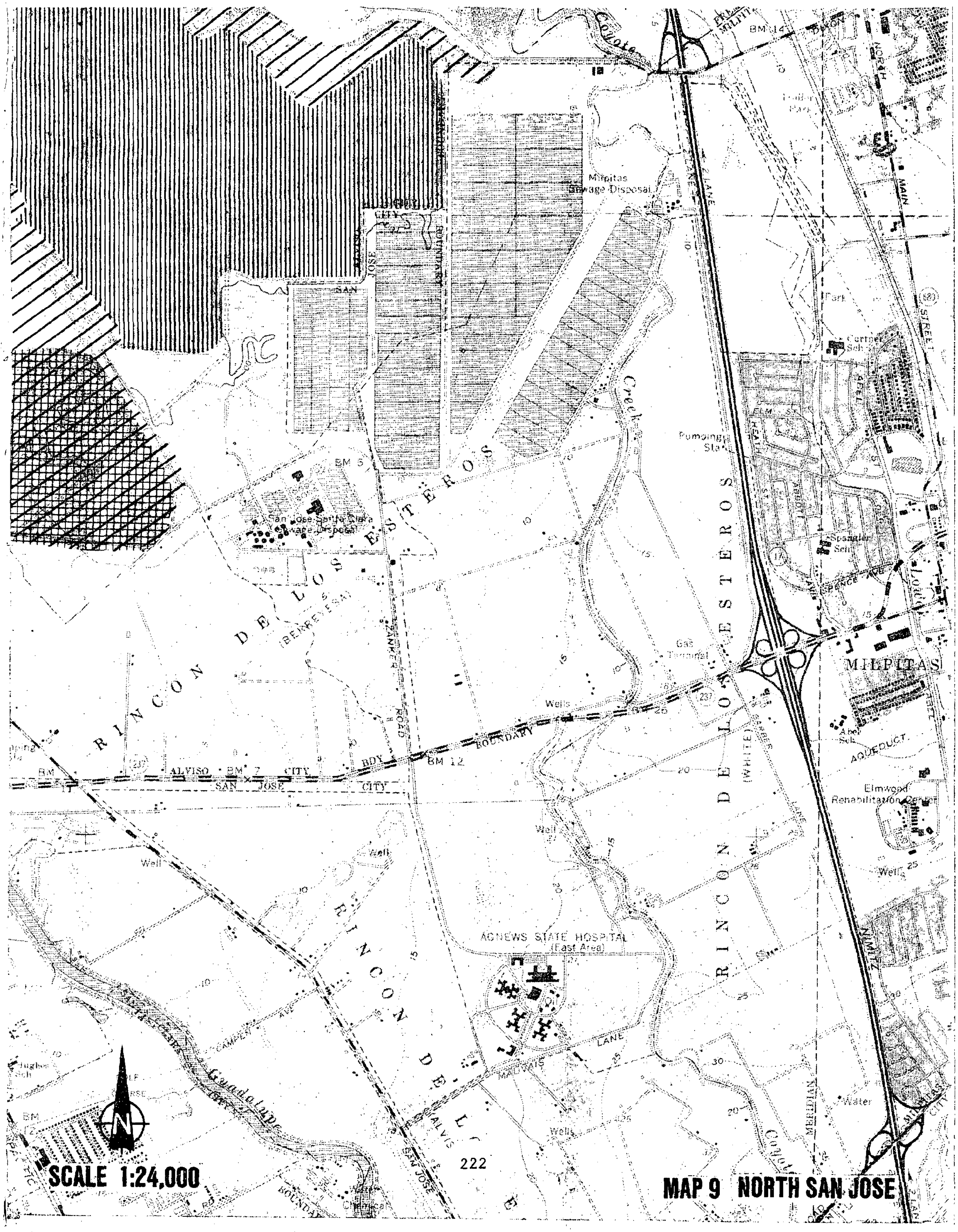

Carquinez Heights
Swanzy Res
Glencove
Selby
Crockett
Valona
Eckley
Tormey
Oleum
Bush Hill
Canada
del
Cierbo
CAÑADA DEL HAM
Y LAS BOLS
FREEWAY
CUMMINGS
CROCKETT BLVD
Nadeen
1:24,000
MAP 6 OLEUM



MAP 7 PT. SAN PEDRO



SAN MATEO CO
Bayshore
Midway Village School
Visitacion Point
GUADALUPE LA
Guadalupe Valley
Y RODEO VIEJO
BRUNO MOUNTAIN
Brisbane
Sierra Point
SAN FRANCISCO BAY
SOUTH SAN FRANCISCO CITY BDY
Oyster Point
Gardens
Parkway School
Martin Sch
Spruce Sch
Magnolia Sch
SOUTH SAN FRANCISCO
Point San Bruno
California National Guard
SCALE 1:24,000
MAP 8 VISITACION PT.


Milpitas Sewage Disposal
San Jose-Santa Clara Sewage Disposal
RINCON DE LOS ESTEROS
RINCON DE LOS ESTEROS
RINCON DE LOS ESTEROS
(BERREYESA)
ZANKER ROAD
ALVISO
SAN JOSE
CITY
BOUNDARY
BM 12
Pumping Sta
Gas Terminal
Wells
MILPITAS
Abel Sch
AQUEDUCT
Elmwood Rehabilitation Center
AGNEWS STATE HOSPITAL
(East Area)
MAUVAIS LANE
CAMPEN AVE
Guadalupe
MERIDIAN
Corner Sch
Spangler Sch
SPENCE AVE
ELM ST
MAIN STREET
Creek
Coyote
SCALE 1:24,000
MAP 9 NORTH SAN JOSE