ENVIRONMENTAL DATA STATEMENT
SAN ONOFRE TO ENCINA
230 KV TRANSMISSION LINE

PREPARED FOR:

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AUGUST 1978

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SECTION I

INTRODUCTION

1.1 GENERAL

The Final Environmental Statement (AEC, 1973) for the San Onofre Nuclear Generating Station, Units 2 and 3, identified the need for San Diego Gas & Electric Company (SDG&E) to provide additional transmission lines if it was to effectively utilize its share of the additional generating capacity of these new units. This Environmental Data Statement (EDS) was developed to evaluate the environmental effects of the placement and operation of 24 miles of single circuit 230 KV transmission line (of which approximately 0.6 miles involve new construction) within the SDG&E system between the San Onofre Nuclear Generating Station (SONGS) and SDG&E's Encina Substation in Carlsbad. This document identifies and evaluates potential environmental impacts associated with the placement, construction (where applicable) and operation of the proposed transmission circuit and has been prepared in conformance with the California Environmental Quality Act of 1970 and subsequent environmental legislation. This document has been structured in accordance with the guidelines contained in Rule 17.1 of the "State of California Public Utilities Commission (CPUC) Rules of Practice and Procedure" dated March 23, 1974, and is intended to accompany an application to this Commission for a Certificate of Public Convenience and Necessity under General Order Number 131. Certification by the Commission is required for those portions of the proposed San Onofre to Encina circuit which involve new construction.

1.2 SCOPE OF THE ENVIRONMENTAL DATA STATEMENT (EDS)

This EDS presents a systematic evaluation of the potential environmental impacts associated with the proposed project, and considers the impacts of alternatives to the project. Characteristics unique to electrical transmission lines have been identified, and their effects considered in light of the present and potential environmental setting of the project area and surroundings. It has been prepared as a focused document in accordance with the March 4, 1978 amendments to the California Environmental Quality Act (CEQA). As such, it has considered all potential environmental effects, but has dismissed those felt to be insignificant, providing a rationale for such conclusions. Thus, this EDS focuses on those environmental effects which are determined to be of significance.

This Draft EDS is not meant to be used as an engineering document. Likewise, it does not relieve the involved agencies of their responsibilities to ensure that engineering documents otherwise required for this project are prepared and submitted.

1.3 NEED FOR THE PROJECT

The San Onofre-Encina 230 KV Circuit is required to transmit power from San Onofre Unit 2 to SDG&E's system and to reliably import power from the intertie with Southern California Edison Company during credible outage conditions. Loss of either the San Onofre-Mission or San Onofre-Talega 230 KV circuits would result in a reduction of firm energy import capabilities through the intertie to the SDG&E system. Loss of both of these circuits would completely sever the SDG&E electric transmission system from the rest of the interconnected systems in the western states. This would isolate SDG&E from its share of power generated by San Onofre Nuclear Generating Station, as well as power normally delivered through the intertie from other off-system resources. Increased on-system generation, if available, would be required to replace generation lost as a result of reduced intertie capabilities.

The San Onofre-Encina 230 KV line will also provide additional outlet capacity for Encina Unit 5, thereby increasing the reliability of power supply from this generating source.

1.4 PREPARATION STAFF

Members of WESTEC Services' professional staff and its consultants contributing to this report are listed below:

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1.5 CERTIFICATION

The environmental information in this EDS has been compiled by the individuals listed above. To the best of our knowledge and belief this information is accurate and correct and reflects our best professional opinion of the direct and indirect environmental impacts associated with the proposed project.

Fay O. Round, Jr.
Principal/Project Manager

SECTION II

PROJECT DESCRIPTION

2.1 LOCATION

The route of the existing right-of-way (R/W) involved in this project is shown in Figure 2-1. It extends for about 24 miles from the San Onofre Nuclear Generating Station in Orange County, through Camp Pendleton, areas of unincorporated San Diego County, and portions of the Cities of Oceanside and Carlsbad, finally terminating at the San Diego Gas & Electric Company's Encina Substation located near the Encina Power Plant in Carlsbad.

2.2 OBJECTIVES

The objectives sought by the applicant in proposing the project include the following:

1. To provide for the transmission of power from San Onofre Unit 2 to SDG&E's system and to reliably import power from the intertie with Southern California Edison Company during credible outage conditions.

2. To avoid the reduction of firm energy import capabilities through the intertie to the SDG&E system which would occur if either the San Onofre-Mission or San Onofre-Talega 230 KV circuit were lost (also see Section 1.3 and Figure 2-2).

3. To provide additional outlet capacity for Encina Unit 5, thereby increasing the reliability of power supply from this generating source.

4. To accommodate a prior request by the City of Oceanside to provide a lower profile for lines in the existing right-of-way adjacent to the Oceanside Airport.

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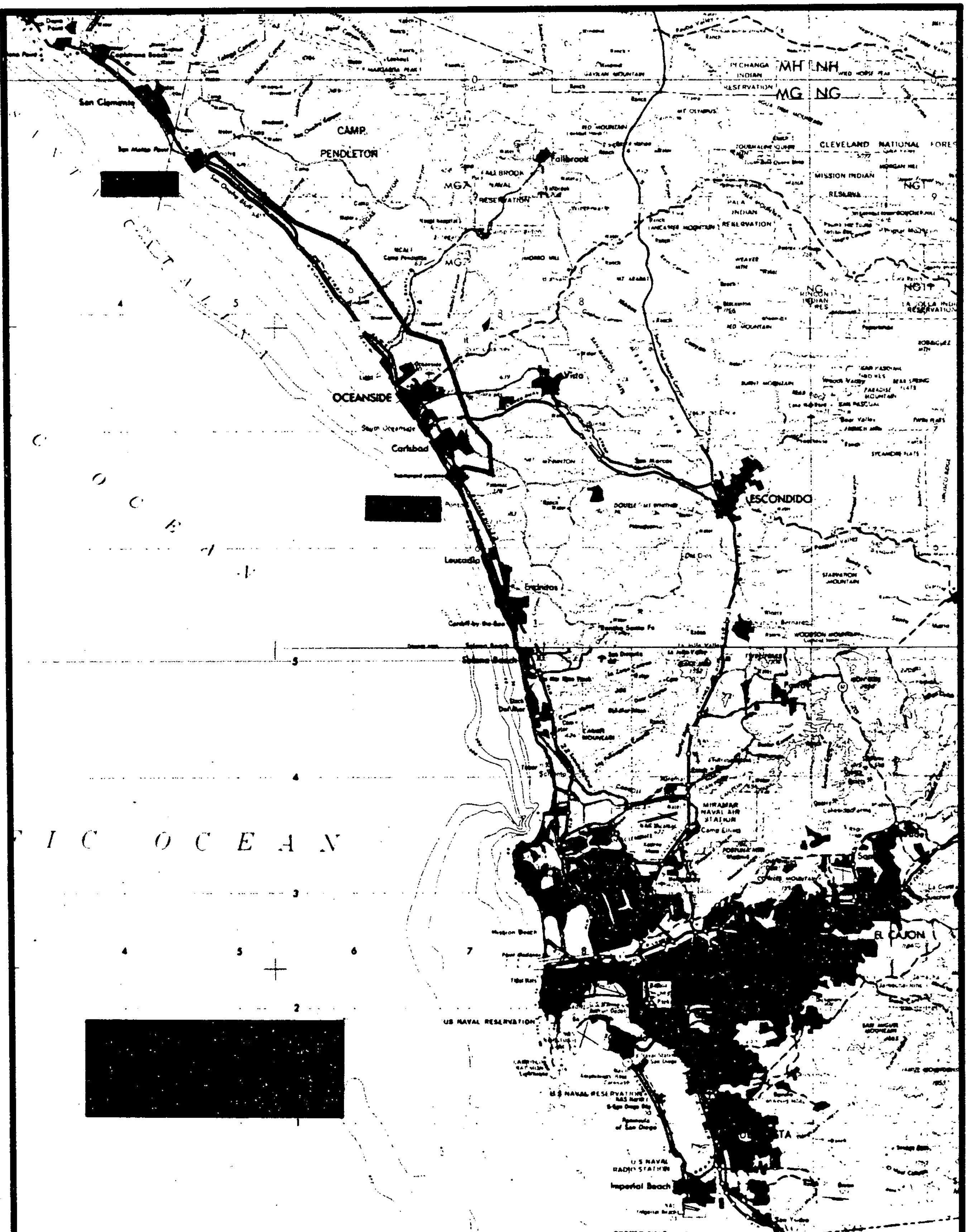
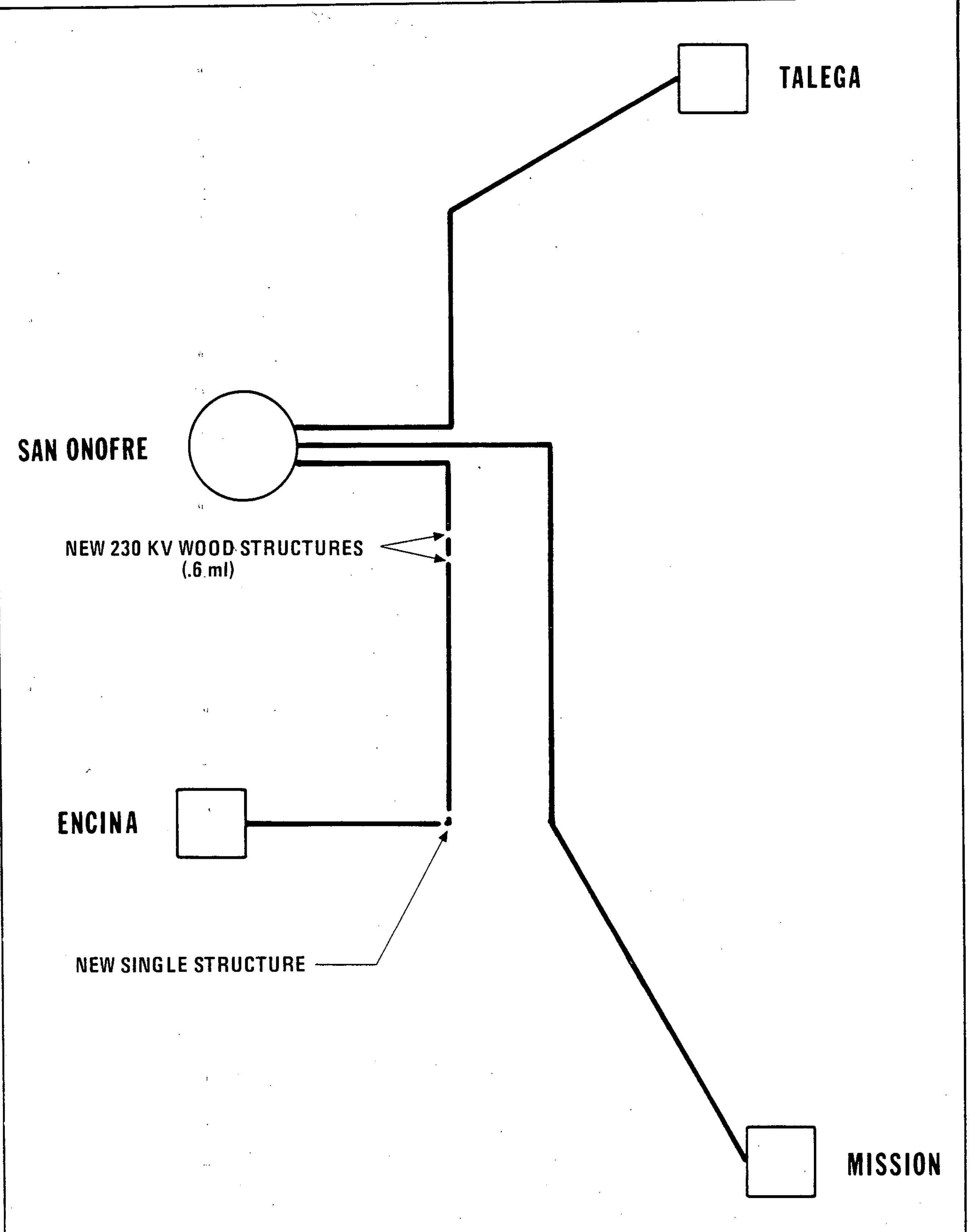


REGIONAL MAP

FIGURE 2-1

WESTEC Services, Inc.



S.D.G.&E. NEW 230 KV CIRCUITS FROM SAN ONOFRE

FIGURE 2-2

2.3 PROJECT CHARACTERISTICS

Currently, a combination of double circuit steel lattice towers, steel poles, and wooden H-frame towers occupies the right-of-way to be used for the San Onofre to Encina transmission line. The R/W varies in width from 100 to 200 feet (see Figure 2-1). One 230 KV circuit, which connects San Onofre with SDG&E's Mission Substation, is now supported by these existing structures. For the majority of the R/W, this circuit is carried by lattice steel towers designed to accommodate two circuits. Thus, for about 97 percent of the San Onofre to Encina R/W, one vacant position exists on the lattice towers.

Approaching the Oceanside Airport from the north, the existing circuit transitions from the steel lattice towers to lower wooden H-frame structures. The reason for this transition is to reduce the height of the circuit and the structures in the vicinity of the Oceanside Airport. South of the airport area, the circuit again transitions to the taller, lattice steel towers, which continue southward to the Encina substation.

The proposed project calls for the addition of one circuit throughout the entire length of the R/W. (Details regarding this circuit are provided in Table 2-1). Where vacant positions currently exist on the lattice towers, the new circuit would merely be pulled into place, thus occupying the second position on the lattice towers. This portion of the project would involve roughly 23.3 miles of the 23.9-mile R/W, the remaining 0.6 mile being that segment just east of the Oceanside Airport. In this area, approximately six new wooden H-frame structures would be built within the

TABLE 2-1

SAN ONOFRE-ENCINA 230 KV LINE DATA

SPECIFICATIONS

Construction Length	-	0.6 Miles
Conductor Type	-	ACSR/AW
Conductor Size	-	1033.5 Kcmil
Configuration	-	3 Phase Vertical
Capacity	-	1030 Amps
Voltage	-	230,000 volts
Structures	-	102 Existing 6 New (est.)
Height of Structure	-	70' Avg. @ Lowest Arm
Span Length	-	1175' Avg.

COST

Material	$ 712,000
Labor	666,000
Engineering	59,000
Total Estimated Cost	$1,437,000

SCHEDULE

Start Work	-	1/15/80
Tower Construction	-	2/15/80
Wire Stringing	-	4/1/80
End Work	-	9/1/80

existing right-of-way parallel to the H-frame structures which now carry the existing circuit past the Oceanside Airport. The new structures will be similar in design and appearance to those already in place (see Figures 2-3, 2-4 and 2-5).

In addition, one new steel tower will be constructed at the Encina "Hub." The "Hub" is a term used to refer to an area about 1.5 miles east of the Encina Substation where several circuits from various directions merge and lead into the Substation. The new tower will be needed to provide the necessary clearance between the new circuit and the existing lines (see Figure 2-6).

Specific work activities involved in the project include the following:

1. Excavation for and placement of footings for the wooden structures near Oceanside Airport and the single lattice tower at the Hub.

2. Hauling, assembly and erection of wooden structures and one steel tower.

3. Hauling and installation of conductor and overhead groundwire assemblies.

4. Conductor stringing operations.

In summary, the proposed project will consist of three interrelated activities:

1. The addition of one circuit to the existing vacant position on existing double circuit steel towers from San Onofre to the Encina Substation (23.3 miles of the 23.9-mile R/W).

2. The installation of new wooden structures for a 0.6-mile segment of the R/W east of the Oceanside Airport.

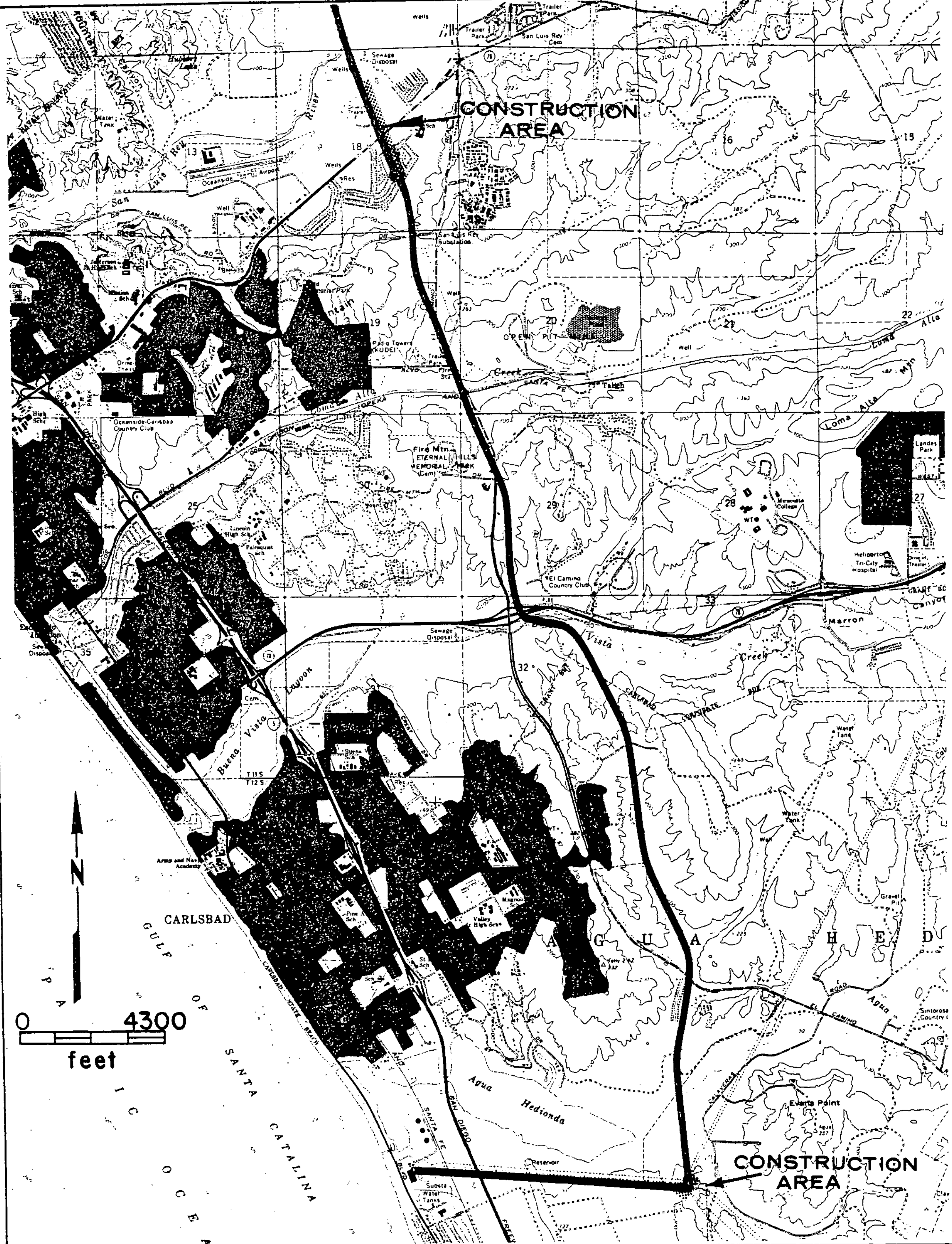
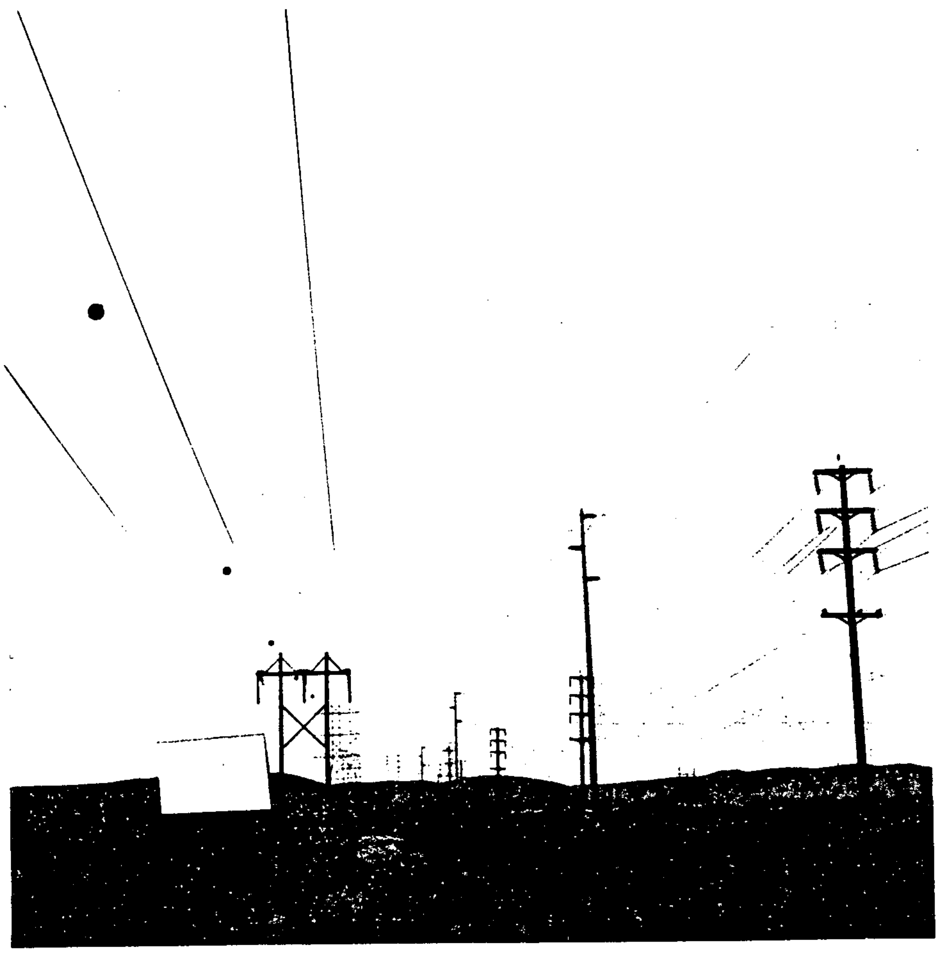


FIGURE 2-3

Areas of Construction.



LOOKING NORTH

SAN ONOFRE–ENCINA LINE

Existing 230 kv wood structures east of Oceanside Airport. New wood structures to be placed as shown in Figure 2-5.

EXISTING 230 KV WOOD STRUCTURES

FIGURE 2-4

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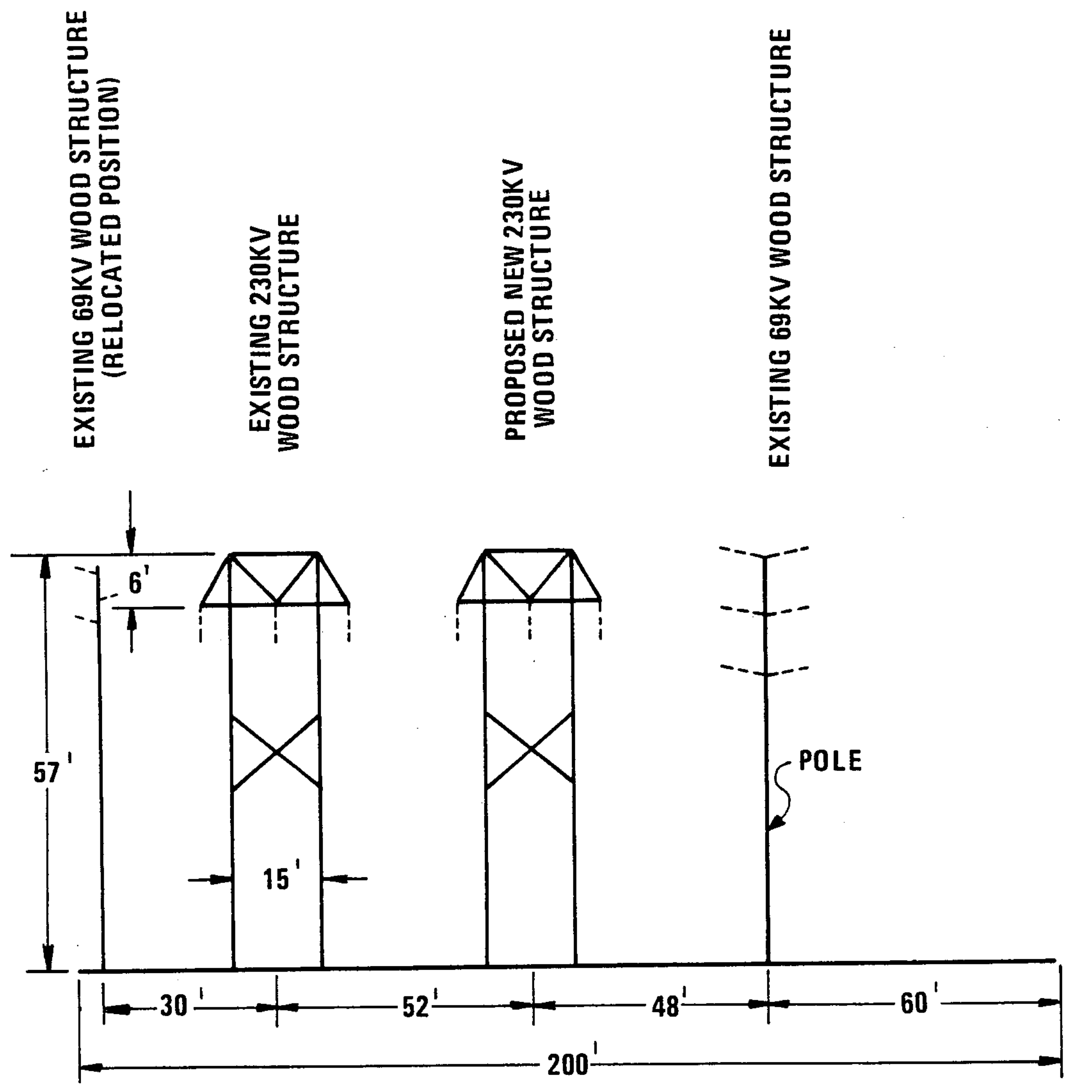
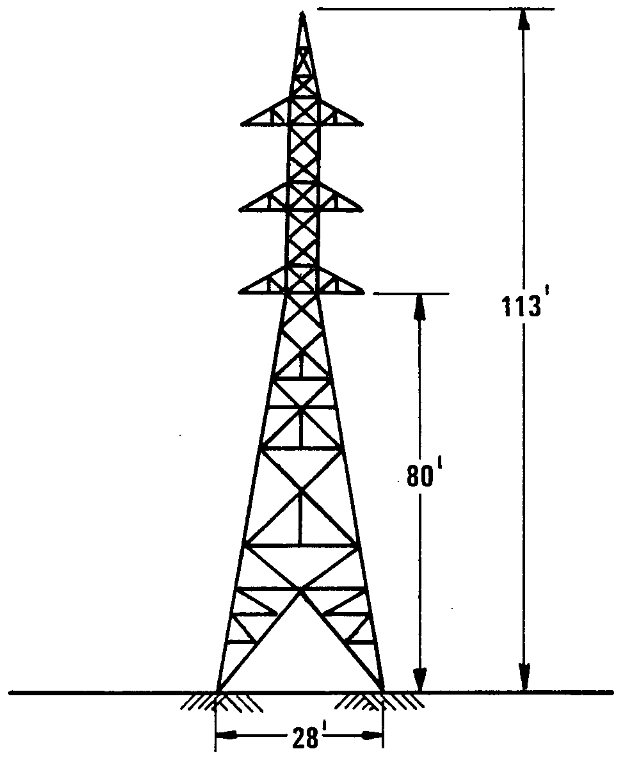


NOTE: 1) ALL TOWER DIMENSIONS TYPICAL
2) MIN. CONDUCTOR CLEARANCE TO GROUND 30 FEET

LOOKING NORTH

SAN ONOFRE – ENCINA 230 KV LINE RIGHT OF WAY CROSS SECTION OCEANSIDE AIRPORT SEGMENT

FIGURE 2-5



LATTICE TOWER

NOTE: 1) ALL DIMENSIONS ARE TYPICAL
2) MIN. CONDUCTOR CLEARANCE TO GROUND 30 FEET

SAN ONOFRE – ENCINA 230 KV LINE SINGLE STEEL TOWER AT ENCINA HUB

FIGURE 2-6

3. The installation of one steel tower at the Encina Hub to provide necessary clearances between the new circuits and existing lines.

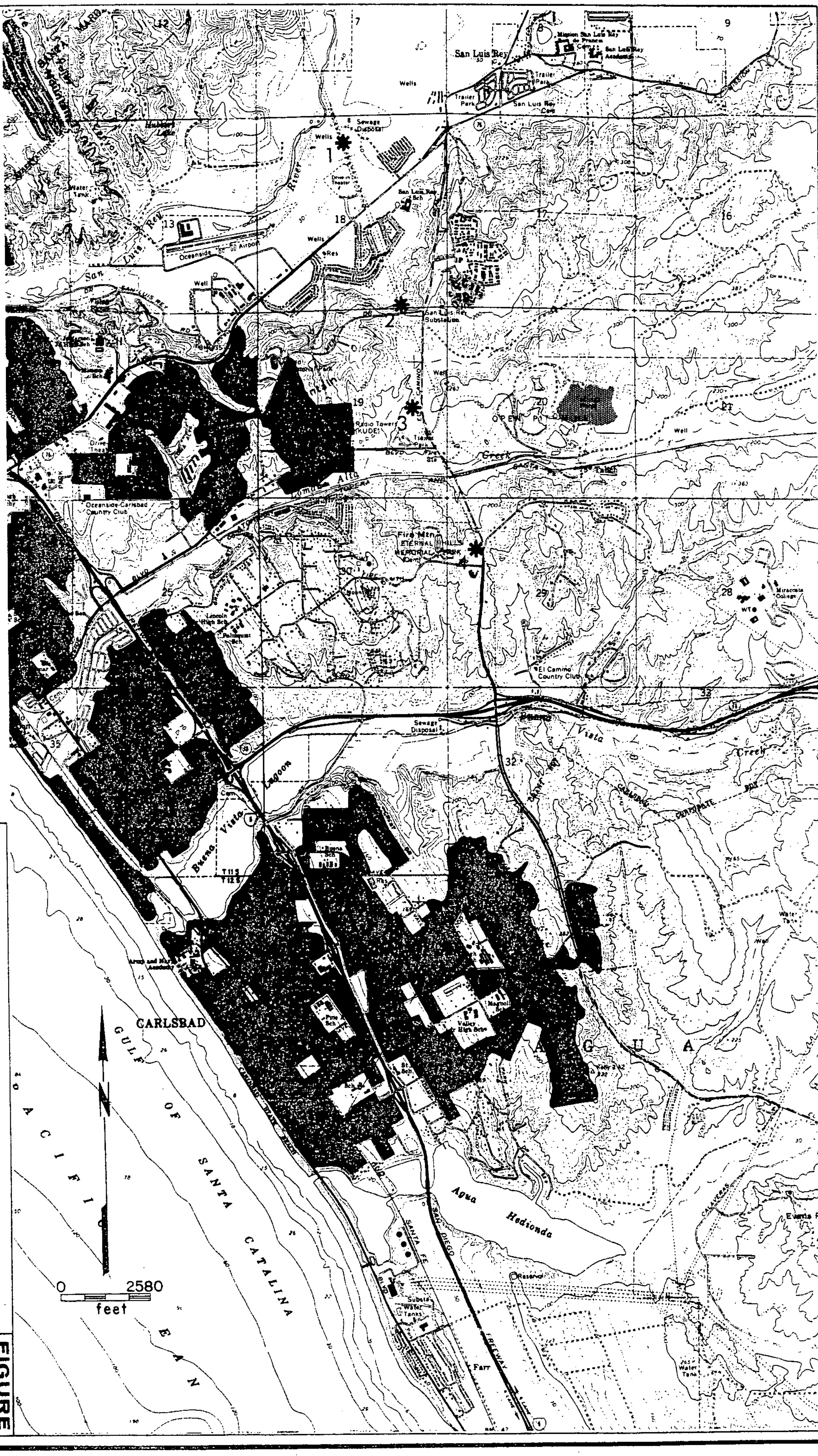
2.4 CONSTRUCTION METHODS

All new structures will be constructed within existing right-of-way and adjacent to existing towers. Existing access roads will be fully utilized. Any required additions to existing access roads, if needed, will be minor in nature.

The 1033 MCM ACSR conductor which will be used for the circuit will be pulled into position. Helicopters will be used to string a pulling rope, while heavy pulling and tensioning equipment will be used to pull the conductor itself. Equipment will include two flatbed trucks, a truck mounted wire puller, two D8 Caterpillar-type tractors, high lifters, and pick-up trucks. During erection of the towers, a crane, digger and concrete trucks will be on hand. The larger equipment will remain at the construction site until work on each section is completed. Equipment remaining at the site overnight will be guarded.

The maximum size of the construction force will be approximately 20 workers. Staging for the work will occur either at the site itself or at an SDG&E substation or other facility nearest the segment undergoing construction. Work will be carried out during the normal daytime shift unless unusual circumstances warrant off-hour work.

As indicated in Table 2-1, construction is scheduled to commence in January 1980 and be completed by September 1, 1980.


San Luis Rey
Mission San Luis Rey de Francia
San Luis Rey Academy
Trailer Park
San Luis Rey Cem
Wells
Sewage Disposal
Drive-in Theater
San Luis Rey Sch
Oceanside Airport
Water Tank
San Luis Rey Substation
Radio Towers (KUDE)
Fire Stn
Oceanside-Carlsbad Country Club
Loma Alta
Fire Mtn
ETERNAL HILLS MEMORIAL PARK
Lincoln High Sch
El Camino Country Club
Miracosta College
Sewage Disposal
Buena Vista Creek
Buena Vista Lagoon
T 11 S
T 12 S
Army and Navy Academy
CARLSBAD
Valley High Sch
Agua Hedionda
SANTA FE
SAN DIEGO
FREEWAY
Reservoir
Substa
Water Tanks
Farr
GULF OF SANTA CATALINA
PACIFIC OCEAN
AGUA
1
2
3
4
0
2580
feet
N

FIGURE

Although not officially designated by the California Department of Fish and Game, the orange-throated whiptail, *Cnemidophorus hyperthrus beldingi*, was recommended by Bury (1971) as early as 1971 for listing as a rare subspecies. This small lizard prefers areas of sparse and variable vegetation (Bostic, 1974). This species would be expected in the rocky and sandy drainages along the right-of-way.

A depleted faunal species is one that, although still occurring in adequate numbers for survival, has been heavily depleted and continues to decline at a rate which gives cause for concern (Bury, 1971). Two such species which would be expected to be present along the R/W based on range and habitat preference include:

Coast Horned Lizard
Phrynosoma coronatum blainvillei
Not observed during the survey period but is expected in the open brushland areas.

Two-Striped Garter Snake
Thamnophis couchi hammondi
Not observed during the survey. May be expected along the San Luis Rey River.

One fully protected bird species, white-tailed kite (*Elanus leucurus*), is expected to hunt along the R/W and adjacent open space. This species, thought to be nearing extinction prior to 1940, had made a notable comeback and is now a relatively common raptor in coastal southern California. No Blue-listed bird species (Arbib, 1977) which are noticeably declining in the San Diego region were observed during the survey. Two species listed on the 1978 Blue List which are expected to utilize the site and are thought to be experiencing serious population declines in the San Diego region are Bell's vireo (*Vireo bellii*) and yellow warbler (*Dendroica petechia*). Both of these species could be expected in the riparian growth along the San Luis Rey River at the start of the survey area and at Buena Vista Creek.

A recent preliminary report by Remsen (1977) which deals with declining or vulnerable bird species in California has gone as far as recommending the inclusion of *Vireo bellii pusillus* on the Federal and California endangered lists. This species has drastically declined throughout its range due primarily to cowbird parasitism (Remsen, 1977). Remsen's Special Concern List (1977) lists Bell's vireo as a highest priority species, indicating the species faces immediate extirpation if current trends continue. Second priority species are defined as those which are definitely on the decline, but whose populations are still sufficiently substantial that the danger is not immediate. Second priority species expected to utilize property within or adjacent to the corridor include Cooper's hawk, yellow warbler, common yellowthroat (*Geothlypis trichas*), and black-tailed gnatcatcher (*Polioptila melanura californica*). The first three species would be expected to be attracted to the riparian habitat along the R/W; the latter species is expected in the heavier brush such as that present on the north-facing slope at Agua Hedionda Lagoon.

3.3 AIR QUALITY

3.3.1 Meteorology

The climate of the area traversed by the transmission line right-of-way is relatively mild, of the Mediterranean regime, due to its southerly latitude and proximity to the Pacific Ocean. Temperatures are moderate, with averages ranging from around 50°F to the mid-70s. Diurnal wind patterns exist, with prevailing daytime breezes coming from the southwest. Precipitation occurs in modest amounts, with highest average rainfalls occurring from November through March or April.

3.3.2 Air Quality

Of the various air quality monitoring stations maintained by the San Diego Air Pollution Control District throughout the area, it was felt that data from the Oceanside Station were most representative of conditions existing along the transmission line route. As shown in Table 3-1, Oceanside suffers air quality problems related primarily to photochemical smog (ozone), hydrocarbons and total suspended particulates. With the exception of particulates, each of these categories worsened from 1975 to 1976.

3.3.3 Electrical Phenomena

Electrical service to northern San Diego County is provided from a number of sources, via various power interties and alternate generating sources. Two major sources include the San Onofre Nuclear Generating Station and SDG&E's Encina plant in Carlsbad. As noted in Section II, a portion of the power from San

Table 3-1

AMBIENT AIR QUALITY -- OCEANSIDE STATION

Pollutant	Number of Days Exceeding Standards	
	1975	1976
Ozone[1]	43	69
Nitrogen Dioxide[2]	1	4
Hydrocarbons[1]	179	222
Carbon Monoxide[2]	0	0
Sulfur Dioxide[2]	0	0
Particulates[2]	25	20

[1]Federal Standard

[2]State Standard

Onofre is brought to northern San Diego County via the San Onofre to Encina circuit, the expansion of which is the subject of this EDS.

The environment surrounding a transmission line may be affected to some degree by the existence of an electric potential and circulation of an electric current.

Corona discharges can potentially result in the generation of radio noise, television interference, ozone, oxides of nitrogen, audible noise or visible light. These corona effects may vary; the anticipated magnitudes of corona effects are discussed in Section 4.3.3a.

Electromagnetic induction can possibly result in the generation of electric potential in metal fences or other conductive items which parallel the transmission lines. These effects are discussed in Section 4.3.3b.

Electrostatic induction can potentially result in the concentration of electric charges in conductive items which are insulated from ground but are located between the line conductors and the ground surface. The effects of electrostatically induced voltages are discussed in Section 4.3.3c.

3.4 HYDROLOGY

Surface water: The portion of the San Onofre to Encina project involving new construction crosses the San Luis Rey River. The San Luis Rey River at normal flow is easily spanned by one tower spacing. Water surface of the standard project flood would be about 8 feet above ground surface at the transmission line crossing and would inundate a strip about 1,100 feet wide (Corps of Engineers, 1968).

Groundwater: Groundwater in the San Luis Rey River alluvium occurs at a depth of about 25 feet. This level is being lowered due to extraction in the adjacent well field. Shallow, perched groundwater may be encountered during pole site preparation. Groundwater should be encountered beneath the Encina Hub at a depth of 100 feet or more. Local shallow saturation may be encountered.

3.4.1 Water Quality

Disruption of soil structure and replacement with foundation materials or poles makes available loose soil materials to be transported to downstream receiving areas. Silting derived from the R/W would be a one-time impact and could be diminished by compacting excavated soils or planting them for stabilization. No change should occur in chemical quality of surface waters resulting from the proposed project.

Groundwaters in the proposed project area are typically saline in character. Water of the Mission Groundwater Basin varies from about 500 to 7,000 ppm in chloride (DWR, 1967). No groundwater quality impact should result from the proposed project.

3.5 LAND USE

3.5.1 Overview

The existing right-of-way for the San Onofre to Encina transmission line passes through a number of different types of land use, most predominant of which are military, urban, agricultural, and transportation. The majority of the existing R/W lies within Camp Pendleton, and only when it approaches the San Luis Rey River does it begin to impact urbanized uses and populated areas.

South of Mission Avenue in the City of Oceanside, the transmission line R/W bisects an existing residential subdivision and, just below the San Luis Rey Substation and prior to crossing El Camino Real, passes near an area of new residential construction. For much of this segment of the R/W, the existing lines run parallel to and just west of El Camino Real. Urbanized uses in this area include commercial, industrial, residential and, just north of Fire Mountain Drive, open space.

About 400 feet north of Fire Mountain Drive, the existing lines cross El Camino Real and turn directly south, paralleling El Camino Real on the east to its intersection with Highway 78. Designated land uses along this portion of the R/W include residential, professional/office, and commercial. At Highway 78, the transmission lines pass from the incorporated areas of Oceanside into the City of Carlsbad. Just south of Highway 78, the lines turn abruptly to the east, thence southeasterly through rather sparsely populated land currently used for grazing or agricultural pursuits. The majority of this area is designated by the City of Carlsbad as predominantly future residential areas, with two areas shown as open space.

Finally, at the Encina Hub, the R/W heads directly west into the substation at Encina. This area, including the Hub, is owned by SDG&E and is designated in the City of Carlsbad's General Plan as open space.

3.5.2 Construction Areas

As discussed in Section II, the area of major activity involves roughly 0.6 mile of right-of-way just east of the Oceanside Airport within the City of Oceanside (see Figures 2-3 and 3-2). The right-of-way forms the boundary line between two areas north of Mission Avenue and west of Foussat Road which are designated as PC (Planned Commercial) and R-1 (Single Family Residential). The PC parcel is occupied by the Valley Drive-in Theatre, while the R-1 area in the vicinity of the right-of-way is largely vacant. The nearest residences range from 500 feet north of the transmission lines to about 1100 feet north as they cross Mission Avenue.

Immediately south of Mission Avenue, the R/W separates an R-3 (Medium Density Residential) area from a C-2 (General Commercial) parcel, then bisects an existing residential subdivision. The right-of-way in this area approximates 200 feet.

After emerging from the subdivision, the lines continue in a southerly direction up the side of a fairly steep slope, crossing Mesa Drive at an approximate ground elevation of 200$\pm$ feet (MSL), and enter the San Luis Rey Substation. Designated land uses adjacent to this portion of the R/W are PRD (Planned Residential Development) to the north and R-1 to the south, although the land is currently lying vacant.

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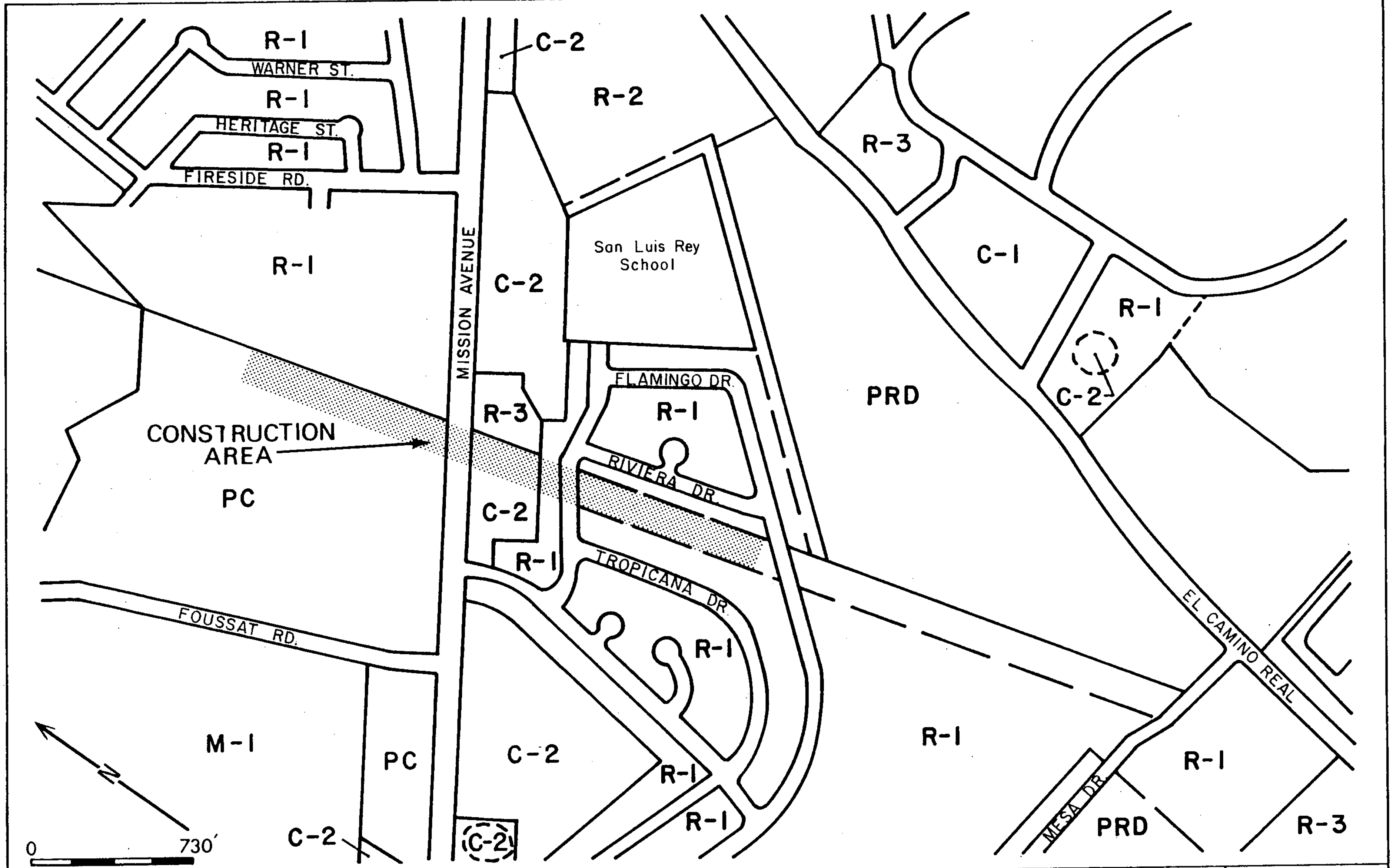


Current Zoning

FIGURE
3-2

Based on an examination of the City of Oceanside's General Plan, it appears that the land uses and zoning designations discussed above are in general conformance with the City's Land Use Element and accurately reflect land use patterns in the future.

The placement of the single tower at the Hub will be in an area designated by the City of Carlsbad as open space with a special treatment overlay. The property is owned by the San Diego Gas & Electric Company.

3.6 SOCIO-ECONOMIC FACTORS

The following data were summarized from the economic profiles for the Cities of Oceanside and Carlsbad which are contained in Appendix B:

	Oceanside	Carlsbad
Population (1977)	62,100	30,000
Taxable Sales ($ million)	$163.3 (1976)	$118.0 (1977)
Housing Stock (1977 units)	24,271	9,300

3.7 CULTURAL RESOURCES

3.7.1 Archaeology

a. Setting

That portion of the proposed San Onofre to Encina 230 KV circuit right-of-way subjected to intensive field reconnaissance is situated within the broad San Luis Rey floodplain, surrounded by steeply sloping hills and canyons. Landform within the subject survey varies only slightly, with elevations between 30 and 40 feet above mean sea level.

Past grazing and farming activities have apparently removed much of the native vegetation which would have been present within a floodplain biotic community. Plant associations noted on or near the portion of the right-of-way proposed for new construction included a relatively small oak woodland or woodland-grass community in a nearby canyon, consisting of coast live oak (*Quercus agrifolia*) and associated undergrowth.

Sporadic stands of chaparral-type associations are present on slopes above the right-of-way scheduled for construction, and in other areas where native vegetation has not been cleared or is currently undergoing autosuccessional replacement. Plants within this community include dense, stiff branched scherophyllous scrubs such as chamise (*Adenostoma fasciculatum*), blue lilac (*Ceanothus tomentosus*), warty-stem ceanothus (*Ceanothus verrucosus*), black sage (*Salvia mellifera*), toyon (*Heteromeles arbutifolia*), scrub oak (*Quercus dumosa*), yucca (*Yucca schidigera*), deerweed (*Lotus scoparius*), and yerba santa (*Eriodictyon crassifolium*). Poison oak (*Toxicodendron diversilobum*), sumac (*Rhus laurina*) and sagebrush (*Artemisia californica*) were also noted. A listing of these plants and others in the immediate vicinity with their known use by native Americans is provided in Appendix C, Table C-2.

Soils within the project area consist primarily of Ramona sandy loams. These soils are well-drained, deep, sandy loams that contain streaks of sticky, plastic clay and a sandy clay subsoil. The Ramona sandy loams can be relatively hard and often become solidified during times of little moisture and prolonged sun.

The area in and around the location of a previously recorded archaeological site, W-1527, has been severely impacted along its eastern portion. Evidence of plowing and discing was apparent to depths of at least 25 centimeters. More significantly, much of that archaeological site has been disturbed by previously constructed transmission corridors, gas pipelines, and easement roads.

b. Regional Potential

Taken as a whole, the San Luis Rey River Basin would have been a suitable and desirable place for native American occupation and use. In terms of native plant and animal life, the area in and around the project had high potential as an exploitation area for the known cultures of San Diego County. Although it is difficult to assess present vegetation in terms of what may have been present in years past, a general overview of contemporary native plant species is provided in Appendix C.

Local granitic and gabbroic rock outcroppings could have been used as food processing centers as is evidenced by intensive grinding complexes throughout the area. Rock overhangs and natural rock shelters would have provided living chambers, mediums for art forms, and temporary shelter from the elements.

Lithic resources which could have been used in stone tool manufacture are not common within the study area, although dykes and veins of quartz and metavolcanic rock are scattered within the probable land-use territory of the peoples who inhabited the area. Cobble formations which would have provided suitable material for grinding stones (manos) can be found in stream beds and within nearby geologic formations.

The nearness of the San Luis Rey River and of several creek and stream channels would have provided a viable and steady water source, a primary factor in selection of aboriginal occupation and campsites. Besides use as a life supportive fluid, water was also used to soak plant fiber during preparation of both food and construction resources. The presence of water also had a direct effect on the type and quantity of plants within a given area and served as an attraction to animals, thus increasing the chance of native hunters finding at least sporadic game.

In summary, the San Luis Rey River Basin could have served as a vast resource area which was probably exploited by Indians on a regular basis depending on the available foodstuffs, lithic resources and water supply. An exploitation pattern such as this could result in archaeological sites indicative of temporary camping, food processing and seasonal occupation.

c. Previous Fieldwork

The coastal region of southern California has long been the subject of archaeological investigation. Stretching back at least to the early fieldwork of Malcolm Rogers in the 1920s, numerous archaeological researchers have collected a vast array of information and data pertinent to reconstructing past lifeways of native Californians (cf. Rogers 1929).

Past field investigations along coastal San Diego County have been sponsored by institutions such as the San Diego Museum of Man, San Diego State University, University of California at Los Angeles, University of San Diego, and Scripps Institution of Oceanography. Implementation of the California Environmental Quality Act has brought the private sector into archaeological research through pre-development surveys and mitigation or salvage projects.

The interpretation and synthesis of over fifty years of coastal archaeological research would entail the preparation of several lengthy papers or monographs. Thus, for the purpose of this analysis, a brief overview of previous fieldwork is provided to establish a broad, regional framework within which the archaeological sites along the proposed San Onofre to Encina 230 KV right-of-way can be viewed. Regionally specific data are presented in this subsection to supplement the cultural history discussed in Appendix C.

Although one major study (Welch 1977) has been conducted just north of the project area, and several smaller studies have been completed along the San Luis Rey River (Carrico 1974, 1977; Drover 1977; Kaldenberg 1973), no major excavation nor survey oriented toward testing hypotheses or generating significant data have been conducted in the area. Studies throughout the general area (Meighan 1954:215-227; McCown 1955; Warren 1964) have added significant data at the survey level, but have not possessed the type of data base which generates or warrants the conclusions necessary to formulate an adequate "cultural history" of the area.

Of the 33 sites considered relevant to this study, the combined categories of camp midden and campsite total 14 sites or 42% of all sites (Table 3-2). These temporary camping complexes often contain shell midden deposits, basic extractive tool assemblages, hearths, and evidence of sporadic visitation rather than sedentary occupation. A favored location for these sites is on marine terraces and mesa tops above bay/estuary features. Proximity to coastal food sources and resource exploitation areas seems to have been a greater criterion for settlement than landform or nearness to water.

Fragmentary data on cultural affinity of the 14 camp middens and campsites indicate that 2 (14%) are La Jollan, 5 (35%) are Diegueño or Luiseño (Late Prehistoric), 4 (28%) are multi-component San Dieguito/La Jollan sites, 1 (7%) is La Jollan/Yuman, 1 (7%) is San Dieguito/La Jollan/Yuman, and 1 (7%) is non-

Table 3-2

ARCHAEOLOGICAL SITES IN THE REGION OF PROPOSED CONSTRUCTION: SAN ONOFRE TO ENCINA 230 KV CIRCUIT

Site	Type	Culture*	Fieldwork	Site	Type	Culture*	Fieldwork
SDi-209	N/D	N/D	Survey	W-118	Habitation	SD/LJ	Survey
SDi-630	Camp Midden	LJ/L	Survey	W-119	Habitation	SD/LJ/Y	Survey
SDi-631	Habitation	LJ/L	Survey	W-120	Campsite	SD/LJ/Y	Survey
SDi-634	Campsite	N/D	Survey	W-121	Habitation	SD/LJ/Y	Survey
SDi-4990	Habitation	SLR II	Excavation	W-125	Campsite	SD/LJ	Survey
SDi-5130	Habitation	LJ	Excavation	W-126	Camp Midden	SD/LJ	Survey
SDi-5131	Habitation	M-A	Survey	W-127	Campsite	SD/LJ	Survey
SDi-5132	Campsite	LJ	Survey	W-130	Camp Midden	SD/LJ	Survey
SDi-5133	Habitation	M-A	Survey	W-132	Habitation	SD/LJ/Y	Survey
SDi-5213a	Camp Midden	LP	Survey	W-132a	Habitation	SD/LJ/Y	Survey
SDi-5213b	Camp Midden	LP	Survey	W-133	Habitation	LJ/Y	Excavation
SDi-5213c	Camp Midden	LP	Survey	W-134	Camp Midden	LJ	Survey
SDi-5214	Camp Midden	LP	Survey	W-139	Habitation	L	Survey
SDi-5353	Shell Midden	LJ	Survey	W-140	Campsite	L	Survey
SDi-5416	Shell Scatter	N/D	Survey	W-1527	Shell Scatter	N/D	Survey
SDi-5445	Shell Scatter	N/D	Survey	W-1539	Campsite	LP	Survey
SDi-5601	Camp Midden	LP	Survey	W-1540	Habitation	M-A	Survey
SDi-5077	Shell Midden	SD/LJ	Survey				

*Cultural affinity for these sites has been gleaned from record search data, and some variations occur. Current research suggests the San Luis Rey traditions (I & II) to be Luiseño, while Yuman has come to be known locally as Diegueño or Kumeyaay. Designations of 'Late Prehistoric' possibly represent those sites where diagnostic artifacts for a clearer designation (Diegueño vs. Luiseño) were not present.

N/D = Non-Diagnostic
LJ/L = La Jollan/Luiseño
SLR II = San Luis Rey II
LJ = La Jollan
M-A = Mexican-American

LP = Late Prehistoric
SD/LJ = San Dieguito/La Jollan
SD/LJ/Y = San Dieguito/La Jollan/Yuman
L = Luiseño

The culture picture that emerges is one of a largely nomadic people who seasonally inhabited the low mesas and knolls overlooking coastal lagoons and bays, beach fronts, and inland slopes. Drawn to the estuaries and ocean bluffs by an environment teeming with edible life forms, the La Jollans evidently exploited the ocean and estuaries as a segment of a seasonal round (Warren 1954:4-5). The end result of La Jollan resource manipulation and seasonal occupation is reflected above in the statistical breakdown of archaeological sites within the study area, on Table 3-2 of this report, and within the following discussions.

If the archaeological record is correct in categorizing La Jollan sites within the study area, it would appear that the La Jollan peoples operated from seasonal base camps located along the ocean front (Shumway *et al.* 1959; Rogers 1929) or along bay-estuary channels (May 1973; Carrico 1976b; Kaldenberg and Ezell 1974; Warren *et al.* 1961; Warren 1964). These seasonal base camps are probably the result of a people who had developed a "Central-Based Wandering" community pattern. As defined by Beardsley and others (1956:138), a Central-Based Wandering people is one "that spends part of each year wandering and the rest at a settlement or 'central base,' to which it may or may not consistently return in subsequent years."

The cultural remains left at seasonal base camps of Central-Based Wanderers should differ significantly from those left at limited-use areas or temporary campsites, by virtue of variable techno-economic activities, intensity of use, ecological setting, and settlement systematics. J.N. Hill (1974:91) has suggested that main village sites or main base camps should possess relatively greater numbers of certain attributes or artifacts when compared with campsites or special use areas. Using the model developed by Hill, it can be seen that certain large La Jollan sites that have been labelled as habitation sites or villages tend to have more structures or features, increased incidence of burials, evidence of multiple sex/age utilization, more hearths, greater variety of artifacts, evidence of tool manufacture and sharpening, more ornaments and decorative artifacts, evidence of a wider variety of floral and faunal remains, location on or near ecological-edge situations (ecotones), location strategically near a wide variety of economical, cultural and technological resources, and, finally, location near major drainages or sources of water. In fact, excavations along the southern San Diego County coast have supported Hill's contention of site differentiation and made it possible to categorize archaeological sites as limited-use areas, campsites and village or base campsites as noted in Table 3-2. Sites such as Scripps Estates I:SDi-525 (Moriarty *et al.* 1959; Shumway *et al.* 1961), Torrey Pines Mesa:W-340/W-1075/W-1076 (Gross 1970; Carrico 1977), Batiquitos Lagoon:SDi-603 (Crabtree *et al.* 1963:323-439), the Sorrento Valley site (Harding 1951) and the Fox Point site (Smith 1973) probably represent major La Jollan base camps or proto-villages. Other sites along coastal

San Diego County probably represent limited-use areas where the La Jollan people sought to exploit the rich and variable environment surrounding them.

d. Record Search Data

The San Diego Museum of Man and the San Diego State University have a number of sites recorded within and surrounding the right-of-way which may be impacted by new construction. Those sites have been discussed in general in the previous subsections and are located and described further in Appendix D of this report.

Additional record search data covering the entire length of the proposed San Onofre to Encina 230 KV R/W have also been requested from the University of California at Los Angeles, the University of California at Riverside, the National Register of Historic Places, the California State Office of Historic Preservation, the San Diego Museum of Man, and the San Diego State University. Responses to these additional requests and consideration of these resources in light of the proposed project will be appended to this report (and Appendix D) when available.

e. Techniques of Archaeological Investigation

(1) Field Survey

The survey techniques employed in this study conform with the guidelines and requirements of the Society for California Archaeology (King *et al.* 1973) and with those set forth by the National Park Service in their "Guidelines for the

Preparation of Statements on Environmental Impact on Archaeological Resources."

On-foot reconnaissance of the transmission line R/W commenced in the region immediately north of Mission Road (S-76) and 3,000 feet east of El Camino Real in the City of Oceanside, California. Walking north along the corridor boundary, two teams of two persons each (in parallel fashion) traversed the approximate 0.6 mile section where new construction is currently proposed. At that time, archaeological resources were tentatively marked on survey maps (scale: 1 inch = 2,000 feet) and nearby natural features (i.e. trees, tall shrubs) were flagged to facilitate a later field check.

All archaeological resources located during the course of the intensive field survey were subsequently field checked. During this secondary field check phase, site record forms were compiled for each site, to include an evaluation of each site's cultural assemblage and areal extent. A photographic record was compiled and, in some cases, a limited subsurface test (i.e. one posthole) was used to determine the resources' relative depth.

(2) Photographic Record

A photographic record of each site encountered within the study area was compiled. Photographs portray those features or remains comprising the most substantial or outstanding aspects of each site, as well as the general setting surrounding each resource.

Camera equipment employed during this process consisted of a 35mm single lens reflex camera (Rollei) and tripod. Kodacolor II color print (ASA 100) film was used for all photographs taken. Photography record forms were used to document each exposure, and these records (along with proof sheets depicting each photograph) are on file at the WESTEC Services, Inc. archaeological laboratory. Additionally, a complete set of prints will be forwarded to SDG&E.

(3) Survey Limitations

Of the entire 24-mile long project right-of-way, only 0.6 mile was intensively field surveyed. This area represents that portion of the San Onofre to Encina 230 KV transmission line right-of-way for which new construction (wooden structures carrying a 230 KV circuit) is proposed. In addition, that area where the existing San Onofre to Encina transmission line parallels the existing San Onofre to Mission circuit (approximately 5.6 miles) was also intensively field surveyed for a separate proposed project (San Onofre to Mission 230 KV circuit). The remaining 17.8 miles of right-of-way received no field reconnaissance, and was not intensively surveyed during the course of the current study.

Most of the subject right-of-way surveyed for the current study is completely covered by dense, drying, ruderal grasses. This flora obscures the surface soils from scrutiny in all but the most recently disturbed areas. For this reason, recently graded access roads, cleared areas around existing power poles, game trails, and other portions of the subject property not blanketed by a dense layer of drying grasses were intensively scrutinized. Nevertheless, it is possible that such heavy ground cover prevented the discovery of additional resources in and around that portion of right-of-way described above. For a more detailed discussion of the effects of these limitations, see Sections 3.7.1e(1) and 3.7.1f.

f. Field Investigation Results

(1) Survey Results

Results of the intensive field survey of those portions of the proposed San Onofre to Encina 230 KV R/W scheduled to receive construction impacts were positive; two previously recorded sites were found within and east of the right-of-way boundaries as shown in Figure 3-3. Location and description of these sites are detailed in the following subsection. Reference is made to each site's location in relation to the project area, each site's apparent area (extent on the surface), and the general condition of each site's resources. Where appropriate, disparities between data obtained through an examination of record searches and that which was noted in the course of this survey are also discussed.

(2) Description of Archaeological Resources

- W-1527: Discovered in 1977 by Richard Norwood, this archaeological site is also recorded with

San Diego State University as SDi-5445. It has been described as a light shell scatter covering an extensive area. No other cultural debris was observed, and ground cover (weeds) was described as heavy (Norwood 1977). The site is located north of Mission Road, west of El Camino Real, and east of the Valley Drive-In in the City of Oceanside, California (Figure 3-3).

During the current investigation, site W-1527 was revisited, assessed, and documentation of current conditions recorded on State of California Archaeological Site Survey Record forms (DPR 422-Rev. 9/76). At that time, it was noted that site W-1527 was located near the 30 foot contour within the natural floodplain of the San Luis Rey River. Although the site as currently studied does not match the previous configurations recorded by Norwood (1977), extremely thick ground cover definitely limited complete documentation of the site's surface extent. As observed, the site measures some 95 meters (311 feet) by 65 meters (213 feet) and covers 6,175 square meters (1.5 acres). Identified as resting primarily within the right-of-way scheduled for construction, it is probable that most site material lies to the south and east of the current project R/W. Cultural debris noted on the surface include probable red adobe tile fragments (3), cobble chopping tools (2), a single scraping tool (1), and shellfish remains consisting of: *Chione* sp. (50+), *Ostrea* sp. (10+), *Aequipecten* sp. (10+), and *Donax* sp. (80+). Several mammal bone fragments were observed, one of which appears to have been notched for an as-yet unknown reason.

The site has been previously impacted by construction of utility transmission corridors, access roads, and possibly by construction of the nearby drive-in. No subsurface testing was conducted during the current study, and it is not known if this site has been subjected to controlled testing in the past.

- W-120: Recorded by Malcolm Rogers (1929) as a highland permanent camp exhibiting cultural debris representative of San Dieguito, La Jolla, and Diegueño cultural patterns, this resource is located at the far southeast end of Agua Hedionda Lagoon (Figure 3-3). Rogers recorded the presence of hearths, manos, and metates from elevations between 120 and 160 feet above sea level.

During the current investigation, additional cultural debris was noted on the lower knolls below site W-120, suggesting the site covers the entire knoll from 40 to 180 feet above sea level, occurring in concentrations or pockets. Flakes, scraping tools, fire cracked rock, manos, shellfish remains, and discolored soils were observed. Due to heavy scherophylous ground cover, no assessment with regard to site area (extent on the surface) was attempted at this time.

g. Resource Analysis and Significance

(1) Resource Analysis

The cultural resources present within and adjacent to those areas scheduled for new construction along the proposed San Onofre to Encina 230 KV R/W are representative of a well-developed hunting and gathering group (or groups) exhibiting a limited range of diverse technologies. A thorough analysis of the resources encountered here would require an adequate temporal framework relative to the deposition of these physical remains.

Such a framework must be the product of cautious research, careful study design, and controlled testing, all of which are beyond the scope of the current investigation. However, it is possible to analyze these resources in terms of their observable qualities relative to the generalized data base for prehistoric cultures in the San Diego County region.

As previously discussed, intensive survey of the project right-of-way scheduled for new construction revealed the presence of two archaeological sites. Food processing, as evidenced by milling technologies, was noted at site W-120, while site W-1527 exhibited an extensive surface scatter of at least four species of saltwater shellfish. Stone working, or evidence of sharpening, using, or making stone tools, was found at both site W-1527 and site W-120. The presence of (suspected) adobe tile, as evidenced by fragmentary remains, was noted only at site W-1527.

The location of any archaeological site is dependent upon several factors, including lack or presence of natural resources, nearness to water, avoidance of areas considered taboo or beyond tribal/band boundaries, and site specific terrain. Generally, one can anticipate finding large shell midden sites within a few miles of the beach/lagoon zone because it is often more expedient in terms of search and preparation time to migrate to a major seasonal food source than it is to transport the resource back to a camp or village located several miles distant. To maximize the quantity and type of exploitable resources, large camps or villages were often situated in locales central to several major resources. Establishment of base camps afforded prehistoric peoples the opportunity to maintain a semi-permanent central base from which they could extensively exploit the varied surrounding resources.

A group of people who operate from a semi-permanent base camp often form "a community that spends part of each year wandering and the rest at a settlement or 'central base,' to which it may or may not consistently return in subsequent years" (Beardsley 1950:138). The concept of central based gatherers is probably applicable to the prehistoric peoples who occupied the sites currently under discussion. If this is the case, sites W-1527 and W-120 may represent small, satellite camps or special use areas that were occupied sporadically as support camps for larger, more permanent camps or villages located nearby. Specifically, the quantity and type of artifacts at each site are indices to the type and intensity of human activity conducted there.

The large portion of the R/W that crosses Camp Pendleton is underlain by sparsely fossiliferous Pleistocene terrace deposits and by the virtually non-fossiliferous San Onofre Breccia (Woodford, 1925; Stuart, 1975).

Eocene formations in the southern portion of the R/W are predominated by sandstones and mudstones of the Santiago Formation (Wilson, 1972). The upper sandstone of this formation (Unit C) is probably of nearshore deltaic origin and contains sparse vertebrate fossils. The lower sandstone is of marine origin and contains sparse marine invertebrate fossils, casts and molds. No fossils were observed during field reconnaissance.

Holocene fossils contained within archaeological sites are not considered to be a significant paleontological resource.

3.8 AESTHETICS

As noted in Section 3.5 and shown in Figures 2-1 and 2-3, the existing 230 KV transmission line passes through a diversity of topographic features, land uses and visual resources. In so doing, the circuit utilizes different types of structures to provide support. These structures vary from single pole steel towers to wooden H-frame structures and lattice towers. The characteristics of the structures which currently exist within the right-of-way have been previously depicted in Figures 2-4 and 2-5.

From a visual aspect, the 24-mile R/W generally traverses the following types of land:

San Onofre to San Luis Rey River - Diverse terrain; limited human access through Camp Pendleton, except for view opportunities from Interstate 5.

San Luis Rey River to Highway 78 - Generally urbanized with a variety of land use; no known scenic corridors or areas of visual significance; however, area designated as general open space lies just east of right-of-way north of Highway 78.

Highway 78 to Encina Hub - Sparsely populated; view opportunities exist although area is predominantly designated for residential development; route crosses two areas designated for open space, one just south of Highway 78 and east of El Camino Real, the other at the Hub.

3.9 NOISE

The following data were summarized from the acoustical analysis included as Appendix E to this EIR.

That portion of the right-of-way existing from San Onofre To just north of the Oceanside Airport crosses through uninhabited areas of Camp Pendleton. Thus the ambient noise levels along the right-of-way are a function of Marine Corps training activities on the base. In the absence of training exercises, the hourly ambient noise levels are on the order of 35 dB(A) as measured in similar territory (USEPA, 1971a).

The right-of-way to the east of the Oceanside Airport passes southward through developed area for an approximate distance of one mile.

This area has an ambient noise level governed by operations from Oceanside Airport and traffic on Mission Avenue. Oceanside Airport noise contours developed by San Diego Acoustics for the Comprehensive Planning Organization (S. D. Acoustics, 1978a) show CNEL's of 60 over the right-of-way area. Traffic noise on Mission Avenue is due to some 22,400 Average Daily Trips. The Day Night Level (LDN), calculated using the Wyle methodology (Wyle, 1973), yields noise levels given in Table 3-3.

Table 3-3

MISSION AVENUE TRAFFIC NOISE

Distance From Roadway (feet)	CNEL/LDN dB(A)
50	70
100	65.5
500	55
1000	50.5

The resulting ambient noise level in the area is on the order of 60 to 63 dB(A).

The Encina Hub is located in an uninhabited area and hence the hourly ambient noise levels are on the order or 35 dB(A) (USEPA, 1971a).

SECTION IV

ENVIRONMENTAL ANALYSIS

4.1 LAND RESOURCES

4.1.1 Overview

The proposed transmission line will be located within an existing 24-mile right-of-way and, with the exception of a 0.6-mile segment near the Oceanside Airport plus one isolated spot near the Hub, no earth movement or construction work, other than clearing activities, will be required.

The only environmental concern of any major consequence along the 23.3-mile segment of the R/W that will not be subject to construction involves the highly erosive nature of many of the soil types that will be encountered. It is recognized that current plans call for the utilization of existing access roads when possible; in those instances, the use of service vehicles and stringing equipment should not excessively increase soil erosion. However, in those locales where new access roads will be required or where existing ones will be expanded, the potential for increased erosion and accompanying sedimentation will exist through the loss of ground cover and the exposure of bare soil to the elements.

In addition, ground accelerations from a magnitude 7 event on the potentially active Rose Canyon Fault (not known to be active in the last 10,000 years) could cause line breakage from differential tower swaying or possible tower failure. Such damage would be widespread in the San Diego-Oceanside area and would contribute to the general chaos resulting from such an event. The proposed transmission line would be affected to no greater extent than would the existing lines and may help assure that some power will reach homeowners in event of such an earthquake.

4.1.2 Landform Alteration

Given the fact that the terrain in the vicinity of the proposed construction activities is relatively flat, no major impacts or landform alteration are foreseen.

4.1.3 Erosion Potential

Tower or steel pole structures will not in themselves affect soil erosion. Foundations necessary to support these structures and the placement of wood poles will necessitate disturbing the existing soil structure. Replacement of soil with foundation materials will result in excess loose soil on the surface which will be available for transport from the structure site, thus contributing to downstream siltation within the San Luis Rey streambed.

4.1.4 Landslide Potential

The existence of excessively oversteepened slopes could affect the transmission lines if a tower were to be located on a slope which had been oversteepened or if differential settlement was of sufficient magnitude to cause line stretching. Inasmuch as the proposed construction will avoid such areas, this potential impact is considered minimal.

4.1.5 Flooding

With the exception of possible tower washout, no impacts related to flooding within the San Luis Rey River Basin should be expected from any new transmission lines.

4.2 BIOLOGICAL RESOURCES

Given that the proposed project will take place within an established right-of-way and existing access roads will be used wherever possible, the impact to existing and adjacent biological resources is expected to be minimal. An itemization of anticipated impacts to identified high interest species and habitats follows:

1. Plants

   No significant adverse effects are anticipated.

2. Animals

Passerculus sandwichensis beldingi (Belding's Savannah Sparrow) - Species utilizes pickleweed marsh surrounding access road and R/W where it crosses upper reaches of Agua Hedionda Lagoon. No new structures will be placed in the lagoon. Impact to preferred habitat of this species is not expected to occur. Impact during the springtime breeding season should be avoided, if possible. Species may nest adjacent to access road across lagoon. Use of helicopter to string initial pull lines could be disruptive to this species.

Sterna albifrons browni (California Least Tern) - Species reportedly nests on salt flats just west of R/W. As with species above, habitat disturbance is not expected to occur due to the proposed project, but line work, especially use of helicopter, could be disruptive during nesting season (May to August).

Dipodomys stephensi (Stephen's Kangaroo Rat) - Since no kangaroo rats were trapped, no distinctive evidence of their presence was noted; and since preferred habitat is marginal at best, the proposed project will not adversely affect any known population of *D. stephensi*.

Phrynosoma coronatum blainvillei (Coast Horned Lizard)
Thamnophis couchi hammondi (Two-Striped Garter Snake)
Cnemidophorus hyperthrus beldingi (Orange Throated Whiptail Lizard)
Vireo bellii pusillus (Bell's Vireo)
Geothylpis trichas (Common Yellowthroat)
Polioptila melanura californica (Black-tailed Gnat-catcher)

Impact to these species is expected to be very minor and non-significant. Actual habitat loss for these species is expected to be negligible.

3. Habitats

Riparian Woodland - This streamside woodland habitat is present at two points along the survey R/W: San Luis Rey River and Buena Vista Creek. Riparian habitat is a unique and valuable resource in San Diego County. It occupies less than 0.2 percent of the total County acreage (California Department of Fish and Game, 1965). It is an attractive and productive wildlife habitat. A number of rare and declining bird species are to be found in this habitat type. This habitat is spanned by the lines and no construction activity within the drainages is anticipated. Impact to this habitat is expected to be of a temporary nature occurring during adjacent construction activity.

4.3 AIR QUALITY

4.3.1 Meteorology

No evidence exists which would indicate that the proposed project will adversely affect the meteorological conditions in the area.

4.3.2 Air Quality

A localized short-term impact on air quality will result from the stringing and tower construction activities. Grading activity, although minimal, will generate dust and fumes during construction of the six wooden towers. Additionally, the movement of construction and stringing vehicles over dirt roads and construction sites, as well as the creation of temporarily exposed graded areas, will create a further source of dust and fumes, as will the use of helicopters for stringing. The degree and severity of these impacts can be reduced given implementation of the mitigation measures offered in subsequent sections.

It is not felt that the quality of the regional air cell will be significantly affected by the proposed project.

4.3.3 Electrical Phenomena

a. Corona

Corona and its associated voltage gradient are primarily functions of the transmission line design parameters: voltage, conductor diameter, number of conductors per phase, phase spacing, and height of phase conductors above ground. Air density parameters, such as altitude, barometric pressure, and air moisture can also influence corona.

Smooth, clean conductor surfaces will tend to reduce voltage gradients; however, sharp points or irregularities increase the voltage gradient. Dust, insects, water drops, burrs, or nicks on the conductor surface will cause the voltage gradient to concentrate at the irregularity or contaminant. These concentrations of voltage gradient will tend to increase the corona for a given set of atmospheric conditions.

It is expected that, infrequently, under certain conditions, the transmission lines will experience corona and its associated effects. However, based on the best available data, the corona discharges associated with the proposed 230 KV transmission line are not expected to have any significant adverse impact on the environment. Elaboration of specific elements of the corona phenomenon is offered below.

(1) Radio Interference Effects

Radio interference or radio noise (RN) can result from overhead transmission lines either by electrical discharges across gaps that separate different voltage potentials or by partial electrical discharges, such as corona. Gaps are usually abnormal conditions and may occur in lines, fences, or metal objects that are in or near the corridor. All such contacts in the electrical field will be provided with good electrical bonds to eliminate gaps.

Radio reception in low signal strength areas adjacent to transmission lines may suffer some interference. A number of variables will determine the degree of radio interference. Radio interference may occur during dry weather; however, interference levels usually average 20 decibels higher during rain, a condition when most objections occur. Few problems are expected in urban areas. Under average foul weather conditions (when conductors collect precipitation), radio interference may be experienced on weaker stations within 300 feet of the edge of the right-of-way.

(2) Television Interference Effects

Television interference (TVI) is evidenced by dots on the screen, bars or black bands, or "snow" and tearing of the picture if interference is severe. It is caused by the same factors as RN and, in fact, is a special case of radio noise. Corona noise is more evident in the form of TVI since it appears as bands on the television screen. The bands appear to drift slowly upwards, due to the slight difference between the power line frequency and the television scanning rate. Spark or arcing TVI is most evident as small "salt and pepper" dots which appear randomly on the screen. Severe interference may cause the picture to become unsynchronized and result in vertical rolling and horizontal tearing.

The tolerability criteria for TVI is difficult to assess since the effect on a television picture differs from the effect on an audio signal; however, TVI is not anticipated to affect residences more than 500 feet from the R/W.

(3) Effects of Ozone and Oxides of Nitrogen

Recent research has indicated that "... high voltage transmission lines up to 765 KV do not generate ozone measurable above the ambient at ground level adjacent to the lines under any weather conditions" (Fern and Brabets, 1974), and (in reference to both O_3 and NO_x) that "...oxidant production from present EHV transmission lines does not create an environmental problem" (Roach, Chartier, and Dietrich, 1973).

Laboratory experiments have shown that the amount of oxides of nitrogen (NO_x) generated by the conductor corona of extra high voltage lines is from 5 to 20 times smaller than the amount of ozone from corona. Therefore, no adverse environmental effects are expected to result from the minute quantities of NO_x generated by operation of the proposed 230 KV line.

(4) Effects of Audible Noise

The phenomenon of transmission line audible noise (AN) has been discussed in technical literature, but limited information exists concerning the magnitude of AN levels. Engineering studies are being conducted to predict, based upon the limited data available, the worst case AN levels of the proposed transmission lines.

Audible noise phenomenon from a 230 KV line will occur principally during foul weather. This noise is made up of many individual corona sources on the line conductors. AN levels during heavy rain will be highest, but will tend to be masked by the sound of the rain. However, noise during fog, light rain and snow may be audible because of a lower ambient level. No adverse reaction is anticipated from AN because of the few hours of AN-producing weather. Other 230 KV installations in the United States with similar or higher AN levels in wetter and more populated areas have experienced few, if any, AN complaints.

Corona can also be affected by secondary climatic factors such as wind, temperature, or inversions. These secondary climatic effects do not significantly affect the level

A voltage will be electromagnetically induced in any conducting material parallel to an electrical circuit carrying alternating current. The electromagnetic effects on an object adjacent to a transmission line will be dependent on the following relationships:

(1) The voltage induced in an object will be directly proportional to the magnitude of the current flowing in the transmission line.

(2) The voltage induced will be directly proportional to the length of the object in a direction parallel to the transmission line.

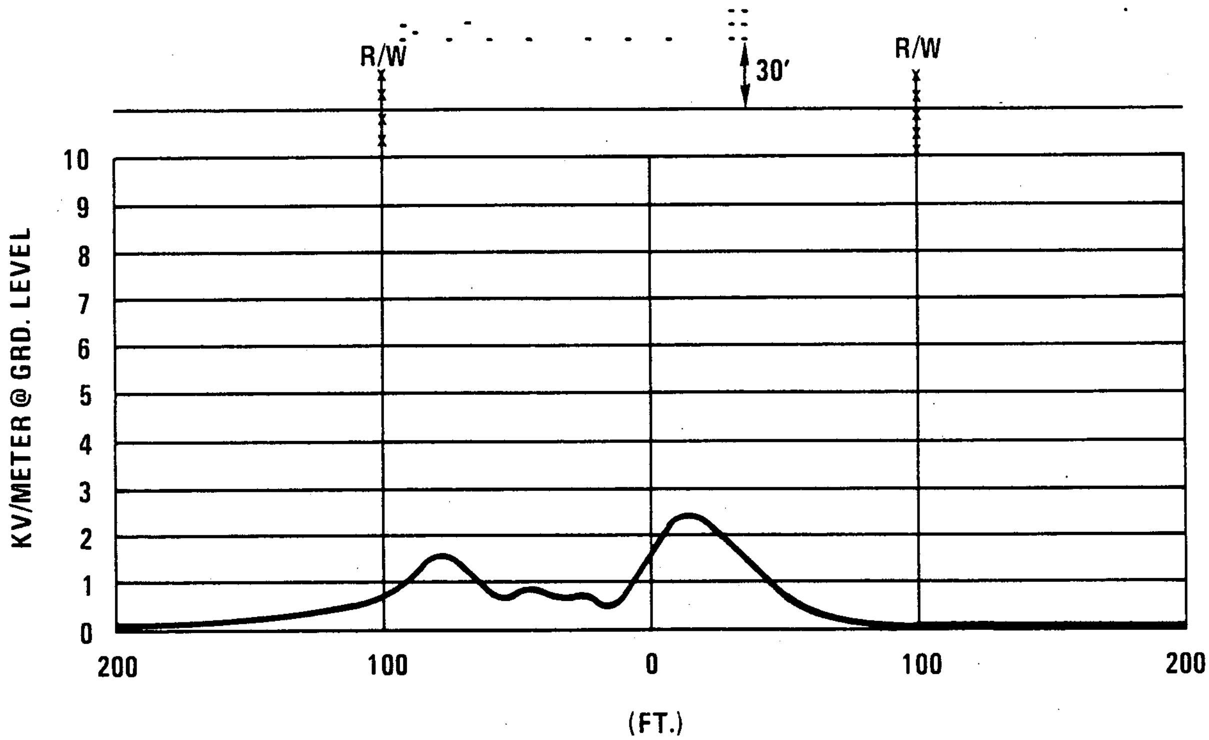
(3) The voltage induced will be inversely proportional to the distance between the object and the transmission line conductors.

(4) The voltage induced will be directly proportional to the ground loop resistance of the object in which the voltage is being induced.

As a general guideline, interference with wire-type communication lines will not be expected if the power transmission line and the communication lines parallel each other for less than a mile and are separated by more than one-fourth to one-half mile. Since no significant electromagnetic effects exist as a result of the present 230 KV line, none would be expected by the addition of a 230 KV circuit within the same right-of-way.

(c) <u>Electrostatic Effects</u>

An electric potential will be induced in any conductive object which is insulated from ground and placed in



CALCULATED ELECTROSTATIC FIELD STRENGTH – OCEANSIDE AIRPORT SEGMENT

FIGURE 4-1.

some sections of the R/W, an increase in sediment loading of the stream courses would be hard to detect because of already heavy loadings. Flooding potential has been previously discussed.

4.4.2 Groundwater

Groundwater should not affect the proposed project nor should the project have any impact on groundwater; however, certain areas of shallow groundwater may require foundation design consideration. Groundwater quality should not be affected by the project.

4.4.3 Water Quality

Disruption of soil structure and replacement with foundation materials make loose soil materials available to be transported to downstream receiving areas. Thus, minor amounts of silting may occur as a result of new construction along the transmission line R/W. Silting thus derived would be a one-time impact and could be diminished by compacting excavated soils or planting them for stabilization. No change should occur in chemical quality of surface waters resulting from the proposed project.

4.5 LAND USE

4.5.1 Overview

No major incompatibilities regarding land use are foreseen along the 23.3-mile segment of the R/W that will be subject only to stringing activities, given the existence of the R/W and an existing 230 KV circuit.

Some annoyance may occur as a result of helicopter noise and other impacts related to the use of stringing equipment, particularly in those areas where the R/W abuts residential land uses. However, as noted later under mitigation, the fact that these activities will be temporary in nature and will occur during the normal working day will serve to ameliorate the effect.

Major transportation corridors may be temporarily affected by the stringing activities, assuming that certain equipment may infringe upon travel lanes. Additionally, traffic will naturally tend to slow as drivers observe the work.

Major potential problem areas as regards transportation corridors include the following:

a. Crossing Mission Avenue (Highway 76).

b. Vicinity of El Camino Real and Oceanside Boulevard.

c. Vicinity of El Camino Real and Fire Mountain Road.

d. Crossing Highway 78.

4.5.2 Construction Areas

Placement of approximately six wooden towers east of the Oceanside Airport will probably cause annoyance through dust, fumes, noise and aesthetics to residential areas to the east (500-1000 feet from the construction area along Fireside Drive; normally downwind of the project area), and the residential subdivision south of Mission Avenue through which the right-of-way currently passes.

In addition, operations at the Oceanside Airport could be minimally affected in high wind and blowing dust conditions.

Inasmuch as SDG&E owns a wide area of land around the Hub, little or no effects on land use are foreseen.

4.6 SOCIO-ECONOMIC IMPACTS

Given the fact that the project will employ a maximum of 20 persons, all of which are currently on the Company's payroll, any impacts on the social milieu and economic well-being of the area are seen as minimal. Some economic benefits will accrue to the area through continued employment, but taken in the overall context of northern San Diego County, these must be considered insignificant.

On the other hand, placement of the new circuit will represent an increase in assessed valuation of the Company's facilities in the area, and as such, will serve to increase the revenues to the affected jurisdictions, primarily the Cities of Oceanside and Carlsbad. Conversely, the proposed transmission line will not create additional costs to any public agencies since the line and its access roads will be maintained by SDG&E. Thus the proposed transmission line will generate additional public revenue without incurring additional public expenses.

In addition to the estimated 20 persons that will be employed for roughly nine months to construct the proposed transmission line and towers, the project will also create a demand for aluminum, wood and steel resources.

4.7 CULTURAL RESOURCES

4.7.1 Archaeology

Implementation of the proposed San Onofre to Encina 230 KV circuit will require two methods of transmission line placement: the addition of one circuit to the vacant positions along existing transmission structures; and the construction of new structures within specified portions of the total project R/W (see Figure 2-3). Between them, these methods have the potential for both direct and indirect adverse impacts to known prehistoric cultural resources.

Directly, sites W-1527 and W-120 (discussed in Sections 3.7.1) may be adversely affected by the construction and placement of new transmission structures. Additional potential direct adverse impacts to these sites include the location and operation of construction staging areas in the immediate vicinity, and the location and operation of those vehicles used to winch preliminary cables and attach new circuits to the proposed transmission structures. Suggested measures to protect these sites or mitigate otherwise adverse impacts are presented in Section V.

As currently proposed, addition of one circuit to the vacant position on existing double circuit steel towers from San Onofre to Encina has the potential for indirect adverse impacts to at least five known cultural resources and, potentially, on previously unrecorded sites. Shown in Figure 3-3, the known sites are: W-1777, W-1778, W-1779, W-1780, and W-1782. The location and operation of vehicles used to winch preliminary cables and others used to attach new circuits to existing double circuit steel structures within and immediately adjacent to these sites may adversely impact the cultural resources present there. Measures to protect these sites or otherwise mitigate identified adverse impacts are suggested in Section V.

4.7.2 Paleontology

No major impacts regarding paleontology are expected to occur.

4.8 AESTHETICS

Visual resources and aesthetic quality are difficult to evaluate objectively since their characteristics do not lend themselves easily to quantification or economic analysis. Judgment of the scenic quality of an area, or the sight-seeing value of a particular biological or physical system, is necessarily dependent on individual philosophies, preferences and interests, as well as more formalized criteria, which often lead to the delineation of an area as a "scenic resource." The degree of attractiveness of an area, therefore, is viewed as a subjective evaluation that is dependent on the bias of the observer.

The scenic quality of much of the area through which the proposed transmission line passes has been recognized, despite the fact that the majority of it lies within a military base. The area, due to its unique combination of pastoral scenes and rolling landforms, is considered to be highly scenic and of significant aesthetic value.

The addition of one circuit to an already existing series of towers, however, will have a certain minimal impact during the stringing operations, but following that, it is highly doubtful that even the most observant traveler will perceive the fact that an additional circuit has been strung.

Likewise, the areas of construction already contain a series of towers and power lines; thus, it is questionable that the introduction of approximately six lower profile wooden towers will either add or detract from the existing milieu. Likewise, the addition of one tower at the Hub is seen as being of only limited aesthetic significance.

4.9 NOISE

Noise impacts related to the installation of new transmission lines are a function of:

(a) Installation equipment type.

(b) Schedule of operations.

(c) Present environmental setting.

(d) Proximity of populated areas to the rights-of-way along which installation operations will occur.

Three specific installation tasks which are to be performed between San Onofre and the Encina Substation have been examined for their noise impact. These tasks and their potential noise problems are summarized below:

1. Addition of one circuit to the vacant position on existing double circuit steel towers from San Onofre to Encina Substation (24 miles). Primary noise sources will be from the helicopter used to pull cables, pulling and tensioning equipment, bucket truck, and various other trucks.

2. Installation of new wood structures for a 0.6-mile segment of the R/W opposite Oceanside Airport. Noise sources for this task include an augering machine, caterpillar, large crane, semi trucks, and concrete trucks.

3. Installation of one steel tower at the Encina Hub to facilitate arrangements of new conductors. Primary noise sources are the same as those described in subparagraph 2 above.

Of the activities planned, only items 1 and 2 above have the potential for impacting upon a populated area. Thus, the noise levels for a typical construction scenario have been developed and are described below.

As previously mentioned, the noise level at a particular site will be a function of the noise source and its operational mode. Installation of new structures and wire stringing involve the operational functions given in Table 4-1.

Table 4-1

OPERATIONS DATA
FOR INSTALLATION OF NEW
STRUCTURES & WIRE INSTALLATION

Noise Source	Operation	Operational Time On Site
Augering Machine	Hole Drilling	4 hours/site
Semi Truck	Pole Delivery	1 hour/day
Equipment Trucks	Personnel & Equipment	1 hour/day
40-Ton Crane	Pole Setup	4 hours/site
Concrete Truck	Cement Footings	1-1/2 hours/day
Caterpillar	Push/Pull	1 hour/day
Helicopter	Rope Pulling	1 hour/day
Pickup Trucks	Personnel & Equipment	1/2 hour/day
Flat Bed Trucks	Small Equipment	1/2 hour/day
Semi Trailer	Conductor Delivery	5 minutes/day
Tensioners	Wire Puller	1 hour/day
Bucket Truck	Wire Installation	4 hours/day

Noise levels for each of these sources were obtained from the literature cited (USEPA, 1971b; EG&G, 1974; S.D. Acoustics, 1978b) and are given in Table 4-2.

Table 4-2

EQUIPMENT NOISE LEVELS

Item	Noise Level	References
Augering Machine	80 @ 50 ft.	USEPA, 1971b
Semi Truck	81 @ 50 ft.	S.D. Acoustics, 1978b
Equipment/ Pickup Trucks	70 @ 50 ft.	USEPA, 1971b
40-Ton Crane	83 @ 50 ft.	USEPA, 1971b
Concrete Truck	85 @ 50 ft.	USEPA, 1971b
Caterpillar	80 @ 50 ft.	USEPA, 1971b
Helicopter	87 @ 150 ft.	EG&G, 1974
Tensioner	80 @ 50 ft.	USEPA, 1971b

The method used to determine the noise impact involves a computation of the Community Noise Equivalent Level (CNEL) based upon the hourly noise levels. The appropriate mathematical relationships are as follows:

$$HNL = 10 \log \frac{1}{60} [\Sigma (10^{NL/10} \cdot \Delta t)]$$

where NL = noise level, in dB(A)
t = duration, in minutes

$$CNEL = 10 \log \frac{1}{24} \Sigma [10^{HNLD/10} + 3 \cdot (10^{HNLE/10}) + 10 \cdot (10^{HNLN/10})]$$

where NHLD = hourly noise level (07001900 hours)
HNLE = hourly noise level (19002100 hours)
HNLN = hourly noise level (21000700 hours)

For the purposes of this analysis, operations do not occur during the evening and nighttime hours. Operations have been combined to yield a CNEL value for the structure installation and for the wire stringing. The resulting levels are 79 CNEL at 50 feet for the structure installation and 76 CNEL at 50 feet for the wire stringing. Propagation of these levels to greater distances is a function of distance and atmospheric absorption. The distance effect is equal to 20 $\log_{10} D_1/D_2$ and the atmospheric absorption is equal to the absorption coefficient times the distance traveled. The absorption coefficient is normally given in terms of decibels per 1000 feet. The absorption coefficient is a non-linear function of frequency and the temperature and humidity. An approximation may be made by assuming that the absorption coefficient at 1000 hertz for a standard day is typical. That value is 1.4 dB/1000 for 59°F and 70% relative humidity. The combined corrections were used to generate the noise level curves in Figure 4-2. Right-of-way widths may vary up to several hundred feet; thus the noise can be generated anywhere on the right-of-way.

Typical structure installation takes two to three days at a site. Wire stringing takes an additional two to three days per mile. Thus, the total impact at any one site will occur for a two to three day time period. This impact will be negligible for those areas which are uninhabited. In the inhabited areas, the prevailing noise levels must be compared with the noise generated by the structure installation and wire stringing operations. The prevailing levels are in terms of annual Community Noise Equivalent Level. The annual level for the structure and wire installations will, of course, be low since the entire sequence of events takes place over a small period of time. Table 4-3 presents a comparison of the annual CNEL values for the proposed construction activity and those currently prevailing at the sites near inhabited areas.

Table 4-3

ANNUAL CNEL

	Existing	Structure SDG&E	Wire Stringing SDG&E
Uninhabited	45	58	55
East of Oceanside Airport	60	58	55

Thus, the annual impact of the proposed operations is negligible in the habitable areas.

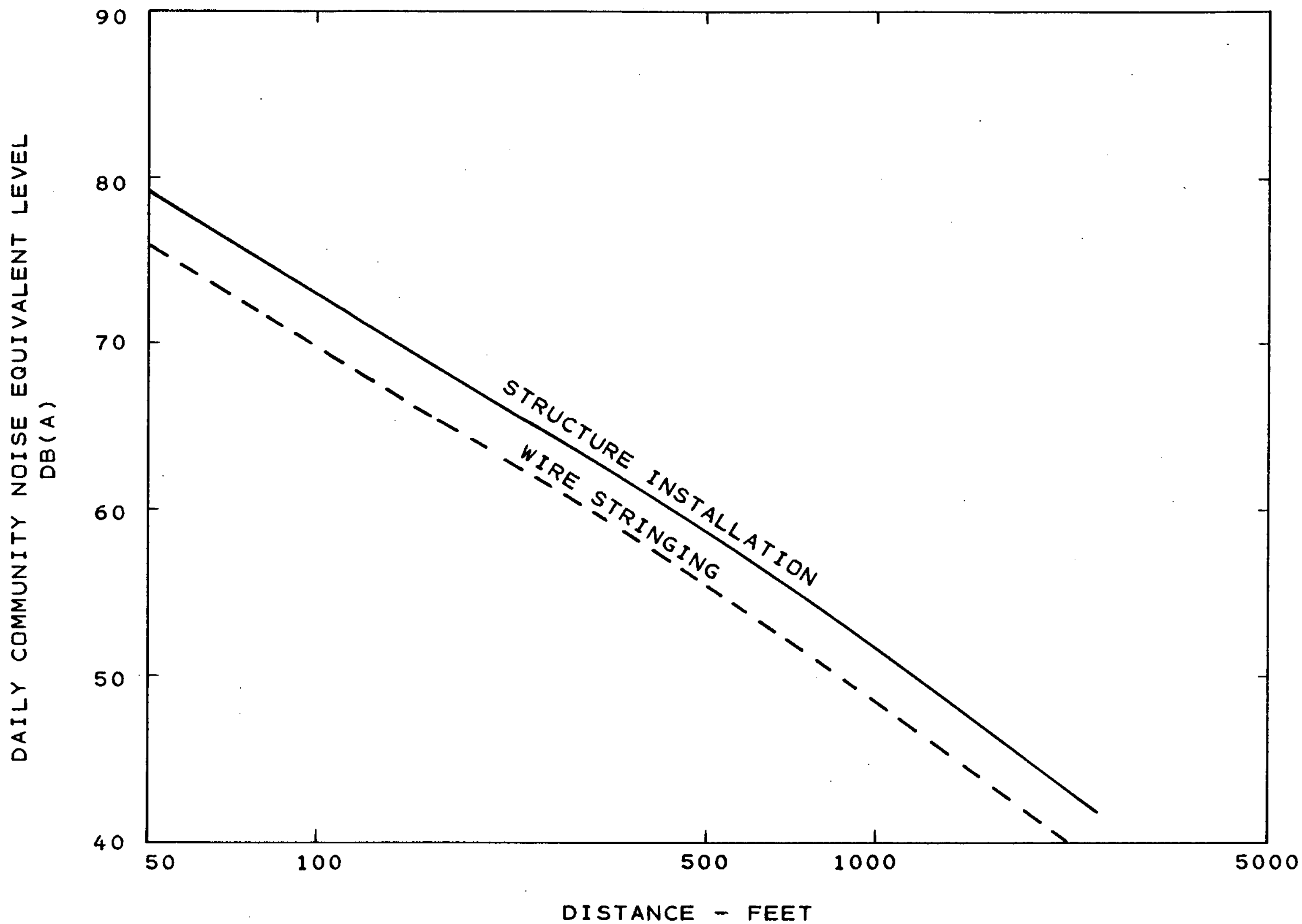
Since the proposed operations will occur within two municipalities and the County of San Diego, the noise ordinances of these jurisdictions were examined. The County Noise Ordinance specifies for construction equipment:

> "No such equipment, or combination of equipment regardless of age or date of acquisition, shall be operated so as to cause noise at a level in excess of seventy-five (75) decibels for more than 8 hours during any twenty-four (24) hour period when measured at a distance of one hundred (100) feet from such equipment or corresponding sound level at some other distance."

These sound levels will be corrected for time duration in accordance with the following table:

Total Duration in 24 Hours	Decibel Level Allowance	Total Decibel Level
Up to 15 minutes	+15	90
Up to 30 minutes	+12	87
Up to 1 hour	+ 9	84
Up to 2 hours	+ 6	81
Up to 4 hours	+ 3	78
Up to 8 hours	0	75

The structure and wire stringing operations at 100 feet are 73 and 70 dB, respectively.



Noise Level Contours.

FIGURE 4-2

In addition to the construction noise, the new transmission line will generate noise due to arcing from the high voltage line. This phenomenon normally occurs under high humidity conditions. Levels measured at the base of a tower by Southern California Edison on a foggy day were 42 to 45 dB(A) from a 220 kV line. Due to the weather variations expected along the transmission line, this noise is not expected to cause a problem.

In summary, the annual noise levels in residential areas resulting from structure installation and wire stringing will be no louder than those currently present. Additionally, the daily noise impact for the 23 day duration will be less than the limit established in local noise ordinances.

4.10 SAFETY

A hazard of electrocution would exist only if weather or an accident caused a line to break and fall to the ground, or if a person or animal came in contact with a live wire or with a conducting object in contact with that wire. However, if a 230 kV wire is felled, power to that line will be discontinued within six cycles, or approximately 1/10 second after the line contacts the towers, earth, or some ground potential (Higgins, 1978).

SECTION V

MITIGATION MEASURES

Except where noted, the following mitigation measures are planned as part of the project.

5.1 LAND RESOURCES

5.1.1 Overview

a. Maximum use will be made of existing access roads and equipment placement areas so as to minimize grading, earthwork, landform alterations and erosion potential.

b. Structural design of the approximately six new wooden towers will accommodate expected seismicity.

5.1.2 Landform Alteration

Due to the flat nature of the terrain in the construction areas, no impacts are foreseen; thus the only mitigation measure offered involves maximum use of existing access roads for pulling, so as to minimize grading elsewhere.

5.1.3 Erosion Potential

Where erosion of bare soil will occur in areas having severe erodeability characteristics, erosion control techniques will be included, as applicable.

5.1.4 Landslide Potential

If towers are to be located near oversteepened slopes, sufficient attention will be given to foundation design in order to minimize potential effects related to landslides.

5.1.5 Flooding

Tower foundation design will take into consideration the possibility that flood waters may result in deposition or erosion of soil materials from their vicinity.

5.2 BIOLOGICAL RESOURCES

Potential significant adverse impacts which must be mitigated occur with regard to the Belding's savannah sparrow and the California least tern at Agua Hedionda Lagoon. Access to this portion of the lagoon via the R/W access road will be restricted. It is further recommended that construction activity, specifically use of helicopters, not be conducted during the nesting season (May to August) if at all possible.

Inasmuch as only a portion of the entire 23.9-mile length of the San Onofre to Encina right-of-way has been intensively surveyed for biological resources, it is recommended that additional surveys be made where existing access roads will not be used. In this way, biological impacts related to the disruption of previously undisturbed areas can be identified and, if warranted, adequate mitigation offered at that time.

5.3 AIR QUALITY

5.3.1 Meteorology

No impacts have been defined, thus, no mitigation is offered.

5.3.2 Air Quality

Again, maximum use of existing access roads will minimize earthwork and thus reduce impacts associated with the temporary degradation of localized air quality from dust and fumes.

It is also recommended that watering equipment be used as necessary to minimize dust, particularly in those areas where residential land uses exist downwind of prevailing winds.

5.3.3 Electrical Phenomena

a. Corona

(1) Radio Interference Effects

Properly designed and maintained 230 KV lines should cause no adverse impact to residents from radio interference outside the right-of-way. Design parameters will be chosen to minimize the predicted value of RN prior to construction.

Consideration will be given to the use of special insulators, tower hardware, and conductor configurations to yield acceptable RN levels consistent with good design practices. During construction, care will be taken to install special hardware and line apparatus for maximum effectiveness.

After the line has been constructed and energized, proper routine maintenance will be performed to keep the line at its design level for RN. Maintenance procedures will include, but are not limited to: cleaning insulators, tightening line hardware, and inspecting conductors. Where anomalies that may cause excessive RN are discovered, they will be promptly corrected to return the line to its design RN level.

A complete survey of background RN levels will be made prior to the start of any line construction. All broadcast stations which can be received in the area of the transmission line will be measured for signal strength.

After the line is constructed, but before energizing, a second survey will be taken of received signal strengths to determine if any signal to noise degradation has occurred. A third survey will be made following the normal energization of the transmission line. RN levels will be taken at points perpendicular to the right-of-way at designated locations near population centers, community service, defense installations, and other significant areas of potential interference.

(2) Television Interference Effects

TVI is not anticipated to affect residences more than 500 feet from the right-of-way. Any TVI problems created by the line will be investigated on an individual basis.

The same measures described in "Mitigation Measures" for Radio Interference (refer to Section 5.3.3a(1)) will be used to minimize television interference. Additionally, all radio noise surveys will include usable television broadcast signals and signal to noise ratios will be computed for these signals both before and after the line is constructed and energized.

(3) Effects of Ozone and Oxides of Nitrogen

It has been stated earlier that the generation of gases are not significant to produce concentrations in excess of the ambient level. Therefore, no special mitigation measures are anticipated for emission of gases.

(4) Audible Noise

Design parameters will be employed to minimize the audible noise level at the edge of the right-of-way. The audible noise level will be maintained below that required by local codes and ordinances and by good design practices.

(5) Visible Light

Proper design of the transmission lines, using the latest types of materials, techniques, and design criteria, should eliminate visible light as an environmental concern.

b. Electro-magnetic Effects

The electric utility and communication industries have worked quite closely for many years to establish safeguards for communication lines parallel to and in close proximity to electric power lines. These safeguards were developed to protect not only workers but the public as well. All safeguards that have been established by General Order No. 95, January 1976, of the California Public Utilities Commission and by the utility industries will be strictly followed. Safeguards for lines and other conductive objects that are near the proposed transmission lines are addressed in these regulations.

Inasmuch as no harmful effects are anticipated from electro-magnetic induction produced by currents flowing in the 230 KV conductors, no additional mitigation is offered. Any permanent object (e.g. fences) capable of acquiring an electrical potential from the line will be grounded.

c. Electrostatic Effects

Engineering studies are currently being conducted to assure that the lines will be constructed so that worst case ground gradients are held below the threshold of sensation and will be harmless.

As an additional measure to reduce electrostatic voltage induction, permanent objects large enough to develop voltages above the normal human sensitivity level will be grounded or shielded. Grounding will keep the induced voltages neutralized.

Electrostatically-induced voltages and currents are not anticipated to be a problem. Other 230 KV transmission lines constructed and operated throughout the United States have shown that properly designed and constructed 230 KV lines do not result in adverse effects from electrostatically-induced voltages.

Measures other than proper design and construction are not anticipated to be needed on the proposed 230 KV lines.

5.4 HYDROLOGY

5.4.1 Surface Water

Potential effects of surface water quality will be minimized through maximum use of existing access roads and limiting earthwork.

Tower foundations will be designed to resist washout within areas of potential inundation.

5.4.2 Groundwater

Shallow groundwater will require consideration in designing foundations for the towers.

5.4.3 Water Quality

Potential impacts related to erosion and siltation will be minimized by compacting excavated soils and, when appropriate, planting them for stabilization.

5.5 LAND USE

It is recommended that, to the maximum extent possible, stringing equipment be kept out of travel lanes, and where potential disruption may occur, that consideration be given to the time of day (avoiding peak hours) and seasonal fluctuations.

Potential annoyance caused by construction activities near residential areas will be mitigated by the fact that they will be conducted during normal working hours and not at night or on weekends.

If high wind conditions and blowing dust are found to be hazardous to the operation of the Oceanside Airport, it is recommended that construction work cease or that maximum use of watering trucks be used to minimize dust.

5.6 SOCIO-ECONOMIC CONSIDERATIONS

Given the lack of adverse impacts, no mitigation measures are offered.

5.7 CULTURAL RESOURCES

5.7.1 Archaeology

Based on current survey and record search data and preliminary construction plans, archaeological sites W-1527, W-120, W-139, W-1777, W-1778, W-1779, W-1780 and W-1782 could be adversely affected by the proposed project. The following measures will be implemented by SDG&E to avoid impacting these cultural resources.

The major area of new construction for the proposed project and, thus, the area with the greatest potential for being adversely impacted, is the 0.6 mile segment along the San Luis Rey River. As noted previously (see Figure 3-3), this area contains site W-1527. Mitigation measures proposed by SDG&E to avoid adversely affecting this area are as follows:

a. A controlled, accurate instrument survey to locate site W-1527 will be completed. Surrounding ground cover will be sufficiently cleared to allow accurate definition of the site's surface extent. These data will be transposed to updated project maps (scale: 1" = 200') for the proposed 230 KV R/W to adequately assess the potential for direct impact.

b. Controlled, limited subsurface testing of site W-1527 will also be completed. A combination of testing methods, to include mechanical trenching (e.g., ditch witch), and linear posthole series will be implemented to assess the nature, extent, and condition of any existing subsurface deposits. All excavated soil will be passed through one-eighth-inch mesh hardware cloth and scrutinized by professional archaeologists to ascertain the presence, or absence, of subsurface cultural debris.

c. At the completion of instrument survey and testing program, the project archaeologist will analyze all information gleaned from the tests and prepare a report detailing the fieldwork, results, and necessity for additional testing or other mitigation measures (i.e. avoidance), if applicable.

d. Contingent on the results of the site survey mapping and limited subsurface testing, SDG&E's project engineers will attempt to design the project so that no construction will occur within or in the immediate vicinity of site W-1527, as defined by detailed mapping. Within the constraints of viable engineering design, SDG&E will incorporate into the project construction specifications a clause prohibiting any construction activities (including equipment staging, material storage, and construction of access roads) within or in the immediate vicinity of site W-1527. In addition, SDG&E will assure that a qualified observer is periodically present to guarantee that the archaeological site is avoided as specified.

e. Should it be found infeasible to avoid construction in the area of site W-1527, additional archaeological testing, to include the salvage of a specified percentage of the portion of the site to be impacted, will be made by SDG&E. The extent of this testing will be largely determined by the results of the survey and limited subsurface testing specified in subparagraphs b. and c. above, and on the exact nature and degree of the proposed construction activities.

Outside of the limited areas of new construction, only activities associated with stringing conductors are proposed, and the potential for significant impacts is, hence, less. The following mitigation measures are proposed by SDG&E to assure the known archaeological resources are not disturbed.

a. Detailed maps showing the precise area proposed for a new steel tower near site W-120, and maps illustrating the specific locations for cable and transmission line pulling activities and construction vehicle access along the remainder of the transmission line R/W will be prepared by SDG&E. An independent, qualified archaeologist will review these maps to assess the potential for impacting known archaeological resources.

b. Should no such potential impacts be identified, SDG&E will proceed with the installation of the new circuit.

c. Should a potential for impacting a known cultural resource be found to exist, SDG&E will apply the same mitigation measures to potential impact areas as those stipulated above (steps a through c) for site W-1527.

5.7.2 Paleontology

As no significant impacts to paleontological resources are foreseen, no mitigation is considered necessary.

5.8 AESTHETICS

Inasmuch as no major impacts are foreseen, no mitigation is offered.

5.9 NOISE

Although potential noise impacts in the construction area have been determined to be negligible, some annoyance may occur in the residential areas through which the R/W passes. This will be mitigated by the restriction of construction activities to daytime, nonweekend hours.

5.10 SAFETY

If a line is felled, power to the line will be discontinued within six cycles, or 1/10 second. Thus, the hazard of electrocution is reduced. All requirements of CPUC General Order Number 95 will be observed (Higgins, 1978).

SECTION VI

ALTERNATIVES TO THE PROPOSED ACTION

6.1 INTRODUCTION

This section identifies and evaluates the alternatives that have been considered in proposing the 230 KV line and improvements discussed herein. Alternatives have been considered for the alignment of the proposed route, as well as for the design of project facilities. In addition, the no action alternative with regard to the overall project is addressed.

6.2 ALTERNATIVE ROUTES

The proposed San Onofre to Encina transmission line has been addressed throughout the Environmental Data Statement as being located in an existing right-of-way. Although an alternative route was considered briefly, it was decided early in this analysis that use of such a route would be significantly less sound than the existing R/W, particularly given the following facts:

a. A vacant position currently exists on the towers along 23.3 miles of the 23.9-mile route.

b. Existing access roads can be used.

c. The right-of-way, including overhead lines, currently exists, and the addition of one circuit to these already existing facilities was seen as having only limited environmental disruption.

The net result is that further consideration of an alternate route for the project seemed ill-advised and was therefore dropped.

6.3 ALTERNATE DESIGN

Given the restrictions associated with the construction area east of the Oceanside Airport, particularly involving height, and after consideration of other low profile wooden structure designs, it was determined that the H-frame structure depicted in Figure 2-5 would be more compatible with the existing structures and would adequately meet the objective of providing lower structures to carry the proposed 230 KV line.

If engineering and environmental considerations permit, the new wooden structures should be placed adjacent to the four existing wooden structures within the right-of-way.

Consideration was given to the use of the steel pole design for the single new structure at the Hub. However, because of aesthetic reasons, it is felt that the proposed lattice design would blend more readily with the existing lattice structures in this area.

6.4 NO PROJECT

The consequences of not implementing the proposed transmission line would be significant in both the short- and long-term effects on the SDG&E service area. The need for providing reliable and continuous electricity has been demonstrated, as made evident by the previous approvals for expansion of the San Onofre Nuclear Generating Station with Units 2 and 3. The existing and projected demands on energy resources of the SDG&E service area have been previously evaluated. Failure to complete the project would deprive the customers in the SDG&E service area of the benefits of the power which will be generated at the San Onofre Nuclear Generating Station, and will result in potential overloads to the system if failures in other routes were to occur.

SECTION VIII

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The only short-term use that the proposed project entails is the construction required to install the wooden transmission towers and string a 24-mile circuit. Short-term losses will be minimal and will be offset by an improvement in the efficient distribution of energy to the SDG&E service area.

SECTION IX

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Those resources irreversibly and irretrievably committed through implementation of the proposed project include manpower and energy. Manpower will be extended in fabrication, transportation, erection, and maintenance of construction materials. Energy resources will be irreversibly and irretrievably committed in manufacturing, transporting, assembling, erecting, and maintaining transmission towers and conductors. There will be no new commitment of land, inasmuch as the structures are proposed within an existing right-of-way.

SECTION X

GROWTH-INDUCING IMPACTS OF THE PROPOSED PROJECT

The major factors which have induced growth within the SDG&E service area include local government policies and decisions regarding development, the quality of the physical environment, the participation of other levels of government in housing, welfare, etc., plus other programs which have provided substantial employment opportunities. On a broader scale, urban growth tends to result from complex forces involving national and international economics, transportation availability and the like.

From one perspective, the addition of the proposed 230 KV transmission line can be seen as an accommodation to growth by having electricity available on demand with a lessened probability of major outages, failures or other disruptions in the system. However, given the health and safety hazards inherent in purposely limiting the availability of electrical power below the recognized need, it seems an imprudent way to attempt to restrict or control growth.

At the same time, considering the fact that the generating capacity of the San Onofre Plant will be increased through the completion of Units 2 and 3, placement of the additional 230 KV line is not in and of itself growth-inducing, but merely represents SDG&E's attempt to efficiently and prudently utilize and distribute its share of this additional capacity. In this context, the project is not seen as being growth-inducing.

SECTION XI

PERMITS AND AGENCY CONTACTS

11.1 PERMITS

The following permits will be required for this project:

1. California Public Utilities Commission: Certificate of Convenience and Necessity

2. California Coastal Commission (S.D. Coastal Region): California Coastal Zone Permit

3. AT & SF Railway: Permits (4) (2 for the Main Line, 1 each for Fallbrook and Escondido branches)

4. CALTRANS: Highway Permits (4) (2 for I-5, 1 each for Highways 76 and 78)

5. FAA: Permit, Oceanside Airport

11.2 AGENCY CONTACTS

The following governmental agencies have been formally contacted regarding this project by SDG&E:

County of San Diego
City of Oceanside
City of Carlsbad
United States Marine Corps - (Camp Pendleton)

SECTION XII

REFERENCES, PERSONS AND ORGANIZATIONS CONSULTED

The documents listed below may be made available by contacting the San Diego officer of WESTEC Services (714-233-7572), or Mr. Terry Higgins, San Diego Gas & Electric Company (714-232-4255).

AEC, 1973; Atomic Energy Commission, Directorate of Licensing; *Final Environmental Statement, San Onofre Nuclear Generating Station Units 2 and 3 U.S.*; March 1973.

Alfors, J.T., J.L. Burnett, T.E. Gay, Jr., 1973; Urban Geology -- Master Plan for California; California Division of Mines, Bulletin 198.

Arbib, R., 1977; The Blue List for 1978; *American Birds*; 31(6):1087-1096.

Atwood, J.L., P.D. Jorgensen, R.M. Jurek, and T.D. Manolis, 1977; *California Least Tern Census and Nesting Survey, 1977*; California Department of Fish and Game, Nongame Wildlife Investigations; E-1-1, Job V-2.11.

Beardsley, R.K., 1956; *Functional and evolutionary implications of community patterning*; In *Seminars in Archaeology, Memoir No. 11*; Society for American Archaeology.

Bostic, Dennis L., 1964; The ecology and behavior of *Cnemidophorus hyperythrus beldingi;* Cope (Sauria: Teiidae); M.S. Thesis, San Diego State University.

Bury, R. Bruce, 1971; Status report on California's threatened amphibians and reptiles; California Department of Fish and Game, Inland Fisheries Administrative Report, No. 72-2.

Carrico, Richard L., 1974; Archaeological survey of Highway 76 near Oceanside, California; Unpublished manuscript on file at San Diego State University.

Carrico, Richard L., 1977; Portola's 1769 trek and the native Americans of coastal San Diego; *Journal of California Anthropology*; 4(1):31-41.

CDF&G, 1965; California Department of Fish and Game; *California Fish and Wildlife Plan;* The Resources Agency; Volume 3(c):908.

CDF&G, 1965; California Department of Fish and Game; *At the Crossroads:* A report on California's endangered and rare fish and wildlife; edited by H.R. Leach, J.M. Brode and S.J. Nicola; The Resources Agency.

CNPS, 1974; California Native Plant Society; Inventory of rare and endangered plants of California; edited by W. Robert Powell; Special Publication No. 1.

Corps of Engineers, 1968; Review report for flood control, San Luis Rey River, San Diego County, California; U.S. Army Engineer District, Los Angeles.

Corps of Engineers, 1973a; Flood plain information, Buena Vista Creek; Department of the Army, Los Angeles District.

Corps of Engineers, 1973b; Flood plain information, Agua Hedionda Creek; Department of the Army, Los Angeles District.

CPUC, 1976; California Public Utilities Comission; Draft Environmental Impact Report, San Onofre to Santiago Tap, 220 KV transmission line; Southern California Edison Company; Application No. 55395; October 1976.

Crabtree, Robert H., Claude Warren, and D.L. True, 1963; Archaeological investigations at Batiquitos Lagoon, San Diego County, California; *University of California Archaeological Survey Report 1962-1963*; Los Angeles.

DWR, 1967; Department of Water Resources, State of California; Groundwater occurrence and quality: San Diego Region; Bulletin 106-2.

Drover, Christopher, 1977; Archaeological site forms; On file at San Diego State University.

EG&G, 1974; Ray E. Glass, EG&G, for Federal Aviation Administration; "Noise Level of Nine Helicopters During Flyby and Hovering Operations;" September 1974.

Fern, W.J., and R.I. Brabets, 1974; Field investigation of ozone adjacent to high voltage transmission lines; IEEE PES Winter Meeting; New York, New York--Transactions Paper T-74-057-6; January 27.

Greensfelder, R.W., 1974; Maximum credible rock acceleration from earthquakes in California; California Division of Mines; Map Sheet 23.

Greenwalt, L.C., 1976; Proposed list of endangered and threatened plant species; U.S. Fish and Wildlife Service, Department of the Interior; *Federal Register*; 41(117):24524-24572, Wednesday, June 16.

Gross, Timothy, 1970; Analysis of mollusc remains from two La Jollan sites; Unpublished manuscript in hands of the author.

Hannan, D.C., 1975; Faulting in the Oceanside, Carlsbad and Vista areas, Northern San Diego County, California; A. Ross and R.J. Dowlen, eds.; In *Studies on the geology of Camp Pendleton and western San Diego County, California*; San Diego Association of Geologists; pp. 56-59.

Harding, Mabel, 1951; La Jollan Culture; *El Museo I* (1); San Diego.

Higgins, Terry, 1978; San Diego Gas & Electric Company; personal conversation with F.O. Round, WESTEC Services; July.

Hill, J.N., 1974; The methodological debate in contemporary archaeology: a model; In *Models in Archaeology*; David L. Clark, ed.; Methune Ltd., London.

Hunt, G.S., and H.G. Hawkins, 1974; Geology of the San Onofre area and portions of the Cristianitos Fault; A. Ross and R.J. Dowlen, eds.; In *Studies on the geology of Camp Pendleton and western San Diego County, California*; San Diego Association of Geologists; pp. 7-14.

Kaldenberg, Russell, 1973; Archaeological survey for portion of Highway 76, San Diego County, California; Unpublished manuscript on file at San Diego State University.

Kaldenberg, Russell L., and Paul H. Ezell, 1974; Results of the archaeological mitigation of Great Western sites A and C, located on the proposed Rancho Park North Development near Olivenhain, California; Manuscript in hands of the authors and on file at San Diego State University, Department of Anthropology.

King, Thomas F., Michael Moratto, and N. Nelson Leonard, 1973; Recommended procedures for archaeological impact evaluation. University of California Archaeological Survey and Society for California Archaeology.

McCown, B.E., 1955; Temeku; *Archaeological Survey Association of Southern California*.

Massey, Barbara W., 1977; *A census of the breeding population of the Belding's Savannah sparrow in California*; California Department of Fish and Game, Nongame Wildlife Investigations; E-1-1; Study IV; Job 1.2.

May, Ronald V., 1973; Archaeological salvage of the Lomas Santa Fe site; Unpublished manuscript on file at San Diego State University, Department of Anthropology.

Meighan, Clement W., 1954; A late complex in southern California prehistory; *Southwestern Journal of Anthropology*; 10:215-227.

Moratto, Michael, and Roger Kelly, 1969; Significance in archaeology; *Kiva*; 42(2):193-202.

Moriarty, James R., 1969; The San Dieguito complex: suggested environmental and cultural relationship; *Anthropological Journal of Canada*; 7(3):1-18.

Moriarty, James R., George Shumway, and Claude Warren, 1959; Scripps Estates Site I (SDi-525): a preliminary report on an early site on the San Diego coast; *University of California Archaeological Survey 1958-1959 Annual Report*; pp. 185-216; Los Angeles.

Moyle, W.R., Jr., 1975; Geologic map of Camp Pendleton, southern California; A. Ross and R.J. Dowlen, eds.; In *Studies on the geology of Camp Pendleton and western San Diego County, California*; San Diego Association of Geologists.

Norwood, Richard, 1977; Archaeological site forms; On file at San Diego State University.

Remsen, Van, 1977; *Preliminary*; The species of special concern list: an annotated list of declining or vulnerable birds in California; Western Field Ornithologists; Museum of Vertebrate Zoology, University of California, Berkeley.

Roach, J.F., V.L. Chartier, and F.M. Dietrich, 1973; Experimental oxidant production rates for EHV transmission lines and theoretical estimates of ozone concentrations near operating lines; IEEE Transmission Power Apparatus & Systems; Vol. 93; pg. 647-657.

Rogers, Malcolm, 1929; The stone art of the San Dieguito plateau; *American Anthropologist*; 31:454-467; Menasha.

Rogers, Malcolm, 1939; Early lithic industries of the Lower Basin of the Colorado and adjacent desert regions; *San Diego Museum Papers, No. 3*; May.

Rogers, Malcolm, 1945; An outline of Yuman prehistory; *Southwestern Journal of Anthropology*; 1(1):167-198.

Rogers, Malcolm, 1966; *Ancient hunters of the far west*; Robert F. Pourade, ed.; Copley Press; San Diego.

S.D. Acoustics, 1978a; San Diego Acoustics Report 2049; "Oceanside Airport Noise Contours;" January.

S.D. Acoustics, 1978b; San Diego Acoustics Report 2219; "Traffic and Noise Analysis, Taylor Borrow Pit Operations;" July.

Shumway, George, Carl L. Hubbs, and James R. Moriarty, 1961; Scripps Estates site, San Diego, California: a La Jollan site dated 5460-7370 years before the present; *Annals of the New York Academy of Sciences*; 93(3):37-72.

Smith, David D., 1973; Archaeological salvage of the Fox Point site; Unpublished manuscript on file at County of San Diego.

Soil Survey Staff, 1973; Soil survey, San Diego area; United States Department of Agriculture; Soil Conservation Service.

Stuart, C.J., 1975; The San Onofre breccia in the Camp Pendleton area, California; A. Ross and R.J. Dowlen, eds.; In *Studies on the geology of Camp Pendleton and western San Diego County, California*; San Diego Association of Geologists; pp. 15-27.

Thorne, Robert F., 1976; The vascular plant communities of California; In *Symposium proceedings -- plant communities of southern California*; edited by June Latting; California Native Plant Society; Special Publication No. 2.

USEPA, 1971a; U.S. Environmental Protection Agency; Report NTID 300.3; December 31.

USEPA, 1971b; U.S. Environmental Protection Agency; "Noise from construction equipment and operations, building equipment and home applicances;" Report NTID 300.1; December 31.

Warren, Claude N., 1954; Archaeological site forms; On file at San Diego State University.

Warren, Claude N., D.L. True, and A. Eudney, 1961; Early gathering complexes of western San Diego County; *University of California, Los Angeles Archaeological Survey Annual Report, 1960-61*; Los Angeles.

Weber, F.H., Jr., 1963; Mines and mineral resources of San Diego County, California; California Division of Mines; County Report 3.

Welch, Patrick, 1977; An archaeological survey of the Santa Margarita River Valley and adjacent areas, Camp Pendleton, San Diego County, California; Unpublished manuscript on file at San Diego State University.

Wilson, K.L., 1972; Eocene and related geology of a portion of the San Luis Rey and Encinitas quadrangles, San Diego County, California; Unpublished M.S. thesis; University of California, Riverside; 135 pp.

Woodford, A.O., 1925; The San Onofre breccia: its nature and origin; University of California Publications in Geological Science; Volume 15; Number 7; pp. 159-280.

Wyle, 1973; Jack W. Swing, Wyle Laboratories, Inc.; "Development of Ground Transportation Systems Noise Contours for the San Diego Region;" Report WCR-73-8; December.

APPENDIX A

SOILS INVESTIGATION

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APPLIED SOIL MECHANICS — FOUNDATIONS
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SOILS INVESTIGATION

Introduction

This is to present the results of a soils investigation conducted at the locations of eight proposed towers which will form a part of a 230 KV Transmission Line between the Encina and San Luis Rey Substations of the San Diego Gas & Electric Company, in San Diego County, California. It is our understanding that the towers are to be supported by drilled and cast-in-place concrete piers whose shafts will be 3.0 feet in diameter and whose bases may be belled out sufficiently to provide the bearing area necessary for the anticipated loads. It is also understood that two of the towers will have design downward loads of 100 kips and upward loads of 90 kips per pier, that five of the towers will have design downward loads of 175 kips and upward loads of 165 kips per pier, and that the eighth tower will have design downward loads of 270 kips and upward loads of 260 kips per pier.

The objectives of this investigation were to determine the existing soil conditions at each of the eight tower sites, and to determine by laboratory testing certain of the physical properties of the soils, so that recommendations could be presented for the design of the piers to support the design downward loads and so that sufficient data for design to resist uplift forces could be presented. In order to accomplish these objectives, a boring was drilled either at or as close as the topography permitted to each of the tower locations, and representative undisturbed samples were obtained from each of the borings for laboratory testing.

Field Investigation

All of the borings were drilled, each to a diameter of 30 inches, with a truck-mounted rotary bucket-type drill rig at locations staked by the San Diego Gas & Electric Company, except for the Boring B-4 which was located 70 feet N 60° W from the stake. The borings were drilled to depths of 21 to 56 feet below the existing ground surface. A continuous log of the soils encountered in the borings was recorded at the time of drilling and is shown in detail on Drawing Nos. 1 to 16, inclusive, each entitled "Summary Sheet."

The soils were visually classified by field identification procedures in accordance with the Unified Soil Classification Chart. A simplified description of this classification system is presented in the attached Appendix A at the end of this report.

Undisturbed samples were obtained at intervals of approximately each 5 feet in depth below finish grade in the soils ahead of the drilling. The drop weight used for driving the sampling tube into the soils was the "Kelly" bar of the drill rig which weighs 1623 pounds, and the average drop was 12 inches. The general procedures used in field sampling are described under "Sampling" in Appendix B.

Laboratory Tests

Laboratory Tests were performed on all undisturbed samples of the soils in order to determine the dry density and moisture content and on samples obtained from probable pier depths to determine the shearing strength. The results of these tests are presented on Drawing Nos. 1 to 16, inclusive.

In addition to the above tests, the minimum angle of internal friction and apparent cohesion of the soils at probable pier depths were determined by shearing saturated and drained samples under varying normal loads. The results of these shear tests are presented on the following page.

TABLE OF SHEAR TEST RESULTS

Boring No.	Sample No.	Depth in Feet	Soil Description	Shear Resistance in Kips/sq. ft. Under Normal Loads of 0.5 (Kips per sq. ft.)	1.0	2.0	Recommended Angle of Internal Friction Φ (degrees)	Recommended Apparent Cohesion (lb/sq ft)
B-1	1	6.0	Sandy siltstone	1.74	2.81	4.23	40.0 *	650
B-1	2	11.0	Silty fine sand	1.07	1.78	2.71	40.0 *	360
B-2	2	11.0	Clayey fine sand	0.69	0.88	1.43	23.5	450
B-3	1	6.0	Clayey fine sand	1.07	1.95	2.00	40.0 *	650
B-3	2	11.0	Clayey siltstone	3.11	1.95	3.32	40.0 *	600
B-4	1	36.0	Slightly clayey fine to medium sand	0.71	0.96	1.95	36.5	350
B-4	2	41.0	Clayey fine to medium sand	1.62	2.17	2.53	31.0	1300
B-5	2	31.0	Silty claystone	1.01	1.55	1.86	34.5	670
B-5	3	36.0	Fine to coarse sand	0.54	1.18	2.63	40.0 *	0
B-6	2	11.0	Fine to medium sand with clay binder	1.10	2.48	3.62	40.0 *	230
B-7	1	6.0	Clayey fine sand	1.12	2.98	4.96	40.0 *	0
B-7	2	11.0	Clayey very fine to fine sand	3.46	5.17	4.11	25.0	1700
B-7	3	16.0	Fine to medium sand	2.24	3.48	3.94	25.0	1350
B-8	1	6.0	Clayey fine to coarse sand	1.09	2.04	3.11	40.0 *	120
B-8	2	11.0	Clayey fine sand	1.36	2.48	3.11	32.5	780

* Arbitrarily reduced.

The general procedures used for the laboratory tests are described briefly in Appendix B.

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Soil Strata and Bearing Value Recommendations

In that the eight tower locations are separated from each other by distances varying from 2000 feet to 5000 feet, each will be discussed separately, as follows:

Boring 2-1

Underlying 1.0 foot of loose clayey fine to medium sand topsoil was a medium firm to firm fine to medium sandy clay to a depth of 4.0 feet. Very firm very fine sandy siltstone was then found to a depth of 9.5 feet, and from that depth to the bottom of the boring at a depth of 26.0 feet was a very firm silty fine sand with some lenses of claystone and silty very fine sand below 23.0 feet. No ground water was encountered in the boring.

It is concluded that the very firm silty fine sand found below a depth of 9.5 feet will provide adequate support for the tower piers. It is concluded from the test data that a bearing value of 14 kips per square foot may be safely used for a 3.0 feet diameter pier founded in this material at a depth of 10 feet below the lowest adjacent final ground surface. This value may be increased at a rate of 940 pounds per square foot for each foot of depth in excess of 10.0 feet, and at an additional rate of 430 pounds per square foot for each foot of width in excess of 3.0 feet, to a recommended maximum value of 20 kips per square foot.

Boring 3-2

Loose fine sandy clay topsoil to a depth of 1.0 foot was underlain at this location by medium firm clayey fine sand to the bottom of the boring at a depth of 31.0 feet. Ground water was encountered below a depth of 29.5 feet.

It is concluded that concrete piers founded in this medium firm clayey fine sand will provide adequate support. It is recommended that a bearing value of 4.0 kips per square foot be used for a 3.0 feet diameter pier founded in the clayey fine sand at a depth of 10.0 feet below the lowest adjacent final ground surface. This value may be increased at a rate of 235 pounds per square foot for each foot of depth in excess of 10.0 feet and at an additional rate of 85 pounds per square foot for each foot of width in excess of 3.0 feet, to a recommended maximum value of 5.0 kips per square foot.

Boring B-3

Loose fine to medium sandy clay topsoil was found to a depth of 1.5 feet, and this was underlain to a depth of 7.0 feet by firm to very firm clayey fine sand containing some siltstone lenses. Between 7.0 and 11.5 feet of depth was a very firm clayey siltstone, and from 11.5 feet of depth to the bottom of the boring at a depth of 21.0 feet was a stratum of very firm clayey siltstone with alternating and merging layers of clayey fine to medium sand. No ground water was encountered in the boring.

It is concluded that concrete piers founded in the firm to very firm clayey fine sand found between 1.5 and 7.0 feet and the clayey siltstone and clayey sand strata below 7 feet will provide adequate support. It is recommended that a bearing value of 9.0 kips per square foot be used for a 3.0 feet diameter pier founded at a depth of 5.0 feet below the lowest adjacent final ground surface. This value may be increased at a rate of 1150 pounds per square foot for each foot of depth in excess of 5.0 feet, and at an additional rate of 480 pounds per square foot for each foot of width in excess of 3.0 feet, to a recommended maximum value of 12 kips per square foot.

Boring B-4

In that this boring was drilled 70 feet from the staked location and at an elevation of 30 feet above the staked location of the tower, the upper 30 feet of soils at this location were not sampled. The log of the soils encountered consisted of 1.3 feet of loose clayey fine sand topsoil, 8.7 feet of firm to very firm clayey very fine to fine or clayey fine to medium sand, 5.0 feet of very firm clay, 11.0 feet of very firm clayey fine to medium sand, and 4.0 feet of very firm fine to medium sandy clay. The soils below the 30 feet depth which compares to the same elevation as the staked tower location were 13.0 feet of very firm clayey and slightly clayey fine to medium sand, then 3.0 feet of very firm gravelly clayey fine to medium sand, and finally 10.0 feet of very firm fine to medium sand. No ground water was encountered in the boring.

It is concluded that the very firm clayey or slightly clayey fine to medium sand found between the depths of 30.0 and 43.0 feet at this location (which corresponds to depths of 0 to 13.0 feet at the tower location) will provide adequate support. This assumes similar soils exist at the tower site. It is therefore recommended that close inspection of the pier holes be made to verify that similar soil conditions also exist in each of the footing excavations for the tower at the time of construction.

It is concluded from the test data that a bearing value of 10 kips per square foot may be safely used for a 3.0 feet diameter pier founded at a depth of 10.0 feet below the lowest adjacent final ground surface. This value may be increased at a rate of 365 pounds per square foot for each foot of depth in excess of 10.0 feet, and at an additional rate of 110 pounds per square foot for each foot of width in excess of 3.0 feet, to a recommended maximum value of 15 kips per square foot.

Boring 6-5

The upper soils at this location to the proposed depth of cut of 20.0 feet included 2.0 feet of loose fine to medium sandy clay, 8.5 feet of firm to very firm clayey fine to medium sand with some layers of clay, 9.0 feet of very firm clayey fine sand, and 0.5 foot of very firm fine to medium sand. The very firm fine to medium sand was then found to a depth of 24.5 feet (corresponding to a depth of 4.5 feet below the proposed cut), and was underlain by 9.5 feet of very firm claystone and silty claystone with slickensided fractures, 5.5 feet of very firm fine to coarse sand and claystone chunks, some rounded like cobbles, and 5.5 feet of very firm fine to medium sand. No ground water was encountered in the boring.

It is concluded that the stratum of very firm claystone and silty claystone found between the depths of 24.5 and 34.0 feet (corresponding to depths of 4.5 to 14.0 feet below the proposed cut), will provide adequate support, although slickensided fractures exist that reduce the overall stability of this stratum. It is recommended that a bearing value not to exceed 5 kips per square foot be used for 3.0 feet or larger diameter piers founded in the zone between 10.0 and 19.5 feet below the lowest adjacent final ground surface.

Boring B-6

Clayey fine to medium sand was found to a depth of 4.5 feet at Boring B-6. The upper 2.0 feet of these soils were a loose topsoil, and below 2.0 feet the soils were very firm, and were underlain to the bottom of the boring at a depth of 26.0 feet by very firm fine to medium sand that contained a clay binder to a depth of 13.0 feet, and also contained scattered gravel. No ground water was encountered in the boring.

It is concluded that the very firm fine to medium sand found below a depth of 4.5 feet will provide adequate support. It is recommended that a bearing value of 13.0 kips per square foot be used for a 3.0 feet diameter pier founded at a depth of 10.0 feet below the lowest adjacent final ground surface. This value may be increased at a rate of 1000 pounds per square foot for each foot of depth in excess of 10.0 feet, and at an additional rate of 450 pounds per square foot for each foot of width in excess of 3.0 feet, to a recommended maximum value of 15.0 kips per square foot.

Boring B-7

Two feet of loose fine to medium sandy clay was underlain to a depth of 5.7 feet by very firm clayey fine sand, and then to a depth of 7.0 feet by very firm clayey siltstone. From 7.0 to 13.5 feet of depth was a very firm clayey very fine to fine sand, and then very firm fine medium sand with a slight clay binder was found to a depth of 28.5 feet. The lower 2.5 feet of soils in the boring consisted of very firm clayey fine sand. No ground water was encountered in the boring.

It is concluded that the stratum of very firm fine to medium sand found between the depths of 13.5 and 28.5 feet will provide adequate support. It is recommended that a bearing value of 10 kips per square foot be used for a 3.0 feet diameter pier founded at a depth of 15.0 feet below the lowest adjacent final ground surface. This value may be increased at a rate of 300 pounds per square foot for each foot of depth in excess of 15.0 feet, and at an additional rate of 70 pounds per square foot for each foot of width in excess of 3.0 feet, to a recommended maximum value of 12 kips per square foot.

Boring B-8

Loose fine to medium sandy clay topsoil was found to a depth of 1.5 feet, and this merged to a firm to very firm clayey fine to medium sand to a depth of 5.7 feet. Between the depths of 5.7 and 8.0 feet was a very firm clayey silt, and very firm clayey fine sand was then found to a depth of 12.5 feet. From 12.5 feet of depth to the bottom of the boring at a depth of 21.0 feet were alternating layers of very firm clayey fine sand and silty claystone. No ground water was encountered in the boring.

It is concluded that the very firm clayey fine to medium sand found between the depths of 8.0 and 12.5 feet, or the very firm soils below that stratum, will provide adequate support. It is recommended that a bearing value of 7 kips per square foot be used for a 3.0 feet diameter pier founded at a depth of 9.0 feet below the lowest adjacent final ground surface. This value may be increased at a rate of 450 pounds per square foot for each foot of depth in excess of 5.0 feet, and at an additional rate of 140 pounds per square foot for each foot of width in excess of 3.0 feet, to a recommended maximum value of 10 kips per square foot.

General Discussion

The bearing values presented above for Borings B-1 to B-8, inclusive, comprise our recommendations for the design of the tower foundations to support safely the design downward loads. The design of the foundations will probably be governed by the uplift forces rather than the downward loads in most cases. In calculating resistance to uplift forces, the total weight of the concrete pier plus the weight of a cone of soil that is inclined upward and outward from the base of the pier may be used. It is our opinion that where slickensided fractures exist such as between 4.5 and 14.0 feet below the proposed cut grade at Boring B-5 and where random fractures exist such as found below 5.7 feet at Boring B-8 that the cone of soil assumed to be intercepted for pullout resistance be reduced to an assumed value no more than 15° from the vertical and that a greater than normal fractor of safety be included in design unless actual field pullout tests are conducted to verify higher values. The densities of the soils are presented in the "Summary Sheets," and the recommended angles of internal friction are presented on the "Table of Shear Test Results." These values, together with appropriate assumptions and factors of safety, may be used as bases for computing allowable resistance to uplift forces. For downward loads, the weight of the concrete piers may be assumed to be supported by the friction between the pier shafts and the soils.

Respectfully submitted,

BENTON ENGINEERING, INC.

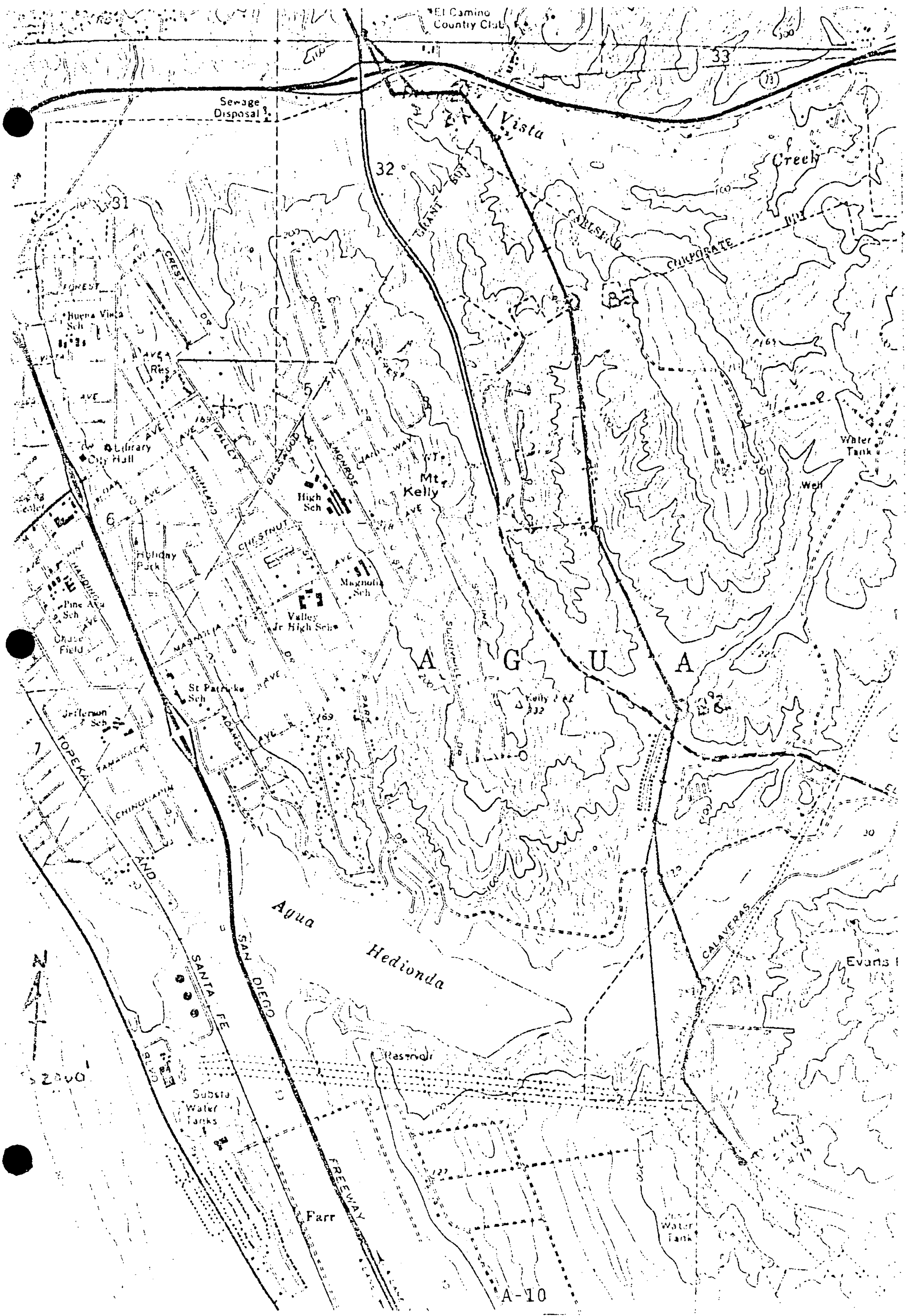
By ______________________

M. V. Pothier, Civil Engineer

Reviewed by ______________________

Philip H. Benton, Civil Engineer

Distr: (4) Addressee
(1) Pioneer Service & Engineering Company
Attention: Mr. Stefan Trausch



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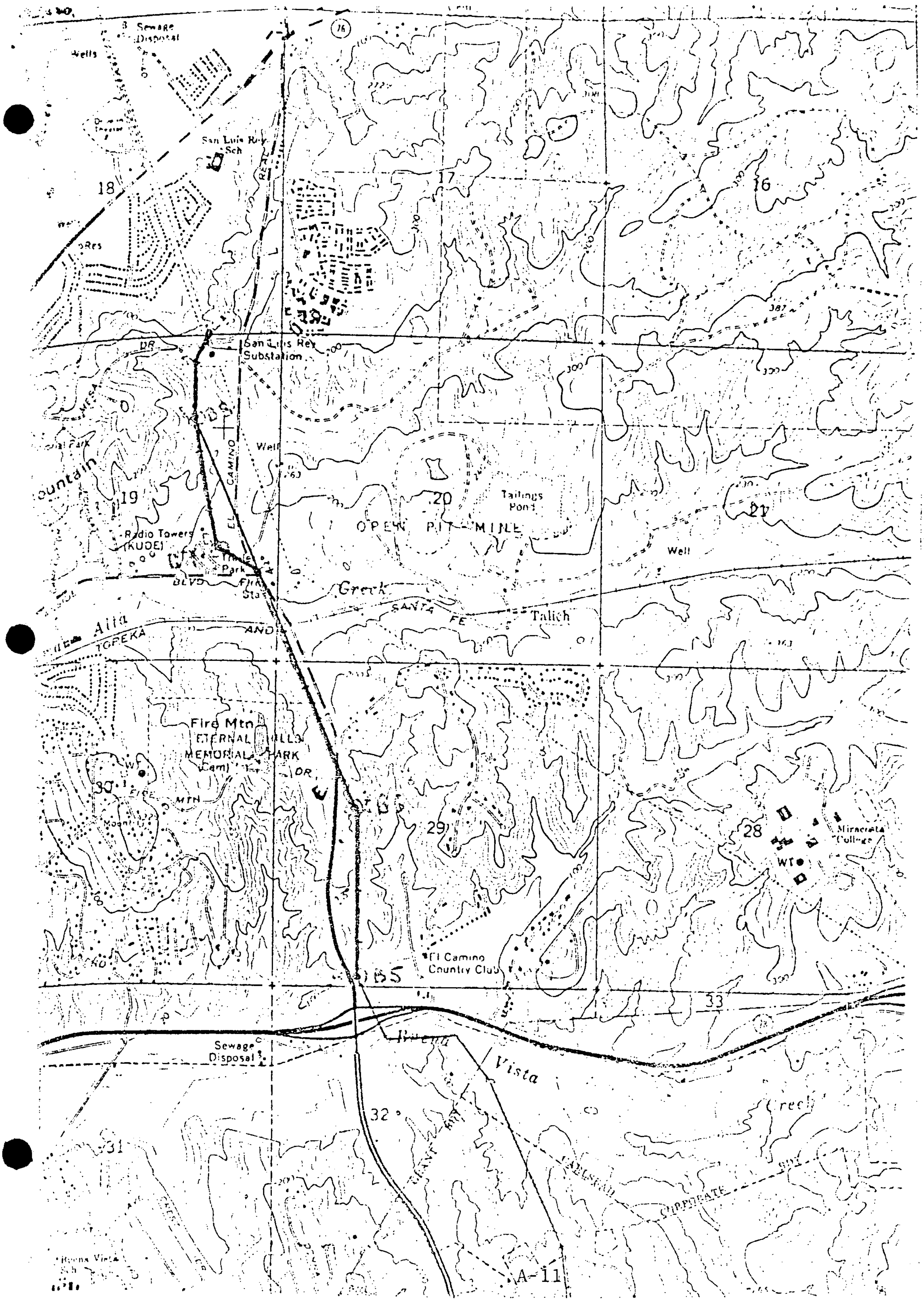

Sewage Disposal
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Mesa
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Camino
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20
21
Tailings Pond
OPEN PIT MINE
Radio Towers (KUDE)
Trailer Park
Fire Sta
BLVD
Creek
Alta
Santa Fe
Topeka
And
Talich
Well
Fire Mtn
ETERNAL HILLS MEMORIAL PARK (Cem)
DR.
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Fire Mtn
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Miracosta College
El Camino Country Club
33
Sewage Disposal
Buena
Vista
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Corporate
A-11
Buena Vista Sch

APPENDIX B

ECONOMIC PROFILES

SPOTLIGHT ON OCEANSIDE

Oceanside is an incorporated city with a population of 62,100 on the coast north of San Diego on Interstate Five. Oceanside is just south of Camp Pendleton, the Marine Corps Base which trains thousands of U.S. Marines each year. The vast military facility is itself almost a small city with over 4,000 buildings including schools, churches, banks, stores and medical facilities. In addition to the military services, Oceanside's residential, commercial and industrial development offer the area increased economic stimulus.

INDUSTRY

Oceanside is experiencing economic growth stemming from industrial development. Of the city's 39.8 square miles, 1,000 acres are zoned for light and general industry; about 40 percent is vacant and available in parcels ranging in size from 1 to 125 acres. Included in this acreage total are 4 industrial parks or districts. The largest of these is Roymar Industrial Park, which is immediately adjacent to the Oceanside Municipal Airport. Within Roymar Industrial Park, nearly 200 acres are developed for industrial uses; 125 vacant developable acres remain. The park is home for three large electronic firms. Future development in electronics is expected, as well as trucking, warehousing and wholesaling activities.

EMPLOYMENT

Total employment within Oceanside's subregional area (SRA) during 1975 was estimated at 15,877 workers, according to the Comprehensive Planning Organization of San Diego. As Table 1 indicates, a majority of the workers, over 61 percent, were in retail trade, local government and services.

TABLE 1
EMPLOYMENT BY INDUSTRY - 1975
OCEANSIDE & SAN DIEGO COUNTY - BY SRA

SECTORS	OCEANSIDE	% OF TOTAL EMPLOYED	SAN DIEGO COUNTY
Agriculture	977	6.1	13,813
Mining	117	0.7	830
Construction	836	5.3	25,090
Manufacturing			
Non-durable	202	1.3	15,220
Durable	1,563	9.8	59,680
Trans. & Util.	877	5.5	23,651
Wholesale Trade	414	2.6	18,277
Retail Trade	3,709	23.4	99,308
Finance, Ins. & Real Estate	670	4.2	29,229
Services	2,997	18.9	116,023
Government			
Civilian	201	1.3	40,662
Military	0	0	119,653
State	200	1.3	18,020
Local	3,114	19.6	72,294
Total*	15,877	100.0	651,750

*Total is for the Subregional Area which is comprised of census tract boundaries, not necessarily identical to Oceanside City boundaries.

Source: CPO, Information Bulletin, October, 1976.

TABLE 2
MAJOR EMPLOYERS - OCEANSIDE - 1977

NAME OF COMPANY	EMPLOY-MENT	PRODUCTS
Manufacturing Employment:		
Deutsch Co., ECD	500	Elec. Connectors
ACDC Electronics, Inc.	400	DC Power Supplies
Swan Electronics	157	Elec. Equipment
Edwin Frazee, Inc.	125	Bulb Grow. & Proc.
Atlas Radio, Inc.	94	Radio/TV Trans.
Monitor Products. Co.	75	Crystal & Elec. Mfg.
Crystal Silica Co.	63	Silica
Oceanside Beachwear, Inc.	60	Women's Clothing
F. Fashions	50	Men's Clothing
Vernon Tool Co.	40	Oil Field Mach.
Triplett Electronic Institute Corp.	40	Ind. Instruments
Machine Industries	38	Aircraft Engines
Non-Manufacturing Employment:		
Tri-City Hospital	678	Hospital
Pacific Telephone	500	Communications
K-Mart	131	Retail Dept. Store
No. County Comm. Hosp.	108	Hospital
Blade-Tribune	85	Newspaper

Source: Oceanside Chamber of Commerce

TAXABLE SALES

Merchants in Oceanside reported $163.3 million in taxable sales for 1976, with retail sales accounting for approximately 79 percent of the total. As Table 3 demonstrates, however, retail sales have been decreasing as a percent of total sales. Since 1972 retail sales have decreased approximately 6 percent.

TABLE 3
SALES ACTIVITY, OCEANSIDE 1970-1976
($ IN 000's)

YEAR	TOTAL SALES	RETAIL SALES	RETAIL SALES AS A % OF TOTAL SALES
1970	$ 84,616	$ 69,895	82.6
1971	90,903	74,618	82.1
1972	112,086	93,403	83.3
1973	127,216	105,785	83.2
1974	125,355	103,686	82.7
1975	137,827	111,958	81.2
1976	163,331	128,418	78.6

Source: Economic Research Bureau of the San Diego Chamber of Commerce.

HOUSING STOCK

The total housing stock in Oceanside was 24,271 units, according to a 1977 estimate by San Diego County's Integrated Planning Office. This is a rise of 70 percent over 1970's total. The growth was primarily caused by the increase in multi-family units, which make up some 45 percent of the total housing units in 1977 compared to 30 percent in 1970.

The overall vacancy rate of Oceanside's housing stock was 6.2 percent in January, 1977.

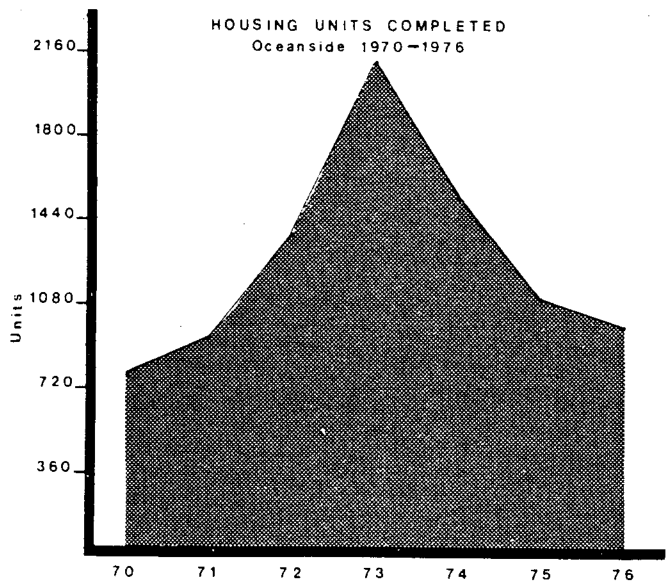
This would seem a low vacancy rate, except it is 21.6 percent higher than the county average of 5.1 percent.

TABLE 4
HOUSING UNITS - OCEANSIDE & SAN DIEGO COUNTY

	OCEANSIDE 1977	SAN DIEGO COUNTY 1977	OCEANSIDE 1970
Single Family	11,123	358,304	8,561
Multiple Family	10,840	207,826	4,360
Mobile Home	2,308	35,769	1,345
Occupied Housing Units	22,914	572,867	13,592
Vacant Units	1,357	29,032	674
Percent Vacant*	6.2	5.1	3.2
Total	24,271	601,899	14,266

*Percent vacant expressed as a percent of total housing units excluding other vacant units (seasonal homes, uninhabitable units, etc.).

Source: Integrated Planning Office, San Diego County.



POPULATION AND INCOME

Oceanside is the fourth largest incorporated city in San Diego County with a population estimated to be 62,100 in January, 1977, according to a recent report completed by the Comprehensive Planning Organization. The population is expected to rise by over 25 percent within the next 8 years, reaching 78,000 in 1985. The projected percentage increase is well above the forecast for the county. As Table 5 shows, the county's population is expected to rise 22.7 percent to over 2 million in 1985.

Whites represented over 76 percent of Oceanside's population in 1975. The Latino segment was the second largest ethnic group comprising 9.7 percent of the total population. Countywide, whites exceeded 80 percent of the total population, and the second largest ethnic group was the Latino population comprising 7.4 percent of the total.

Median household income in Oceanside was $8,358 in 1975, according to the County's Integrated Planning Office and is somewhat lower than the City of San Diego average of $10,625. As the graph indicates, the main concentrations of income in Oceanside are between $7,000 and $14,999 accounting for more than 40 percent of the total household income. This is slightly above San Diego County's 36.7 percent for a comparable income group.

TABLE 5
POPULATION TRENDS - HISTORICAL AND FORECAST
OCEANSIDE & SAN DIEGO COUNTY

YEAR	POPULATION OCEANSIDE	POPULATION SAN DIEGO COUNTY
1930	3,508	209,659
1940	4,651	289,348
1950	12,881	556,808
1960	24,971	1,033,011
1970	40,494	1,357,854
1975	55,267	1,559,505
1977	62,100	1,656,800
1980*	N.A.	1,768,100
1985	78,100	2,032,400
1990*	N.A.	2,222,800
1995	102,000	2,460,200

*Years are not strictly comparable.
Sources: Comprehensive Planning Organization for population projections; U.S. Census for historical data.

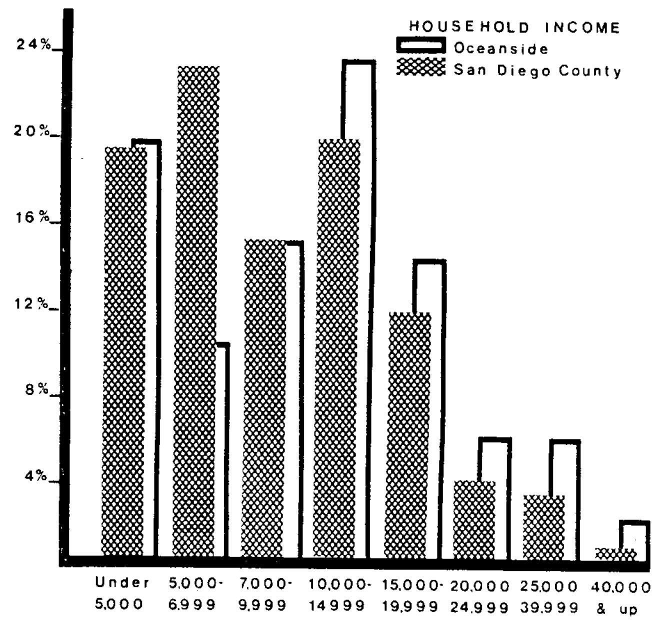


TABLE 6
RACE-ETHNIC ORIGIN BY HEAD - BY SRA
OCEANSIDE AND SAN DIEGO COUNTY - 1975

ORIGIN	OCEANSIDE	%	COUNTY	%
White	42,214	76.7	1,183,175	80.8
Black	3,383	6.1	64,696	4.3
Latino	5,315	9.7	109,200	7.4
American Indian	260	0.5	5,370	0.4
Filipino	348	0.6	18,558	1.3
Japanese	353	0.6	5,538	0.4
Chinese	41	0.0	3,084	0.2
Other Asian	534	1.0	4,069	0.3
Other	638	1.2	9,630	0.6
Unknown	2,004	3.6	63,153	4.3
Total	55,090	100.0	1,466,473	100.0

Source: Comprehensive Planning Organization.

3/78

COMMUNITY ECONOMIC PROFILE
for
CARLSBAD SAN DIEGO COUNTY CALIFORNIA

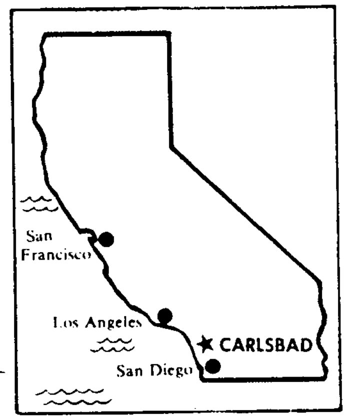
Prepared by the

Carlsbad Chamber of Commerce

Based on the format established by the California Chamber of Commerce

1. LOCATION

Carlsbad, incorporated in 1952, is located 90 miles south of Los Angeles, 485 miles south of San Francisco, and 35 miles north of San Diego.



2. ECONOMIC GROWTH AND TRENDS

	1960	1970		1977	1995(proj)
POPULATION IN COUNTY	1,033,011	1,358,854		1,560,038	2,429,354
CO. TAXABLE RETAIL SALES	2,777,201,000(1972)			4,740,460,000	
POPULATION IN CITY	9,253	14,944		30,000	63,900
CITY TAXABLE RETAIL SALES	5,686,000	35,385,000		118,014,000	
CITY OCCUPIED DWELLINGS	2,676	4,836		9,300	15,500
SCHOOL			9-12	1,800	
ENROLLMENT			7-8	680	
GR 1-6		2,060	K-6	2,051	4,500

SOURCES: City of Carlsbad, S.D. Co. Planning Dept., State Dept. of Finance, State Board of Equalization, San Diego Gas & Electric, Union Tribune Index

3. CLIMATE

	Avg. Temp.			Rain	Humidity		
Period	min.	max.	mean	Inches	4 am	10 am	4 pm
JAN.	45.8	64.6	55.2	1.88	68%	54%	55%
APR.	53.8	67.6	60.7	0.81	74	58	59
JUL.	63.9	75.3	69.6	0.01	82	69	66
OCT.	58.4	73.8	66.1	0.49	74	58	60
YEAR	55.4	70.3	62.9	9.45	75	61	62

4. TRANSPORTATION

Highways: Interstate 5, State 78, State 21

Rail: Amtrak - A.T. & S.F. Railway (Santa Fe Railway Co., Southern Pacific Trans. Co., and the Union Pacific Railroad provide service to major U.S. Cities and Mexico)

Bus: Greyhound Lines, North County Transit District (inter and intra-city)

Truck: More than 160 major carriers serve the area; the majority have terminals, Overnight delivery to Los Angeles, San Francisco, Sacramento & Phoenix

Air: Palomar Airport (within city limits); San Diego International (Linbergh Field) 35 miles south. Commuter passenger service available at Palomar Airport through Golden West Airlines.

5. INDUSTRIAL SITES

There are approximately 900 acres in the city limits now zoned for light, medium and heavy industy, and another 75 acres which are expected to be annexed to the city in the comparatively near future. About 90% of the total is vacant, available in parcels ranging from .01 to 29 acres. Typical sale prices in 1975 ranged from $37,000 to $65,000 per acre. The terrain varies in slope and drainage is satisfactory. Subsoil varies but piling is not required in most areas. Sizes of water mains range from 4 to 18 inches. Size of sewer lines range from 6-27 inches. One industrial park of 340 acres (Palomar Airport Business Park) is now available, and another,(Japatul) of 350 acres is in the planning stages. Still another parcel of 187 acres(Carlsbad Airport Business Center) has been proposed. (Site data compiled in cooperation with SDG&E and Carlsbad Planning Commission.)

6. WATER SUPPLY

Supplier: Carlsbad Municipal Water District through San Diego Water Authority and Metropolitan Water District.

Maximum system capacity from SDCWA: 14.26 million gal/day. Average consumption: 8.3 mg/d. Cost per 1,000 gallons in quantities of 100,000 gal/month: .24 per 100/cuft (1 cuft-7.48 gal). Cost per 1,000 gallons in quantities of one million gal/mo: no change. Water standby change: Varies with meter size - e.g. 2-inch meter: $11.50

7. SEWER SERVICE

Supplier: Cities of Carlsbad, Vista and San Marcos, Encinitas, Leucadia, Buena, jt. owners.

Capacity of sewer plant: 13.75 million gal/day; Carlsbad share, 3.43, presently using flow of approx 3.00, 9 million gal/day.
Sewer service charge? Yes - rated on per toilet basis.
Type of treatment plant: Primary
Facilities for non-recoverable industrial waste water: Yes
Sewer connection charges: Varies

8. STORM DRAINS & FLOOD CONTROL

Master plan of storm drains adopted? Yes
Charges based on: No fees on acreage at this time; developer installs local drains

9. STREET IMPROVEMENTS

Dedication requirements? Yes
Improvement requirements: one-half street

10. NATURAL GAS

Supplier: San Diego Gas & Electric Co.
For rates applicable to the City of Carlsbad, contact the Oceanside office at 620 Mission Ave., Oceanside, CA. 92054

11. ELECTRIC POWER

Supplier: San Diego Gas & Electric Co.
For rates applicable to the City of Carlsbad, contact the Oceanside office at 620 Mission Ave., Oceanside, CA 92054

12. TELEPHONE

Supplier: Pacific Telephone
For rates and type of service applicable to the City of Carlsbad, contact the office at 102 No. Ditmar St., Oceanside, CA. 92054

13. GOVERNMENTAL FACILITIES TAX AND INSURANCE RATES

Carlsbad has the mayor/council/manager form of government. Assessed valuation in 1975-76: $150,148,000
County: $5,855,903,286
Combined total property tax rates, 1977-78 per $100 assessed value code areas 9009, 9010, 9011, 9012, 9013, 9014, 9015, 9016, 76109, 76110: $10.531 (min). City tax rate: $1.930; County: $2.621; Schools: $5.102; Other: .878

No distinction made in commercial, industrial, residential property per se.

13. GOVERNMENT FACILITIES (continued)

Retail Sales Tax: State: 5% City/County: 1% Total: 6% Transient Tax: 6%

Police Department: 42 officers, 16 vehicles, plus 25 reserve officers

Fire Department: 45 men, 16 vehicles, 3 stations.

Fire Insurance Classification: Source of Rating · Insurance Service Office. City Rating of 4(1976) all of city.

Major projects authorized for improvement of city services or to adjacent unincorporated areas: Branch library, Community Center for Senior Citizens and Young People, development of Leo Carillo Ranch, development of existing part sites, swimming pool, joint fire training center, additional storm drains and street improvements.

14. NORTH COASTAL LABOR MARKET AREA - Includes Carlsbad, Oceanside, Fallbrook, Vista and excluding Camp Pendleton

Estimated area population: 166,300
Estimated total labor force: 44,600
Estimated total employment: 39,694

Agriculture and Agricultural Services	2.2%	Retail & Wholesale trade	21.0%
Construction	5.0%	Finance/Real Estate/Ins	5.3%
Manufacturing	15.8%	Services	21.5%
Transp/Communications/Utilities	5.1%	Government	24.1%

(Source: Employment Development Department)

15. CHARACTERISTICS OF THE LABOR FORCE

The available labor force consists of a wide variety of skilled and unskilled workers. Near is Camp Pendleton Marine Corps Base, the largest Marine amphibian training base in the West. Its sizeable number of military and civilian personnel form a large pool of skilled workers in various job classifications. As of the Fall of 1977 many jobs are available but wages are low and competition is keen, with an unemployment rate of 10.0 per cent. The situation is expected to continue for the balance of the year, according to officials of the Oceanside office of the Employment Development Department. Wage rates, extent of unionization, fringe benefits, and related information for specific industries and job classifications may be obtained from the local Employment Development Department at 141 Canyon Street, Oceanside, 92054, or at 800 Capitol Mall, Sacramento, Ca., 95814

16. MANUFACTURING EMPLOYMENT

There are 29 manufacturing plants in the Carlsbad area. Electronics firms predominate. The largest manufacturing firms in Carlsbad are:

COMPANY	EMPLOYMENT	PRODUCT
Anthony Industries (Pool Division)	80	Swimming Pools & Related Equip
Beckman Instruments	75	Microbics Operation
Burroughs Corporation	390	Computer Components
Coded Communications Corp	125	Public Safety Communications
Dyna Med Inc.	140	Emergency Medical Products
Hughes Aircraft Company Industrial Products Division	700	Electronic Components
Lancer Pacific Ins.	65	Orthodonic Supplies & Services
Magnedyne Inc.	70	Electronic Motors
Sargent Industries	256	Industrial Seals
South Coast Asphalt Products Co.	55	Rock/Asphalt products
Summa Corp./Hughes Helicopter Div.	110	Assembly/Testing
Tom Morey and Company, Inc.	80	Boogie boards and surf products

17. MAJOR RAW MATERIALS: Rock and gravel, silica

18. NON-MANUFACTURING EMPLOYMENT - Carlsbad area

Army & Navy Academy	88	Private junior, senior high school
Dixon Ford	103	Car dealer
Frazee Flowers	350	Flower growing and Processing
La Costa Hotel & Spa	1010	Hotel and health spa
Mira Costa College	247	Community college (District)

18. NON-MANUFACTURING EMPLOYMENT - continued

COMPANY	EMPLOYMENT	PRODUCT
Plaza Camino Real	1000 apx	Shopping center - 72 shops
San Diego Gas & Electric, Encina	110	Power generation
Tri-City Hospital	775	District hospital , tax-supported

19. COMMUNITY FACILITIES

HEALTH: Carlsbad has one district hospital (with Oceanside and Vista), tax-supported, with 300 total bed capacity, eight physicians/surgeons, 17 dentists, five optometrists, one chiropractor, one 59-bed health facility, fully-trained Fire Department medical technicians.

EDUCATION:

Thirteen churches, one 102,500-volume library, two newspapers plus home delivery of three daily newspapers from Oceanside and San Diego; one FM radio station, reception of 13 TV channels, including PBS, TV cable in some areas, six banks, five savings and loan associations, eight parks, five theatres, public golf course, private country club, convention center. Other recreational facilities include water sports at lagoon marina, surfing, fishing, boating, dragracing, skateboard park, two state beaches, (one, day use only; one, overnight camping) organized youth and senior citizen activities.

20. HOUSING AVAILABILITY, PRICES AND RENTALS

As of the Fall of 1977, there were 9300 dwelling units in the city. Rentals begin at $200 mo. for studios and 1-Br and $225 for 2 BR apartments, and from $250 to $350 for 2 and 3-BR houses. Luxury homes are also available in a wide price range. Existing homes sold in 1977 from $70,000 and up, with the average home costing $85,000. There are five mobile home parks, one hotel with 370 units, and eight motels with a total of 305 rooms in the city.

21. While the Coastal Commission and the Environmental Impact measure have without doubt affected the growth and development of the immediate coastal area of Carlsbad, much of the city's industrial area lies beyond the controlled area and is immediately available for development. The North County area of San Diego County is currently seen as the fastest growing area in the county, and its rapid growth is recognized state-wide and nationally. Carlsbad itself has grown 29.8 percent in the last five years and its retail sales increase was one of the highest gains in the San Diego County. 1976 retail sales total $118,839,000. During the first nine months of 1977, retail sales totaled more than $100,000,000.

For Additional Information, write:

The Carlsbad Chamber of Commerce
P.O. Box 1605
Carlsbad, California 92008
(714) 729-5924

APPENDIX C

ARCHAEOLOGIC BACKGROUND DATA

APPENDIX C

ARCHAEOLOGICAL BACKGROUND DATA

1. Cultural History

In the prehistoric past, the area now comprising San Diego County was densely occupied by native American peoples including at least three major cultures. From roughly 12,000 to 8,000 years ago, the San Dieguito people were the sole inhabitors of this region. Beginning about 8,000 years ago and extending to about 3,000 years ago, the La Jollan-Pauma culture was in existence, with the Pauma aspect being present in the inland regions. Commencing about 2,500 years ago and extending into the Spanish period, Shoshoneans or Luiseño lived and hunted in the area. A broad overview of the three major cultural patterns is provided below.

The following cultural history is a means of outlining and briefly describing the known prehistoric cultural traditions. A primary goal of a cultural history is to provide a diachronic or developmental approach to past life-ways, settlement patterns and cultural patterns and cultural processes.

Lacking a synthesis of valid, regionally specific data, we are forced to fall back on a geographically generalized accepted cultural history which is, at best, ill-defined and probably out-moded. As perceived by recent scholars, at least three major cultural patterns have operated in San Diego County (Table C-1). There is also the possibility that a much older "Early Man" period may have existed in North America, if not San Diego County.

Table C-1

CHRONOLOGICAL MODEL FOR SAN DIEGO COUNTY PREHISTORY AND HISTORY

CLIMATE	TIME	CULTURAL SETTING	STAGE
Medithermal			
Moderately warm; arid and semi-arid	1876 A.D.	Reservation Period	
	1850 A.D.	Anglo-European Era	
	1830 A.D.	Mexican Era	
	1769 A.D.	Hispanic Era	Historic
	1542 A.D.	Spanish Era	Protohistoric
	1000 A.D.	Late Prehistoric cultures	Late Milling
	3,000 B.P.	La Jolla Complex termination	
Altithermal	4,000 B.P.		
	6,000 B.P.	Los Compadres (W-578) occupied	
Arid, warmer than present	7,500 B.P.	La Jolla Complex	Early Milling
Anathermal	8,000 B.P.		
		Harris Site (SDi-149) occupied	
Climate like present but growing warm, humid and subhumid	9,500 B.P.	San Dieguito Complex	Paleo-Indian
End of Glaciations	10,000 B.P.		
	21,000 B.P.	Yuha Man	Early Man
	48,000 B.P.	Del Mar Man	Early Man

Recent research and experimentation with amino-acid dating (Bada *et al.* 1974) has given new life to a decades old assertion (Carter 1957) that humans were in the New World, and specifically along Mission Valley and the San Diego River, over 40,000 years ago. Although such a possibility exists, and continuing research seems to point in that direction, many scholars are unwilling to categorically state that humans occupied the New World before approximately 30,000 years ago. Continued research in the Arctic region and within our own area should help in resolving the date of initial New World occupation.

a. San Dieguito

The oldest well-documented inhabitants of the region were apparently the Paleo-Indian San Dieguito people. Typified as nomadic large-game hunters, these people occupied the mesas, mountains and deserts of San Diego County roughly between 21,000 and 8,000 years ago (Warren 1961:252-253; Rogers 1966:140-148; Ezell 1974:personal communication). The culture of the San Dieguito people has been divided into three relatively distinct phases representing assumed variations in time and space. Within these three phases exists various "industries" that are geographically and ecologically based; these are not of specific concern in this analysis. San Dieguito I, the oldest of the known Paleo-Indians in San Diego County, inhabited the desert regions east of the Cuyamaca/Laguna mountain ranges as long ago as 21,000 years (Childers 1974; Ezell 1974:personal communication).

In general, the ancient hunters of the San Dieguito I phase apparently left little or no permanent record on the land, except for their scattered lithic tools, waste stone debris and two recently discovered burials in the Yuha Basin-Truckhaven area (Rogers 1939:25-31; Ezell 1974: personal communication; Childers 1974; Wallace 1955:189-191). Broad characteristics of the San Dieguito I people include their manufacture and use of crudely formed stone flakes, blades and scrapers.

San Dieguito II is found both in the desert and throughout western San Diego County. Lithic artifacts represented by this phase include more finely worked blades, somewhat smaller and lighter points, and a larger variety of scrapers and choppers. In general, however, the same morphological types remain basically unchanged from the earlier phase. Like their predecessors, these people were medium-to-large-game hunters, although foraging must have served to supplement their diet (Warren 1961:262; Moriarty 1969:1-18), perhaps to a greater extent than most scholars have implied.

The terminal San Dieguito phase, San Dieguito III, represents a morphological and typological change, as indicated by an altered technology. The tool types become far more varied both in style and in functional design, thus indicating a change in the culturally determined mental templates. Such alteration in technological form can be attributed to environmental adaptation and/or a technological "snowball" effect, wherein technological advances and changes thrive and feed on themselves and progressively create a new technological mode.

As a result of such technological changes, the tools of the San Dieguito III phase exhibit not only a wider variety of tool types, but also a fundamental refinement in tool manufacture. A primary difference in tool technology is represented by the introduction of pressure-flaked blades and points. Unlike simple percussion flaking, pressure flaking requires a more delicate touch and more finely conceived mental template. The resulting tools exhibit form, complexity and balance not found in the early phases of the San Dieguito people.

Other diagnostic traits associated with San Dieguito III include planes, choppers, plano-convex scrapers, crescentic stones, elongated bifacial knives, and intricate leaf-shaped projectile points (Rogers 1939:28-31). Beyond specific tool types and the introduction of pressure-flaking, there exists no absolute method of discerning between San Dieguito II and III. Patination, a weathering process involving chemical change on the surface of stones, is a relative guide to antiquity and provides gross distinctions between the San Dieguito phases; however, its use is limited by the many variables which are involved in its application.

b. La Jollan-Pauma

By about 7,000 years ago, a new group of peoples had begun to inhabit and exploit the coastal and inland regions of San Diego County (Moriarty 1969:12-13). These people, the La Jollans, were nomadic exploiters of maritime resources (Harding 1951; Moriarty *et al.* 1959:185-216; Wallace 1960:277-306), who also relied on seed gathering and vegetal processing. The La Jollans may have been entering into the mortar and pestle phase late in the terminal stage of the La Jollan-Pauma transitional period (Warren 1961). The tool types of the La Jollans indicate that these members of what Wallace (1955) terms Early Milling Horizon possessed a far greater reliance on the sea and foraging than their predecessors, the San Dieguito people, although Kaldenberg and Ezell (1974) have excavated at least one San Dieguito site, W-49, which contained a well-defined shell midden. The variety and quality of lithic tool manufacture is much more basic and unrefined when compared with even the basal phase of the San Dieguito complex.

Characteristic traits of the La Jollan culture include fire hearths, shell middens, flexed inhumation, grinding implements, and absence of ceramics. The archetype La Jollan sites are located along the coast near bay or lagoon areas. In recent years, inland La Jollan sites of a seemingly later period have been discovered in transverse valleys and sheltered canyons, including Valley Center (True 1959:225-263; Warren *et al.* 1961:1-108; Meighan 1954:215-227). These non-coastal sites have led to a new name for La Jollan-type sites with an inland location. True (1959), Warren (1961) and Meighan (1954) had applied the term Pauma Complex to certain inland sites which possess a predominance of grinding implements (especially manos and metates), lack of shell, greater tool variety, more sedentary life patterns than expressed by San Dieguito sites, and an increased dependence upon gathering. However, it is more probable that these inland sites represent a non-coastal manifestation of Early Milling peoples who adopted or developed a hunting mode more so than their coastal brethren. Wallace (1955:214-230) denotes this late transitional phase as Intermediate, and establishes its position between Early Milling Horizon and Late Milling Horizon.

c. Kumeyaay/Northern Diegueño - Luiseño

By 2,000 years ago, Yuman-speaking peoples sharing cultural elements had occupied the Gila/Colorado River drainage (Moriarty 1966). Through gradual westward migration the Yumans drifted into Imperial and San Diego Counties, where they came into contact and apparently acculturated with the remnants of the Early Milling La Jollan cultural tradition (Moriarty 1966; 1965). Because of basic similarities in the late La Jollan/early Yuman patterns, it is difficult to clearly define the contact period or point between La Jollan/Yuman.

Dr. James R. Moriarty (1965; 1966) has suggested that there existed a pre-ceramic Yuman phase, as evidenced from his work at the Spindrift Site in La Jolla. Based on a limited number of radiometric samples, Moriarty has concluded that a pre-pottery Yuman phase occupied the San Diego coast 2,000 years ago; that by 1,200 years ago ceramics had diffused from the eastern deserts.

Although some researchers still follow Malcolm Rogers' belief that Yuman peoples first appeared in San Diego County only 1,000 years ago (Rogers 1945), there is a growing body of data supporting Moriarty's hypothesis. A recent excavation of a La Jollan/Kumeyaay site in Sorrento Valley (Carrico 1975) encountered a cultural stratification with a basal date of 3,755 years ago and a terminal date of 2,525 years ago. It is worth noting that the upper stratum (0-10 centimeters) of the dated column contained ceramics and projectile points commonly considered time-markers indicative of Late Milling Kumeyaay. Radiometric dating of a large shell sample from this stratum produced a date of 2,525±70 years B.P. The near absence of ceramics and total lack of projectile points below the 10-centimeter level, within a series of strata that contained a variety of seemingly early cultural material dated at 2,925±75 B.P. (50-60 centimeters) may indicate that the Rimbach Site is a multi-component, culturally stratified site containing a transition between La Jollan and Yuman circa 2,500 years ago.

Whether the Yuman peoples moved into the area 2,500, 2,000, or 1,500 years ago, they brought with them a culture heavily influenced by their Yuman neighbors in the eastern desert region of California and along the Colorado River. These prehistoric/protohistoric peoples possessed ceramics, operated a closely knit clan system, utilized a highly developed grinding technology, had elaborate and extremely complex kinship patterns, created rock art, and carried on extensive trade with the surrounding cultural areas (Rogers 1945:167-198; Kroeber 1970:709-725; Strong 1929). It has also been postulated that the Kumeyaay and their northern neighbors, the Luiseño, may have been practicing a basic type of protoagriculture prior to Hispanic contact (Lewis 1973; Shipek 1974: personal communication; Treganza 1947).

About 1,000 to 1,500 years ago, a group of Shoshonean-speaking people migrated out of the Great Basin region and intruded like a wedge into southern California. This wedge separated the Yuman groups and was eventually to cause great cultural variations (Kroeber 1970:278; True 1966). In coastal San Diego County, this group of Shoshonean intruders has been labeled the San Luis Rey I and II Complex (Meighan 1954:215-227). When the early Hispanic explorers contacted these people, they called them Luiseños, after the Mission San Luis Rey de Francia founded in the heart of Luiseño (San Luis Rey II) territory.

Although of a different linguistic stock, the Luiseño and the Kumeyaay (Diegueño, after San Diego) shared many cultural traits. D.L. True (1966) has suggested that basic similarities in ecological exploitation, environmental setting and temporal placement forced the late-coming and highly nomadic Shoshoneans to adapt to a life style and cultural pattern that was established and functioning upon their arrival. D.L. True outlines certain attributes or traits which he finds as dissimilar between the two cultures. He notes that Luiseño projectile points are more basic than those of the Kumeyaay; those of the Luiseño are predominantly made of quartz. He also notes that ceramics were evidently a late development of the Luiseño; they probably learned the use of pottery from the Northern Diegueño. True also postulates the Luiseño possessed a very small, very closed trade network;

that in general they were not as world-aware as the Kumeyaay, although Luiseño cosmology and religion seem better developed.

d. Protohistoric Period

The Hispanic intrusion (1769-1822) into native-American southern California affected the coastal tribes and peoples living in well-traveled river valleys. The Mexican Period (1822-1848) saw continued displacement of the native population by expansion of the land grant program and development of extensive ranchos. The Gold Rush and the concomitant granting of statehood, combined with an influx of aggressive, land-hungry Anglos, caused a rapid displacement of the natives, as well as deterioration of their culture and life-ways (Shipek 1974; Bancroft 1886; Kroeber 1970).

The literature on these later peoples, the Kumeyaay, Luiseño, Cahuilla, Cupeño and others, is rather extensive and includes Barrows (1900), Bean and Saubel (1972), Caughey (1952), Gifford (1918), Hayes (1929), True (1970), Heizer and Whipple (1957), Hooper (1920), Kroeber (1970), Cuero (1968), Sparkman (1908:87-234), and Strong (1929).

2. Ethnobotanical Data

The wide variety of vegetative types afforded in the study area would have provided native Americans with an ideal setting for procurement of plant resources. The close proximity of water, construction material and natural bedrock grinding platforms would have further enhanced the suitability of the area for prehistoric utilization. A brief listing of native vegetation known to have been used by native Americans in the San Diego area and present within the general study area is noted in Table C-2.

The intimate and complex relationship between native Americans and their environment has received renewed attention in recent years. Archaeologists, ethnographers, palynologists and other scholars have attempted to gain insights into folk medicine, vegetal exploitation and preparation, and to understand the interrelationships between past people and their environs. Through ethnographies, histories and personal interviews, a large, although not comprehensive, body of knowledge about native American plant use in southern California has been compiled.

The reader is referred to a series of works which, taken together, comprise a broad ethnobotanical background for San Diego County. "Santa Ysabel Ethnobotany" by Ken Hedges (1967), *Temalpakh* by Lowell John Bean and Katherine Saubel (1972), *The Culture of the Luiseño Indians* by Philip Sparkman (1908), *The Autobiography of Delfina Cuero* (Cuero 1968), *Indians of the Oaks* by Melicent Lee (1937), *Handbook of the Indians of California* by Alfred Kroeber (1970) and "Southern Diegueño Customs" by Leslie Spier (1923) are examples. A brief but thorough synopsis of these works is offered by Kaldenberg and Ezell (1974:11-18).

The presence of certain plants in the proto-historic period and verification of their use by Late Milling peoples (circa 2,000 B.P. to 1769 A.D.) would offer no assurance that earlier peoples utilized or even knew how to utilize specific

Table C-2

PALEO-BOTANY OF THE SAN LUIS REY AREA

Scientific Name	Common Name	Aboriginal Use
Juncus sp.	Rush	Basketry
Yucca whipplei	Our Lord's Candle	Food, fiber, basketry
Salix gooddingii	Black Willow	Basketry, construction, twine, bows
Prunus ilicifolia	Holly-Leaved Cherry	Food, beverage
Heteromeles arbutifolia	Toyon	Beverage
Claytonia perfoliata	Miner's Lettuce	Food
Eriogonum fasciculatum	California Buckwheat	Medicinal
Platanus racemosa	Western Sycamore	Medicinal
Salvia mellifera	Black Sage	Food, medicinal
Salvia apiana	White Sage	Food, medicinal
Eriodictyon crassifolium	Yerba Santa	Medicinal, soap, tea
Quercus englemannii	Englemann Oak	Food, fuel
Quercus dumosa	Scrub Oak	Food, fuel, medicinal, basketry
Quercus agrifolia	Coast Live Oak	Food, fuel
Xyloccus bicolor	Mission Manzanita	Beverage, food, tools, fuel
Sambucus mexicana	Elderberry	Medicinal, beverage, food, dye, construction
Pluchea sericea	Arrow Weed	Arrow shafts
Artemisia douglasiana	Mugwort	Arrow shafts
Artemisia californica	Sagebrush	Medicinal
Toxicodendron diversilobum	Poison Oak	Medicinal
Rhus trilobata	Squaw Bush	Basketry, twine, medicinal
Rhus ovata	Sugar Bush	Beverage
Rhus laurina	Laurel Sumac	Basketry, twine

The staff calculated the number of MSSVs required to maintain the RCS temperature at an acceptable level following a scram from full power after a loss of offsite AC. Based on an initial after scram decay heat level of 6.75% (Reference 4), the relieving rates shown above, and an energy removal capability of about 650 Btu/lbm (h_{fg} at P = 1000 psig), one MSSV will maintain RCS temperature (at about 545°F) immediately after the loss of AC and scram.* Even though the MSSVs are passive devices, and as such are normally considered failure free, the failure of one valve would not be unacceptable because of the redundancy provided by the other four MSSVs on each steam line.

Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from where it may be operated, and its power supply.

Location	Operation	Power Supply
Outside, mounted on 24" branch lines off of each main steam line (two) leaving the containment sphere. Access to by walkway.	Self-actuated only. No local manual operation is possible.	No electrical power is needed.

*This quantity (one MSSV) does not consider any pressure transients on the steam system as a result of the loss of load.

Atmospheric Dump Valves and Steam Dump Control System

Task: Removal of core decay heat by venting steam from the main steam system directly to atmosphere.

Discussion

Immediately after the loss of offsite AC, turbine trip and reactor scram, the MSSVs automatically actuate to control steam system pressure and RCS temperature. However, the San Onofre Unit 1 steam dump control system (SDCS) provides additional steam relieving paths to (1) prevent and/or limit the operation of the MSSVs,* and (2) provide a means of RCS cooldown by venting steam to either the main condenser or directly to atmosphere.

The SDCS actuates four air controlled atmospheric dump valves (ADVs) and two air-controlled steam bypass valves (SBVs). The ADVs are mounted on the same two branch lines containing the MSSVs, and there are two ADVs on each branch line. The ADVs vent steam directly to atmosphere via individual vent stacks. The SBVs allow main steam from each main steam header** to flow to the main condenser via a

* Since the SDCS is an active component, the staff considered the MSSVs as the principal components in initially controlling RCS temperature following the loss of AC. However, the SDCS would normally act to prevent or limit MSSV operation.

** The main steam headers are cross connected just downstream of manually operated header isolation valves.

single inlet header in the front of the #1 LP turbine condenser. The SBVs have low vacuum interlocks so that their operation is blocked whenever condenser vacuum goes below 2" Hg.

The control room portion of the SDCS consists of a dual range controller which opens the two SBVs in the first 50% of its range, and the four ADVs in the last 50% of its range. The controller has the following selector switch positions:

OFF	
TEMPERATURE:	Automatic
PRESSURE:	Atmosphere and Condenser
PRESSURE:	Atmosphere
PRESSURE:	Condenser

A full open signal (i.e., 100% of range) is developed when the controller is in "Temperature: Automatic" and (1) there is $\geq$ 10% change in turbine load, or (2) T_{REF} and T_{AVG}* differ by $\geq$ 10°F. When in any of the "Pressure" modes, the respective valves are controlled by dialing in the desired pressure. The control room SDCS controller controls the amount of air to the SBVs and ADVs air diaphragms. The SDCS controller at the auxiliary shutdown panel is separate from the control room controller (electrically) and controls only the four ADVs.

* T_{REF} is a measure of turbine power and varies with HP turbine first stage shell pressure. At no load, T_{REF} is 535°F and at full load, 560°F. T_{AVG} varies from 535°F at 15% power to 575°F at 100% power. T_{AVG} is constant (535°F) below 15% power.

Redundancy

Assuming the availability of either SDCS controller, there are at least four ADVs available for removing energy from the RCS. However, the plant procedures for a loss of offsite AC direct the operators to start (if not already started) one of the two 6000 kW station emergency diesel generators (EDGs), energize one of the 4 kV busses, and restart one circulating water pump. Once condenser vacuum has been restored, the SBVs are then able to dump steam directly to the condenser thereby providing another path for RCS energy removal. Each EDG has sufficient generating capacity to power the necessary feed system components (condensate and feedwater pump) to utilize the condensed steam in the hotwell. (This is further discussed in the following section.) Although the condensate pump and feedwater pumps are not part of the "minimum systems," they are mentioned here because they provide further redundancy beyond that provided by the four ADVs.

Other steam loads which would remove energy from the steam generators and therefore assist in cooling the RCS are the condenser air ejectors* and the turbine driven auxiliary feed pump (AFP). The air ejectors normally help maintain vacuum in the condenser by removing noncondensible

*As in the case of the condensate and feedwater pumps, the air ejectors are not part of the "minimum systems" list.

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gases. There are two sets of air ejectors, and each set has four steam nozzles. Each set utilizes approximately 1000 lbm/hr of main steam; thus, about 2000 lbm/hr is available.

The turbine-driven AFP would be started if the motor-driven AFP were not available or failed to start or operate properly. The turbine uses about 8000 lbm/hr of main steam at 600 psig inlet and 5 psig outlet pressure.

The earliest time following the loss of offsite AC and scram when each component individually can remove the amount of core decay heat being added to the RCS is shown below. The staff used the core decay heat curve resulting from infinite operating time, the steam flow rates presented below, and an energy removal rate of 650 Btu/lbm (h_{fg} at P = 100 psig).

Component	Steam Flow	RCS Energy Removal	Full Power Fraction	Time After Scram* (sec)
ADV	--	2.38×10^8 Btu/hr	5.12%	~ 8 sec
SBV	--	1.74×10^8 Btu/hr	3.79%	~ 55 sec
Turbine AFP	8000 lbm/hr	5.20×10^6 Btu/hr	0.11%	~ 10^7 sec
AE	1000 lbm/hr	650×10^5 Btu/hr	0.01%	∞

* Based on Reference 4.

The time when the component energy removal capability equals the decay heat input corresponds to the time when (1) plant cooldown commences if the component is used, and (2) intermittent MSSV lifting would stop.

Redundancy

To establish the degree of redundancy provided by the various components above, the staff calculated the cooldown time (i.e., time to lower RCS temperature from 540°F to 350°F) with a single ADV. This calculation also addresses the rapid loss in steam generator level (beyond the capability of a single AFP) and the consequential reduction in ADV relieving rate.

The calculation shows that a single ADV can reduce the RCS temperature from 540°F to 350°F in about 3.9 hours providing both AFPs are available. If only one AFP is used, then the cooldown takes about 4.7 hours since the ADV must be partially closed to control steam generator level. The staff also calculated that the administrative cooldown limit of 50°F/hr is achievable with one AFP and ADV, and the RCS can be cooled to 350°F in about 5.2 hours.

If the RCS cooldown (using a single ADV) were initiated four hours after the scram, then a cooldown rate larger than the Technical Specification maximum of 100°F/hr could be achieved when the ADV is

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first fully opened because the decay heat level would be much lower (0.85% vs. 6.75%). Assuming the cooldown rate stays within the limit, the total cooldown time (i.e., from SCRAM to 350°F) is the sum of the wait time (4 hours) and the cooldown time (100°F/hr from 540° to 350°F - 1.90 hours), or 5.90 hours.*

Therefore, ADVs are fully redundant,** and only one is required to cool the RCS to the point of RHR usage. Based on single failure considerations, two ADVs are included in the minimum list.

Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from where it may operated, and the equipment's power supply.

Turbine and Motor Auxiliary Feed Pumps

Task: Providing steam generator makeup inventory whenever RCS temperature is $\geq$ 350°F.

* The staff's calculations show that the time to reach the RHR cut in temperature is independent of the initial wait time. (The longer the cooldown is delayed, the higher the cooldown rate once the ADV is fully opened.) In the case of San Onofre, and a 4-hour wait, the 100°F/hr limit is utilized even though a higher cooldown rate is possible.

**The availability of sufficient water inventory to accomplish the plant cooldown is evaluated in the next section.

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
Atmospheric Dump Dump Valves (four)	Outside, two on each main steam branch line; these are the same branch lines, containing the MSSVs.	Control room using the SDCS controller on the "J Board"; auxiliary shutdown panel (south end of turbine building); no local operation.	125 VDC Bus #1 (only source).
Steam Bypass Valves (two)	On either side of #1 LP turbine; the SBVs discharge to a common 12" header which then discharges directly into the forward end of the #1 LP turbine condenser.	Control room using the SDSC controlled in the "J Board."	125 VDC Bus #1 (only source); same source (breaker) as above.
Turbine-Driven AFP	See AFP discussion.	See AFP discussion.	See AFP discussion.
Air Ejectors	Lower level of turbine building, in vicinity of condensate pumps.	Local manual operation only.	No electrical power is needed.
Control Room SDCS	T panel of the control room.	Local (control room) automatic or manual.	DC Bus #1.
Auxiliary Shutdown Panel SDCS	Auxiliary shutdown.	Local (ASD panel) manual.	MCC-2A.

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Discussion

While the RCS temperature is above 350°F, the core decay heat is removed by bleeding steam from the steam generators using the various components and flowpaths discussed in the previous sections. The condensate and feedwater pumps are normally powered from offsite power so these components will not be immediately available.

Each steam generator contains about 3600 gallons of feedwater at full power;* therefore, about 10,800 gallons are immediately available for primary energy removal (by MSSV or ADV actuation).

The staff calculated the amount of energy 10,800 gallons would remove by vaporization. These calculations show that this inventory is sufficient to maintain RCS temperature acceptable, without initiating any steam generator makeup, for approximately 25 minutes. Even if there were a 15-second delay time between the loss of offsite AC (loss of load and feedwater) and the reactor scram (i.e., the steam generators are producing 100% power without feedwater), the staff calculation shows that steam generators can remove the core decay heat for about 15 minutes before boiling dry.

* The SONGS Unit 1 steam generator level system controls S/G level at about 30% at full power. 30% level corresponds to about 3600 gal (120 gallons per % level).

Two auxiliary feed pumps (AFPs), one turbine-driven and one motor-driven, are provided to supply steam generator feed in the event of a loss of the main feed system. Flow from the AFPs can be directed to the steam generators by two paths. The normal path is from the pumps to the main feed header through connections upstream and downstream of high pressure feed heater E-6B. The emergency feedwater line, which is the second path, is a four-inch line which can be supplied by either AFP. This line branches into three three-inch lines which join the main feed lines for each of the three steam generators between the main feedwater regulating valves (FRVs) and the main feed line containment penetrations. A normally closed isolation valve in the four-inch line must be manually opened to supply feedwater through the emergency line. Control of AFP flow through the normal path is by means of air-operated auxiliary feedwater regulating valves (AFRVs) which bypass the main FRVs. Another bypass line exists around each of the FRVs. This line has a two-inch manual valve which may be opened to allow feedwater to bypass a failed-closed FRV. The FRVs and AFRVs are air-operated and controlled from the control room, and they fail closed on loss of air pressure.

Isolation of failed portions of the AFP flow paths can be accomplished by manual valves. The remotely-operated valves which can be used for isolation of failed portions of the AFS are the FRVs, AFRVs, and motor-operated valves (852A, 852B) which can be shut to isolate the main feed pumps from the normal AFP flow path.

Both AFPs receive water via the four-inch condensate makeup and reject line from the condensate storage tank (CST). The passive failure of this line would render both AFPs inoperable. Also, no indications in the control room would allow the operator to determine if such a failure had occurred. If such a failure would occur, the steam generators could still be supplied by the main feed trains as addressed in the following discussion of system redundancy.

The steam supply for the turbine-driven AFP is provided from the main steam header upstream of the main steam stop valves. The main steam header design at San Onofre Unit 1 permits the depressurization of all three steam generators if a main steam line break (MSLB) were to occur upstream of the stop valves. Therefore, such a MSLB would disable the turbine-driven pump. If a single failure of the motor-driven AFP were then postulated, no means of steam generator decay heat removal would be available. In this scenario, the main feed pumps could not be used for steam generator feeding since they would be operating in the emergency core cooling system injection mode following a MSLB. The staff will evaluate the significance of this postulated scenario in the SEP integrated assessment of San Onofre Unit 1. Because of the low probability of occurrence of this sequence of events, we believe it is acceptable to resolve this issue after taking account of the SEP design basis event evaluations and other reviews in the integrated assessment.

The turbine-driven AFP is started by local manual startup of the turbine. This pump can deliver feedwater at 300 gpm with a discharge head of 2560 feet (approximately 1100 psig). CV-113, the valve which supplies steam to the turbine, would fail closed on loss of air pressure and render the turbine-driven AFP inoperable.

The motor-driven pump can be started from the control room, the auxiliary control panel (C38), or with the local operation of its breaker (480V switchgear room). The motor receives power from 480V switchgear bus #3. This bus can receive electrical power from both offsite and onsite sources. During a loss of offsite power, emergency diesel generator #1 supplies power to switchgear bus #3 via 4160V bus 1C after the electrical system has been realigned.* The AFP motor is 250 HP and the pump is designed to supply 300 gpm of feedwater at a discharge head of 2400 feet (approximately 1040 psig).

* The safeguard load sequencer automatically performs several breaker alignments when a loss of offsite AC is detected. However, the EDG output breaker is not automatically closed.

Redundancy

If the motor-driven AFP fails due to electrical or mechanical problems, the turbine-driven AFP is available to provide the necessary steam generator makeup during a shutdown and cooldown. The staff calculations show that the flow from either the motor- or turbine-driven AFP (300 gpm) is sufficient to control and raise steam generator level about 4 minutes after the scram.*

The San Onofre Unit 1 feedwater pumps (two) are also utilized in the ECCS system, and hence are provided with a highly reliable power supply. There are two 6000 kW emergency diesel generators (EDGs) which enable the plant to operate the normal feedwater system (condensate and feedwater pumps) following a loss of offsite AC.

Since there are redundant EDGs and feedwater trains, there is full redundancy in the plant's ability to utilize the feedwater train following a sustained loss of offsite power. However, as in the case of the two SBVs, the feedwater components are not included in the "minimum systems" list, and are only mentioned here for completeness.

Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table

* The calculation shows that the vaporization rate at 4 minutes is equal to the AFP mass input rate.

below gives the equipment's location, the places from where it may be operated, and the equipment's power supply. The design of the AFS instrumentation and controls will be evaluated later in the electrical portion of the resolution of SEP Topic VII-3.

Water Sources - CST, PPMT and SWR

Task: Provide water to the auxiliary feedwater system for steam generator makeup.

Discussion

Both AFPs take a suction from the CST via the 14" hotwell makeup and rejection line. This line leaves the bottom of the CST and then branches into the following:

1. A 3" hotwell rejection line (i.e., flow from hotwell using condensate pumps into the CST).
2. A 4" combined AFP suction.
3. A 10" emergency hotwell makeup line.
4. An 8" normal hotwell makeup line.

The CST has a capacity of 240,000 gallons, and Technical Specification 3.4 requires a minimum of 15,000 gallons. Following the loss of

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
Turbine AFP	West side of main condenser, on the 14' level (lower level).	Operable only locally by the manipulation of the control valves.	No electrical power is needed.
Motor AFP	West side of main condenser, adjacent to turbine AFP.	Operable from control room, auxiliary shutdown panel and in 4kV room at the supply breaker.	480V SWGR #3.
Normal Flow Path:			
Aux FRV	Feedwater mezzanine.	Operable from control room and aux. shutdown panel.	Vital Bus.
2" Manual FRV Bypass	Feedwater mezzanine.	Local operation only.	No electrical power is needed.
3" AFP Isolation Valves	Turbine building near AFPs.	Local operation only.	No electrical power is needed.
Emergency Flow Path:			
4" Isolation Valve	Between CS and north end of turbine building.	Local operation only.	No electrical power is needed.

offsite AC power, the CST can be filled from either the primary plant makeup tank (PPMT) or from the service water reservoir (SWR).*

The PPMT has a capacity of 150,000 gallons and the SWR has a capacity of 3,000,000 gallons. The SWR supplies water to the two service water pumps (SWPs) and the two motor-driven fire pumps (FPs). Technical Specification 3.4.1 requires these to be at least 105,000 gallons available from the PPMT and/or the SWR.**

Water from the PPMT can be pumped directly into the CST using either of the two primary plant makeup pumps (PPMPs). Each pump is rated at 100 gpm at 235 TDH.

Water from the SWR can be supplied to the CST using the fire protection system. The two FPs pressurize the 8" facility yard fire main from the SWR. Two fire hydrants in the vicinity of the CST (FH-6 and FH-7) could be used to fill the CST using portable fire hoses† attached to 3" couplings on the CST overflow and drain lines.††

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* The flash evaporators are the normal source of makeup of the CST, PPMUT and SWR. Since the evaporators require LP turbine extraction steam from heating, the loss of AC will disable them.

** Technical Specification 3.14 requires 300,000 gallons in the SWR fir fire protection, if the fire main is being pressurized by the two SONGS-1 fire pumps.

† At the time of the staff's visit, the licensee did not have designated fittings, hoses or wrenches for this eventuality.

†† The CST has a top vent to prevent tank pressurization if the normal overflow line is used for filling.

Redundancy

There are two PPMPs which can provide flow from the PPMT to the CST. The pumps have separate power supplies (MCC-1 and MCC-2) which are powered from separate power sources. Even if both pumps become unavailable, the SWR normally has a large amount of unpure water which can be used.

The licensee has calculated that gravity drain from the SWR into the fire protection system then through the portable 3" fire hoses gives more than 220 gpm of flow into the CST. If more flow is required, two fire houses can be utilized. (There are only two 3" nipples available on the CST.)

The staff calculated the maximum length of time the plant can stay at hot shutdown using the initial S/G water inventory and the Technical Specification minimum CST inventory. These calculations show that approximately 3 hours of water supply are available before CST makeup (via either the PPMT or the fire system) must be initiated.

The staff also calculated that the total (Technical Specification required) secondary makeup water inventory, 120,000 gallons, is enough to either keep the plant at hot shutdown for 20 hours, or to complete a shutdown to the point of RHR initiation, 350°F, in about 15 hours. These calculations take no credit for the initial S/G inventory, nor any condensate in the hotwell. The component cooldown times previously discussed show that one ADV alone can cool the RCS from 540°F to 350°F in about 4.70 hours which is significantly less than the calculated maximum available cooldown time based on minimum Tech Spec water sources (15 hours). Also, if the plant stayed at hot shutdown for 4 hours after the scram, then initiated RCS cooldown, a single ADV could cool the system to 350°F in an additional 1.9 hours, or a total time from scram to RHR initiation of 5.9 hours.

Both AFPs take a suction from the hotwell makeup and rejection line. Therefore, the plant has the ability to utilize the water inventory in the condenser hotwell for AFP suction. This could be accomplished by starting a condensate pump and opening (throttling) the hotwell rejection valve (CV 21) or its bypass. (The manual isolation valve at the CST would be closed to prevent pumping the hotwell contents into the CST). The hotwell has a capacity of about 60,000 gallons and a normal operating level of about 30,000 gallons. However, the hotwell contents following a loss of AC and subsequent pump trip and reactor scram cannot be estimated since event times and component coastdowns cannot be accurately predicted. Therefore, no credit can be given for this inventory. However, it is highly likely that there would be a significant amount of condensate available to supplement the already mentioned supplies (i.e., steam generator inventory, CST, PPMUT and SWR).

Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from where it may be operated, and the equipment's power supply. The design of the instrumentation and controls available for an assessment of the equipment's operation will be evaluated later in the electrical portion of the resolution of SEP Topic VII-3.

Residual Heat Removal System

Task: Removal of core decay heat and RCS latent heat to cool the system from 350°F to 140°F.

Discussion

The RHR loop is placed in service after the RCS temperature has been reduced to approximately 350°F and the pressure to less than 400 psig. The RHR system then reduces the RCS temperature to 140°F approximately 20 hours after shutdown, and operates continuously to maintain this

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
CST	Outside, SW of main turbine.	NA	No electrical power is needed.
PPMUT	Outside, west of spent fuel storage building.	NA	No electrical power is needed.
SWR	Bluff to the north and overlooking plant.	NA	No electrical power is needed.
PPMUPs	Between PPMUT and RWST.		Pump G-28 - MCC1 (480V) Pump G-28S - MCC 2 (480V)
FH-6 and FH-7*	FH-7 S. end of circ. water pit and turbine building; FH-6 turbine building, outside.	Local operation only.	No electrical power is needed.
Main Condensate Pumps (four)	Two on east, two on west side of hotwell, on lower floor.	Operable from control room and in the 4kV room at supply breaker.	Pump G-1A-BUS 2C(2400V) Pump G-1B-BUS 2C(2400V) Pump G-1C-BUS 1C(2400V) Pump G-1C-BUS 1C(2400V)
Main Feed Pumps (two)	East and west side of forward end (HP turbine) of main turbine on lower floor (14' level)	Operable from control room and in the 4kV room at supply breaker.	Pump G-3A-BUS 2C(2400V) Pump G-3B-BUS 1C(2400V)
Fire Pumps	Outside SW of spent fuel storage building.	Operator from control room and locally at pumps.	Pump G-11-SWGR1 (480V) Pump G-11S-SWGR2 (480V)
Portable Fire Hoses and Fittings	Hose house SW of turbine building and CST (close to end of railroad spur).	Local, manual operation.	No electrical power is needed.

* Numbers taken from formal fire protection submittal. SCE may change hydrant designation.

temperature as long as is required by maintenance and/or refueling operations.

The RHR loop consists of two heat exchangers, two RHR pumps, and the associated piping, valves, and instrumentation necessary for operational control. During plant shutdown, coolant is withdrawn from the hot leg of loop C, pumped through the tube side of the residual heat exchangers, and then returned to the reactor coolant system in the cold leg of loop A. Decay heat load is transferred through the RHR cooler to the component cooling system which is cooled by salt water (salt water cooling system). An alarm will sound in the control room if the RHR flow drops to 1000 gpm.

Double remotely-operated valving is provided to isolate the residual heat removal loop from the reactor coolant system. When reactor coolant system pressure is above the RHR loop design pressure, an electrical interlock between the RCS wide range pressure channel and the first set of RHR isolation valves prevents the valves from being opened. During plant heatup, an alarm sounds in the main control room if RHR pump discharge pressure exceeds a preset amount when the isolation valves are open (thus indicating an approaching overpressure event).

The RHR loop is designed to be placed in operation approximately 4 hours after reactor shutdown, when the RCS pressure and temperature are less than 400 psig and 350°F, respectively. The maximum heat load removed by the residual heat removal loop occurs at this time.* This heat load is the sum of the residual heat produced by the core and the sensible heat removed from the RCS.

When placing the RHR loop in service, the hot reactor coolant must be introduced into the residual heat removal loop gradually, by regulating the remote-manual control bypass valve and observing the flow indication instrumentation. The RHR to RCS return temperature is controlled by an automatic air control valve that throttles the CCW through each RHR heat exchanger. The valves sense RHR temperature just downstream of the RHR heat exchanger and if higher than a preset value, the CCW flow is increased. The cooldown rate is also controlled by throttling the RHR to RCS return flow with an air-operated control valve.

During normal plant operation, one residual heat exchanger is used for cooling the reactor coolant letdown flow (chemical and volume control system). Temperature control is maintained by automatic

* This is still under review. ANS 5.1 decay curve at 4 hours is about .8% power, but heat exchanger design data indicates a heat removal capability of only .7% (4 hours of wait time until $p/p_o = 0.007$).

control valves which regulate the flow of the component cooling water through the shell side of the exchangers.

Redundancy

Each RHR pump is sized for one-half the maximum loop flow requirement, and each RHR cooler is sized for one-half the maximum required heat removal capability. The maximum flow and heat removal requirements are when the RHR system is first placed on line 4 hours following a scram from full power. Since there are two RHR pumps and coolers, a single failure does not completely disable the RHR system. The use of two units also allows maintenance when the plant is shut down and after core decay heat has diminished.

RHR heat exchanger design data shows that each unit can remove 16.1×10^6 Btu/hr under the following conditions:

RHR flow: 1170 gpm	CCW flow: 2218 gpm
RHR inlet: 140°F	CCW inlet: 81°F
RHR outlet: 112.5°F	CCW outlet: 95.5°F

The heat removal capability of the RHR system, therefore, would be twice that for one RHR heat exchanger, or about 32.2×10^6 Btu/hr. The RHR system's heat removal capability is affected by the RHR flow (number of RHR pumps operating or amount of throttling), the number

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of RHR heat exchangers operating, the RHR inlet temperature, the CCW flow (number of CCW pumps operating, amount of CCW throttling, or flow to other CCW loads), the number of CCW heat exchangers operating, the salt water cooling flow to the CCW heat exchangers, and the SW temperature. The staff performed some scoping calculations to determine the RHR to CCW to SWC heat transfer under varying single failures.

The calculations are summarized below for failures in the RHR system. Failures of CCW system components obviously effect the RHR system heat removal capability, and are discussed in the following section.

RHR Pump	RHR HX's	(total) RHR flow	RHR HX Temps Tube In	Tube Out	Shell In	Shell Out	(total) RHR Heat Removal
2	2	1.17×10^6 lbm/hr	140°	112.5	81°	95.5°	32.2×10^6 Btu/hr
2	2	1.17×10^6 lbm/hr	350°	230°	142°	205.9°	141×10^6 Btu/hr
2	1	$.936 \times 10^3$ lbm/hr	350°	251°	1192°	186°	93×10^6 Btu/hr
1	1	585×10^3 lbm/hr	350°	230°	105°	155.6°	70.1×10^6 Btu/hr
1	2	800×10^3 lbm/hr	350°	214°	105.2°	154.9°	109×10^6 Btu/hr

The worst single failure associated with the RHR system from the standpoint of heat removal is the failure, or unavailability of a single RHR heat exchanger. This reduces the system's heat removal capability by about 34%. However, even if an entire RHR train were unavailable (one RHR pump and Hx), the heat removal capability of the system is well above the core decay heat output 4 hours after the loss of AC, and scram (Pp_o = 0.86% = 39.5 x 10^6 Btu/hr). Therefore, if the RHR system suffered a loss of a pump and HX, the remaining train can be placed in service at 4 hours after the scram, and the RCS cooldown can continue using only the remaining RHR train.

The licensee estimated the capability of the RHR system under various single failures, and the results are given below.

RHR equipment available	Earliest when RHR system can be placed on line	Time to Cooldown RCS from 350 to 140
2 pumps + 2 coolers	4 hours	16 hours
1 pump + 1 cooler	4 hours	---
1 pump + 2 coolers	4 hours	30-32 hours
2 pumps + 1 cooler	4 hours	30-32 hours

As an additional consideration, the staff noted that the SWR may be required to have at least 300,000 gallons for site fire protection purposes (Technical Specification 3.14).* If the CST had 15,000 gallons and the SWR had 300,000 gallons, the technical specification requirements for minimum water inventory would be satisfied, and there would be significantly more time available for the removal of core decay heat by steam venting. Therefore, the decay heat power would be less

* If the SONGS-1 fire pumps are being used to pressurize the fire main.

when the RHR cooldown commenced, thus giving more margin between the minimum heat removal capability of the RHR system (with the worst single failure) and the core decay heat level.

The San Onofre Unit 1 RHR system is susceptible to a single failure which completely disables the RHR system. If either RHR suction valve failed to open, the system would be rendered inoperable. In this case, if the reactor vessel head were installed, the RCS would be allowed to heat up until the steam generators could be used for heat removal. If the vessel head were removed, the core could be adequately cooled by keeping it flooded using the CVCS or other system.

Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from where it may be operated, and the equipment's power supply.

Component Cooling Water System

Task: Provide cooling of the RHR heat exchangers and the other essential equipment.

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
RHR Pumps and Heat Exchangers	Inside containment sphere.	Operable from the control room and at either the 4kV or the 480V rooms at their supply breakers.	Pump A - SWGR 1 (480V) Pump B - SWGR 2 (480V)
RCS/RHR MOVs	Inside containment sphere.	Operable from the control room only.	Same.
Cooldown Valve HCV 602	Inside containment and ~10 feet near bottom of A steam generator.	Operable from the control room and at the valve (local) feed/bleed air to diaphragm; a backup valve, 776-4-754 (manually operated) is also available.	MCC-1.

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Discussion

The CCW loop removes heat from the reactor coolant pumps, reactor shield cooling coils, excess letdown heat exchanger, seal water heat exchanger, spent fuel pit heat exchanger, sample heat exchangers, and the residual heat exchangers. As water is circulated through these components, heat is transferred to the CCW which in turn is cooled by salt water in the CCW heat exchangers. Thus, the component cooling loop serves as an intermediate cooling system between the reactor coolant system and the salt water cooling system.

The CCW loop consists of three pumps, two heat exchangers, a surge tank, cooling water lines to the various components being cooled, and associated valves and instrumentation. The CCW flows from the component cooling pumps, through the shell side of the component cooling heat exchangers, through the components being cooled, and back to the pumps. The surge tank is connected to the suction side of the pumps. The tank is located at an elevation which provides the required NPSH for proper operation of the component cooling pumps. The tank has a capacity of 2000 gallons and level is normally maintained at about 1000 gallons. Surge tank level is locally indicated by a level gauge and high and low level alarms are annunciated in the control room. Makeup is from the reactor cycle makeup water through a manually operated valve.

The maximum heat load on the CCW system occurs when the RHR loop is first placed in operation during plant shutdown.

During normal full-power operation, one component cooling pump and one component cooling heat exchanger accommodate the heat removal loads. Either of the standby pumps and a standby heat exchanger provide 100% backup during normal operation.

A pressure switch on the component cooling pumps discharge header automatically starts the standby pumps if header pressure falls below the normal discharge pressure. The pump must be manually shut off. The manual valves at the component cooling water inlet to the component cooling heat exchangers are normally open. The component cooling water outlet valves of the component cooling heat exchangers are remotely-operated valves controlled from the control room for the selection of the operating heat exchanger.

Component cooling water is circulated through the shell side of each residual heat exchanger and the flow rate is automatically regulated to maintain the temperature of the reactor coolant effluent from the exchanger at 115°F. This automatic control is accomplished by a temperature controller in the residual heat exchanger tube side outlet which operates a control valve in the CCW return line.

Redundancy

Operation of all three pumps and both heat exchangers is required during removal of residual and sensible heat during plant shutdown. If all the components are not operative, the time-to-shutdown is extended, but the safe operation of the plant is not affected. Each heat exchanger is capable of removing one-half of the maximum heat removal load occurring between the 4th hour and the 20th hour after a normal shutdown. The use of two CCW heat exchangers and three CCW pumps assures that the heat removal capacity is only partially lost if one exchanger or one pump fails. This provision also permits maintenance of one exchanger and one pump while the other heat exchanger and one pump are in service. The table below summarize the licensee's estimation of the CCW system capability under various single failures.

CCW Equipment Available	Time to Place RHR in service*	Time to Cooldown RCS 350° to 140°
3 pumps + 2 coolers	4 hours	16 hours
2 pumps + 2 coolers	4 hours	18-20 hours
3 pumps + 1 cooler	4 hours	30-32 hours

There is no system which can replace the CCW system in the removal of heat from the RHR coolers and the other heat loads. Should a rupture of the CCW system occur, the break must be isolated from the remainder

* Time after scram when heat removal capability of CCW system just equals all loads + RHR decay heat removal.

of the system. If, for example, a CCW return line ruptured then continuous makeup from the surge tank using the manual fill valve may provide sufficient flow to the CCW pump suction requirement. (An isolation valve in the CCW system between the surge tank and the makeup line would cause pressurization of the CCW pump suction with the PPMUP.)

The staff calculated the maximum heat removal capability of the CCW system considering various equipment configurations and throttling of the CCW from the RHR HXs. These calculations, allow changes in the heat transfer coefficient (HTC) of the RHR and CCW HXs due to flow (both tube and shell) variations. Although the HTC is known to vary also with coolant temperature, it was the staff's intent to perform only scoping calculations. The reference HTC* used was conservative and was obtained from design data for the HXs.

The CCW system has temperature limitations to protect the equipment being cooled and the CCW equipment itself. The pump suction and HX inlet temperature is to remain below 200°F, and the HX outlet temperature is to remain below 120°F for protection of the RCP bearing coolers. The calculations determined the hot and cold CCW temperatures (T_1 and T_2), and the maximum heat removal capability. If T_1 was above 200°F or if T_2 was above 120°F, then further calculations were

* The reference HTC is the HTC from the design data, and it was assumed to vary linearly with flow.

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performed to determine T_1 and T_2 assuming throttling of the CCW from the RHR coolers. The results are summarized below:

RHR Pumps/ HXs	CCW Pumps/ HXs	Total RHR flow	Total CCW flow	T_1	T_2	Total Heat Removal from RHR
2/2	3/2	$1.7x10^6$	$2.22x10^6$	205°	142°	$141x10^6$ Btu/hr
2/2*	3/2	$1.7x10^6$	$1.60x10^6$	214°	136°	$125x10^6$ Btu/hr
2/2	2/2	$1.7x10^6$	$1.6\ x10^6$	188.4°	118°	$113x10^6$ Btu/hr
2/2	2/1	$1.7x10^6$	1.4×10^6	222.6°	158°	$91x10^6$ Btu/hr
2/2*	2/1	$1.7x10^6$	$1.0x10^6$	232°	153°	$79x10^6$ Btu/hr
2/2**	3/1	$1.7x10^6$	$1.9x10^6$	212°	159°	$101x10^6$ Btu/hr

The staff's scoping calculations, which assumed no variation of the HX HTC with temperature, ignored other heat inputs to the CCW system (other than the RHR Hxs), and assumed conservative CCW flow values show the CCW temperatures to be above their limits in two cases even with the most advantageous flows. However, the heat removal rate is greater than the decay heat, hence the RCS temperatures will drop and the core temperatures would return to normal (they may not even have approached their limit).

* These are cases where the CCW from the RHR HXs is throttled in an attempt to control the CCW temperature.

** The staff assumed here that the 3rd CCW pump could be started without overpressurizing the system, or violating any other system limits.

Even in the most limiting case, which is a loss of a single CCW HX and CCW pump, the CCW can remove significantly more energy than the core is producing at 4 hours after the scram. Therefore, the RHR system can be placed on-line 4 hours after the scram, even with the most limiting failure in the CCW system.

Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from where it may be operated, and the equipment's power supply.

Salt Water Cooling System

Task: Provide cooling water to the component cooling heat exchangers.

Discussion

The salt water cooling system's only function is to cool the CCW heat exchangers. The two SWCPs take suction from the intake structure and, after passing through the tube side of the CCW coolers, discharge into the facility's discharge structure. Normally, only one SWCP is required with the second SWCP serving as a standby unit. During RCS cooldown, just after the RHR system is placed in service, both CCW heat exchangers are operating. The SWC system is arranged so that

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
CCW Pumps (three)	Outside, on roof of reactor auxiliary building, west of containment sphere.	Operation from the control room and in the 4kV or 480V rooms the supply breakers.	Pump A - SWGR 1(480V) Pump B - SWGR 2(480V) Pump C - SWGR 3(480V)
CCW Heat Exchangers and Surge Tank	Same as above.	Local operation of the heat exchangers, and CCW expansion tank filling from local operation only.	No electrical power is needed.

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each pump independently cools a CCW heat exchanger. Therefore, two SWCPs are required when the RHR system is placed on-line.

Redundancy

An auxiliary SWCP is available to provide cooling water to the E-20A (upper) CCW cooler. That is, the ASWCP provides redundancy to the G13B SWCP.

The screen wash pumps can be manually placed into operation as backup to the salt water cooling pumps. A 6-inch header is provided from the screen wash pump discharge. The header is connected by manually operated valves to each component cooling heat exchanger inlet line, and to the 24-inch circulating water header to the turbine plant coolers. This backup adds to the reliability of the salt water cooling system and prevents a possible shutdown if one salt water cooling pump fails.

The facility fire protection system can also be used to pressurize the SWC system through two 8" manually operated butterfly valves. Therefore, the two motor-driven fire pumps (discussed in Section 3.4) provide further SWC system redundancy. Also, either of the two 1500 HP main circulation water pumps can pressurize the SWC system via two 6" butterfly valves.

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Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from where it may be operated, and the equipment's power supply.

Instrument Air System

Task: Provide compressed air for instrumentation and the control of system valves.

Discussion

During normal plant operations, one of the three 300 scfm air compressors supplies the service air and instrument air headers; the other two air compressors in standby. The three 120 ft^3 air receivers serve as surge chambers for the compressors to minimize system pressure fluctuations. The air receivers are equipped with relief valves (RV-23, RV-24 and RV-25) and local pressure indicators. Each receiver and its respective air compressor can be isolated for maintenance. A check valve is provided at each air receiver outlet to prevent loss of compressed air through a stopped compressor with broken discharge valves.

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
SWCPs (two)	Outside, side-by-side in the facility pump well.	Operable from the control room and...	Pump A - SWGR 1 (480V) Pump B - SWGR 2 (480V)
Auxiliary SWCP			SWGR 3 (480V)
Screen Wash Pumps (two)	Outside, side-by-side in the facility pump well, west of the SWCPs.	Operable from the control room and...	Pump G43-SWGR 1 (480V) Pump G435-SWGR 2 (48)V)
Main Circulation Water Pumps (two)	Outside, side-by-side in the facility pump well, east of SWCPs.	Operable from the control room and...	Pump A - Bus 2C (2400V) Pump B - Bus 1C (2400V)

A common air supply header receives air flow from the three receivers and supplies the instrument air and the service air headers. The instrument air header supplies instrumentation and pneumatic controllers throughout the station which require compressed air of high purity and low dew point.

Redundancy

When the compressed air load exceeds 300 cfm, which is the capacity of one compressor, system pressure will drop. When system pressure drops to 75 psig, a pressure switch (PS-57) closes, starting the second compressor. If system pressure continues to drop, the third compressor is started automatically at 70 psig by PS-58. At 70 psig, service air flow is stopped by CV-41, and the three compressors (900 cfm) are utilized for instrument air supply exclusively.

All three compressors will continue to operate after system pressure has been returned to 100 psig. When system demand returns to normal, two compressors can be turned off and repositioned manually to automatic standby.

Any of the three compressors can be selected as the operating compressor from the control room with the remaining compressors on automatic standby. Sequence of operation may be varied by adjusting the pressure switch settings.

The SONGS-1 Air System is susceptible to a single (passive) failure of the air header supplying the four ADVs. In this event, the four ADVs would be rendered inoperable. However, hot shutdown is achievable by the automatic operation of the MSSVs, and if repairs could not be made to the system, cold shutdown could be accomplished by the operation of the SBVs and the main condenser* (and its auxiliaries).

Location and Operation

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from which it may be operated, and the equipment's power supply.

Emergency Diesel Generator

Task: Supply a reliable source of AC power to run necessary equipment.

Discussion

The staff's evaluation of the recently installed EDVs is contained in Section 2.1.2 of the SER regarding the startup of San Onofre Unit 1 for Cycle 6 (Amendment 25, April 1, 1977).

* As part of the Fire Protection Review Program, SONGS-1 agreed to install the necessary fittings to utilize the pallet air system so that the safe shutdown systems air-controlled valves have a redundant supply of motive force. The hookups and time schedule are described in the SCE submittal dated November 22, 1978.

125 V DC Power

Task: Supply a reliable source of DC power for breaker control and instrumentation.

Discussion

The staff's evaluation of the 125 V DC San Onofre bus #1 is contained in the SER referenced in the EDG section, above.

Chemical and Volume Control System

Task: Provide RCS makeup (due to the contraction of the coolant during cooldown) and borate the RCS to the necessary shutdown margin.

Discussion

The CVCS consists of two centrifugal charging pumps, the regenerative heat exchangers, pressure reducing valves and orifices, one of the two RHR heat exchangers, the volume control tank (VCT), refueling water storage tank (RWST), and associated piping, valves, fittings and instruments. Since the CVCS must also borate the RCS to ensure adequate shutdown margin, the following additional equipment is required: the boric acid tank (BAT) and one boric acid transfer pump (BATP).*

* The blender could also be used, but it requires the PPMUP, the boric acid injection pump, and the BAT. Since only 2 components are required using the other flow path (BAT + BATP), this is the preferred alternate to the RWST.

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
Air Compressors (three)	Side-by-side, on west side of condenser hotwell, on 14' level, adjacent to auxiliary feed pumps.	Operable from the control room and...	Comp. A - SWGR 1 (480V) Comp. B - SWGR 2 (480V) Comp. C - SWGR 3 (480V)
Air Receivers (three)	Side-by-side, in a partitioned room next to air compressors.	NA	No electrical power is needed.

During normal operation, reactor coolant is withdrawn from the cold leg of loop A at approximately 550°F. The coolant then passes through the shell side of the regenerative heat exchanger (RHX), the letdown orifices (three in parallel), then through the tube side of one of the RHR heat exchangers. The coolant temperature and pressure have been reduced to about 115°F and 350 psig, respectively. After another pressure reduction to 150 psig, and after leaving containment, the coolant flows through various demineralizers, then into the volume control tank (VCT).

The charging pumps take a suction from the VCT, then pump the coolant through charging and pressurizer level control valves, through the tube side of the RHX, then into loop A at about 460°F.

During periods of decreasing power level, the charging flow is increased by the pressurizer level control to make up for contraction of reactor coolant water and the temperature of the letdown steam leaving the regenerative heat exchanger decreases. There is sufficient space in the volume control tank between the makeup set point and radioactive waste disposal system dump set point to accommodate coolant expansion and contraction resulting from changing reactor power level, but makeup is available to compensate for any leakage that may have occurred during power operation.

The chemical blender, BAIP and reactor makeup control system set together to inject a predetermined volume of mixed boric acid and pure water into the VCT. There are three modes of operation: automatic makeup mode, dilute mode and borate mode.

The charging pumps are centrifugal pumps with a shutoff head of 5600 feet (~2400 psig) and a maximum flow of 280 gpm (at 5100 feet). The charging pump suction can be from the following sources:

1. RWST (gravity flow)
2. VCT (gravity flow)
3. Chemical blender (BAIP + PPMUP)
4. PPMUT (PPMUP)
5. BAT (BATP)
6. Batching tank (BATP)

Boration of the RCS using the blender described above is accomplished with the boric acid tank (3500 gallons - 12 wt/o H_3BO_3). The refueling water storage tank supplies the charging pumps directly (200,000 gallons - 2900 ppm). The chemical blender and makeup control system are normally used for RCS boration during shutdown and cooldowns.

Redundancy

The amount of RCS makeup during cooldown (and filling of the pressurizer) from 550°F to 200°F was calculated by the staff to be about 17,800 gallons. Therefore, the BAT alone doesn't provide enough RCS makeup for the plant cooldown to 300°F. However, there are other sources of primary grade water available (e.g., VCT, PPMUT, RWST).

To ensure the pressurizer level can be controlled during the most rapid cooldown assuming the use of only one ADV, the staff performed cooldown calculations. This cooldown rate was initially (i.e., at T_{RCS} = 544°F) slightly greater than 100°F/hr, the Technical Specification maximum (during a 1-hour interval). A cooldown rate of 100°F/hr* causes an RCS liquid contraction rate of about 107 gpm. Since the capacity of each charging pump is about 280 gpm, the pressurizer level can be raised by only one charging pump during a cooldown with one ADS venting steam from the steam generators, and the other charging pump provides a redundant RCS makeup capability.

Either the BAT (12 Wt/%) or the RWST (3750 ppm) can borate the RCS sufficiently to reach cold shutdown with adequate shutdown margin at any time in core life.*

* From bases for Technical Specification 3.2.

<u>Location and Operation</u>

The staff evaluated the equipment discussed above with respect to its location and operability during a loss of offsite AC. The table below gives the equipment's location, the places from where it may be operated, and the equipment's power supply.

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EQUIPMENT	LOCATION	OPERATION	POWER SUPPLY
Charging Pumps (two) and Test Pump (one)	Side-by-side, on the 20.0' level of the PAB, in a shield cubicle.	Operable from the control room and at the breaker panel.	CPA - 4160 Bus 2C CPB - 4160 Bus 1C Test Pump - 480V MCC 2 (Front)
Volume Control Tank (VCT)	In a cubicle on the RAB roof, in the vicinity of the BAT.	Makeup to the VCT is via the makeup control system in the control room. VCT makeup can also be initiated manually from the control room.	No electrical power is needed.
Refueling Water Storage Tank	Outside, SW of containment sphere, inboard of the PPMUT.	Level instrumentation and makeup control is in the control room and local manual valve alignment.	Heaters
Boric Acid Tank (BAT)	Outside, on roof of reactor aux. bldg. due west of containment sphere.	Filled from local manual valve alignment and ___ of BATP from control room or local, manual.	Heaters
Boric Acid Transfer Pump (BATP)	Just inside door of aux. bldg., same elution as roof of aux. bldg.	BATP operable from CR or local control (pushbuttons).	BATP A (North)-480V MCC-1 (Front) BATP B (South)-480V MCC-2 (Front)

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TABLE 3.1 CLASSIFICATION OF SHUTDOWN SYSTEMS - SAN ONOFRE UNIT 1

Components/Subsystems	Quality Group: R.G. 1.26 SRP 3.2.2	Quality Group: Plant Design	Seismic: R.G. 1.29 SRP 3.2.1	Seismic: Plant Design	Remarks
Chemical and Volume Control System					
Regenerative Heat Exchanger	ASME III Class 2	ASME VIII Cases 1270N 1273N	Seismic Category I	Seismic Category A	Ref. Tables 2.13 and 9.2 of FSAR - Note that the portions of the CVCS system associated with the demineralizers are not required for safe shutdown.
Excess Letdown Heat Exchanger	ASME III Class 2 (tube side) Class 2 (shell side)	ASME VIII Cases 1270N 1273N (tube side)	Seismic Category I	Seismic Category B	
Seal Water Heat Exchanger	ASME III Class 2 (tube side) Class 3 (shell side)	ASME VIII Case 1270N (sec. vessel)	Seismic Category I	Seismic Category A	
Mixed Bed Demineralizer	ASME III Class 3	ASME VIII Case 1270N (sec. vessel)	Non-Seismic Category I	Seismic Category A	
Seal Water Filter	ASME III Class 2	ASME VIII Case 1270N (sec. vessel)	Seismic Category I	Seismic Category A	
Volume Control Tank	ASME III Class 2		Seismic Category I		

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group R.G. 1.26 SRP 3.2.2	Quality Group Plant Design	Seismic R.G. 1.29 SRP 3.2.1	Seismic Plant Design	Remarks
Reactor Coolant Filter	ASME III Class 2				
Boric Acid Tank	ASME III Class 3	No code provided		Seismic Category A	
Boric Acid Filter	ASME III Class 3	ASME VIII	Seismic Category I	Seismic Category 14	
Batching Tank	ASME VIII (NNS)	No code	Non-Seismic Category I	Seismic Category B	
Chemical Mixing Tank	ANSI B31.1 (NNS)	No code	Non-Seismic Category I	Seismic Category C	
Seal Water Supply Filters	ASME III Class 2	ASME III Class "C" vessel	Seismic Category I	?	
Charging pumps	ASME III Class 2	No code	Seismic Category I	Seismic Category A	
Boric Acid Injection Pumps	ASME III Class 3	No code			
Boric Acid Transfer Pumps		No code			
Test Pump	ASME III Class 3		Seismic Category I	Seismic Category A	

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group R.G. 1.26 SRP 3.2.2	Quality Group Plant Design	Seismic R.G. 1.29 SRP 3.2.1	Seismic Plant Design	Remarks
Piping, fittings, valves	ASME III Class 1 thru Class 3	USASI B31.1			Ref. Table 2.13 of FSAR
Piping (loop A), letdown line via reg. HX to and including air operated valves CV-202, -203, & -204	ASME III Class 1	USASI B31.1	Seismic Category I	?	
Piping (loop B), letdown line via excess letdown HX to and including air operated valve HCV-1117					
Piping downstream of valves CV-202, -203, and -204 to RHR line interface	ASME III Class 2		Seismic Category I	?	
Piping downstream of RHRHX thru valve TC-1105, via RC filter to Volume Control Tank (VCT)	ASME III Class 2	USASI B31.1	Seismic Category I	?	Ref. Dwg. No. M20-568767

TABLE 3.1 (Continued)

Components/Subsystems	Quality Group R.G. 1.26 SRP 3.2.2	Quality Group Plant Design	Seismic R.G. 1.29 SRP 3.2.1	Seismic Plant Design	Remarks
Piping downstream TCV-1105 via demineralizers up to valves #317-3-X42D and #273A-2-X42D	ASME III Class 3		Non-Seismic Category I	?	
Piping from VCT to charging pumps	ASME III Class		Seismic Category I	?	
Piping from boric acid tank via transfer pump and boric acid filter to charging pumps	ASME III Class 3	USASI B31.1	Seismic Category I	?	Note: For boric acid injection, control valve CV-334, located downstream of boric acid filter is air-operated
Piping from boric acid tank via boric acid injection pump to charging pump suction	ASME III Class 3	USAI B31.1	Seismic Category I	Seismic Category A?	
Piping from charging pumps via Reg. HX to RCS charging line and aux. spray in pressurizer up to valves CV-304 & -305	ASME III Class 2				
Piping from charging pumps via reactor coolant pumps to seal Water HX	ASME III Class 2				

valves--see App. of SCE letter

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group: R.G. 1.26 SRP 3.2.2	Quality Group: Plant Design	Seismic: R.G. 1.29 SRP 3.2.1	Seismic: Plant Design	Remarks
Auxiliary Coolant System					
Component Cooling Loop					Reference, pages 2-221 thru 2-240 of FSAR. Dwg. No. M20-568768
Component Cooling Heat Exchangers (shell side)	ASME III Class 3	ASME VIII Case 1270N	Seismic Category I	Seismic Category A	
Component Cooling Pumps	ASME III Class 3	No code			
Component Cooling Surge Tank	ASME III Class 3	ASME VIII Case 1270N			
Piping to reactor coolant pump oil coolers and thermal barriers	ASME III Class 3	USASI B31.1 Section 1			Note: Per FSAR footnote on page 2-231, USASI B31.1 code used "where applicable"
Piping to shield cooling coils	?	?	?	?	
Piping to charging pumps oil coolers	ASME III Class 3		Seismic Category I	Seismic Category A	
Charging pump oil coolers	ASME III Class 3	?	Seismic Category I	Seismic Category?	Ref. Appendix of SCE report dated March 21, 1975

TABLE 3.1 (Continued)

Components/Subsystems	Quality Group: R.G. 1.26 SRP 3.2.2	Quality Group: Plant Design	Seismic: R.G. 1.29 SRP 3.2.1	Seismic: Plant Design	Remarks
Piping to isol. valves upstream and downstream of excess letdown HX	ASME III Class 3	USASI B31.1	Seismic Category I*	Seismic Category A	*Piping up to and including isolation valves upstream and downstream of excess letdown HX
Piping to shell side of sample HXs	ANSI B31.1		Non-Seismic Category I	?	Note: Based on Table 9.2 of FSAR; infers that piping, fittings, and valves are seismic Category A
Piping to shell side of seal water HX	ASME III Class 3		Seismic Category I	?	Per Table 9.2 of FSAR, sample heat exchangers are seismic Category B
Piping to shell side of residual HXs and RHR pumps	ASME III Class 3			?	Note: Valve 705-1½" - G32 may have to be MOV.
Piping to shell side of spent fuel pit HX	ASME III Class 3			?	
Piping to shell side Recirculation HX	ASME III Class 3	USASI B31.1 Section 1	Seismic Category I	Seismic Category A	
Piping to gas stripper condenser	?	?	?	?	
Valves MOV-720A, B; TCV-601A, B located downstream of CCHX and RHRHX, respectively	ASME III Class 3	?	Seismic Category I	?	

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group R.G. 1.26 SRP 3.2.2	Quality Group Plant Design	Seismic R.G. 1.29 SRP 3.2.1	Seismic Plant Design	Remarks
Residual Heat Removal Loop					
Residual Heat Exchanger	ASME III Class 2 (tube side) Class 3 (shell side)	ASME VIII Case 1270N	Seismic Category I	Seismic Category A	
Residual Heat Removal Pumps	ASME III Class 2	No code			
Residual Heat Removal Piping, Valves, Fittings, (e.g., valves MOV-813, 814 MOV-822A, B MOV-833, 834 HCV-602)	ASME III Class 2	USASI B31.1	Seismic Category I	Seismic Category A	Note: Based on Table 9.2 of FSAR; infers that piping and valves are seismic Category A
Circulating Water System					
Salt Water Cooling Pumps	ASME III Class 3	?	Seismic Category I	Seismic Category A	Ref. Dwg. No. M20-568775 Table 9.4 of FSAR
Salt Water Supply Piping and Valves to Component Cooling Heat Exchangers	ASME III Class 3	? ?	Seismic Category I	Seismic Category A?	Note: Discharge valves POV-5 and -6 are air-operated

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group: R.G. 1.26 SRP 3.2.2	Quality Group: Plant Design	Seismic: R.G. 1.29 SRP 3.2.1	Seismic: Plant Design	Remarks
Auxiliary Salt Water Cooling Pump		?		?	
<u>Auxiliary Feedwater System</u>					Ref. Dwg. No. M20-568779 and pages 3-21 and 3-22 of FSAR
Auxiliary Feedwater Pump (motor-driven)	ASME III Class 3	?	Seismic Category I	?	Note: Aux. F.W. System is manually initiated
Auxiliary Feedwater Pump (turbine-driven)	ASME III Class 3	?	Seismic Category I	?	
Piping from Aux. Feed pumps and including containment isolation valves to connections with feedwater system lines	ASME III Class 2	?		?	
1st pt. H.P. Heater E-6B	----	----	----	----	Not sure if Aux F.W. goes through this component.
<u>Feedwater System</u>					Note: AFW system uses main feed header for a steam generator feed flow path
Piping inside containment and outside up to and including valves HV-852 A, B	ASME III Class 2	?	Seismic Category I	?	

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group R.G. 1.26 SRP 3.2.2	Quality Group Plant Design	Seismic R.G. 1.29 SRP 3.2.1	Seismic Plant Design	Remarks
Piping from valves HV-852 A, B to HV-854 A, B		?		?	
Feedwater Pumps (G-3A, G-3B)					See sheet 8
Hydraulic System for valves HV-852 A, B HV-854 A, B	N/A	----	Seismic Category I	?	
Main Steam System					
Main Steam Safety Valves	ASME III Class 2	ASME VIII	Seismic Category I	?	Ref. page 3-18 of FSAR Dwg. No. M20-568773
Steam Dump Valves (CV-76, -77, -78, -79)		?		?	Note: Dump valves have no air accumulators but actuated from air supply line
Piping from steam generators to and including the MSIVs	ASME III Class 2	(Material ASTM-A106, Grade B, Schedule 60)	Seismic Category I	Seismic Category A*	Ref. page 3-19 of FSAR per Appendix of SCE* letter dated March 21, 1975
Piping and valves from main steam line to Aux. Feedwater Pump Turbine	ASME III Class 3	?		?	

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group: R.G. 1.26 SRP 3.2.2	Quality Group: Plant Design	Seismic: R.G. 1.29 SRP 3.2.1	Seismic: Plant Design	Remarks
Compressed Air System					
Air Compressors	Quality Group D*	----	Non-Seismic Category*	Non-Seismic Category A	Ref. pages 3-76 thru 3-77 of FSAR and Dwg. No. M20-568780 *Note: Generally, compressed air system is Quality Group D; however, air systems required to perform safety functions (e.g., accumulator and piping to a safety-related valve) are seismic Category I. Air system is required for valves in the RHR, CCW, CVCS systems and for steam supply to turbine AFP and atmospheric dump valves (ADVs).
After coolers		---			
Air Receivers		---			
Emergency air compressor with receiver		---			
Instrument Air Dryer		---			
Instrument Air Header loop and filters		---			
Compressors and piping for safe shutdown valves in RHR, CCW, CVCS, AFP and ADV systems.	ASME III Class 3	?	Seismic Category I	?	
Diesel Generator Fuel Oil Storage and Supply System					Ref. Dwg. No. M20-5154026. Note: Info below is for Diesel Unit 1, but it applies to Diesel Unit 2 also. Tank located underground
Diesel Fuel Oil Storage Tank (D-23)	ASME III Class 3	ASME ?	Seismic Category I	?	
Diesel Fuel Oil Transfer Pumps	ASME Class 3	?		?	

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group: R.G. 1.26 SRP 3.2.2	Quality Group: Plant Design	Seismic: R.G. 1.29 SRP 3.2.1	Seismic: Plant Design	Remarks
Fuel Oil Filters (C-21A, C-21B)		?		?	
Fuel Oil Day Tank (D-14)	ASME III Class 3	?	Seismic Category I	?	
Piping and valves from F.O. Storage Tank to F.O. Day Tank	ASME III Class 3	ASME III	Seismic Category I	Seismic Category A	Ref. Dwg. No. M20-5154026. Tank located in diesel building, Area 16.
Fuel Oil Pumps (G-42, G-76)	ASME I Class 3	?		?	
Fuel Oil piping and Valves from F.O. Day Tank to Diesel Fuel	ASME III Class 3	ASME III or ANSI B31.1		Seismic Category A	Ref. Dwg. No. M20-5154026
<u>Diesel Generator Lube Oil System</u>					
Lube Oil Cooler (E-10)	ASME III Class 3	?	Seismic Category I	?	Ref. Dwg. No. M20-5154027. Note: Info below is for Diesel Unit 1, but it also applies for Diesel Unit 2.
Duplex L.O. Filters		?		?	
L.O. Strainer		?		?	
L.O. Pump		?		?	

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group: R.G. 1.26 SRP 3.2.2	Quality Group: Plant Design	Seismic: R.G. 1.29 SRP 3.2.1	Seismic: Plant Design	Remarks
Piping and Valves		ASME VIII or ANSI B31.1		Seismic Category A	
Diesel Generator Cooling Water System					
Cooling Water Heat Exchanger (E-5)	ASME III Class 3	?	Seismic Category I	?	Ref. Dwg. No. M20-5154028. Note: Info below is for Diesel Unit 1, but it also applies to Diesel Unit 2.
Expansion Tank (D-27)	ASME III Class 3	?	Seismic Category I	?	
Cooling Water Pump		?		?	
Piping and Valves		ASME VIII or ANSI B31.1		Seismic Category A	
Diesel Generator Starting Air System					Ref. Dwg. No. M20-5154029
Starting Air Storage Tanks (C-13A, C-13B)	ASME III Class 3	?	Seismic Category I	?	Note: Info is for Diesel Unit 1, but it also applies to Diesel Unit 2.
Piping and Valves	ASME III Class 3	ASME VIII or ANSI B31.1		Seismic Category A	

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TABLE 3.1 (Continued)

Components/Subsystems	Quality Group R.G. 1.26 SRP 3.2.2	Quality Group Plant Design	Seismic R.G. 1.29 SRP 3.2.1	Seismic Plant Design	Remarks
Diesel Generator Combustion Air Intake - Exhaust and Control Air System					Ref. Dwg. No. M20-5154030
Air Intake Filters	ASME III Class 3	?	Seismic Category I	?	Note: Info is for Diesel Unit 1, but it also applies to Diesel Unit 2.
Air Intake Silencers		?		?	
Piping	ASME III Class 3	ASME VIII or ANSI B31.1	Seismic Category I	Seismic Category A	
Exhaust Silencer	----	----	----	----	Nonsafety-related per P&ID.

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4.0 SPECIFIC RESIDUAL HEAT REMOVAL AND OTHER REQUIREMENTS OF BRANCH TECHNICAL POSITION 5-1

Branch Technical Position 5-1 contains the functional requirements discussed in Section 3.0 herein, and also, detailed requirements applied to specific systems utilized during safe shutdowns. Each requirement is presented below along with a description of the San Onofre system or component features applicable to the requirement.

4.1 RHR System Isolation Requirements

The following shall be provided in the suction side of the RHR system to isolate it from the RCS.

1. Isolation shall be provided by at least two power-operated valves in series. The valve positions shall be indicated in the control room.
2. The valves shall have independent diverse interlocks to prevent the valves from being opened unless the RCS pressure is below the RHR system design pressure. Failure of a power supply shall not cause any valve to change position.
3. The valves shall have independent diverse interlocks to protect against one or both valves being open during an RCS increase above the design pressure of the RHR system.

Evaluation

1. The San Onofre Unit 1 RHR suction line has two power operated isolation valves which have position indication in the control room.

2. The upstream valve, MOV 813 (i.e., closest to the RCS), is provided with an "open permissive" interlock. The interlock, PC-425, prevents opening MOV 813 whenever RCS (pressurizer) pressure is above 399 psig. The other (downstream) RHR suction valve, MOV 814, is under administrative control only.

   The two suction valves, MOV 813 and MOV 814, are powered from the rear panels of MCC 1 and MCC 2, respectively. Since both valves are "limitorque" type motors, a failure of the power supply (MCC 1 and/or MCC 2) would not cause valve position changes (either open-to-close, or close-to-open).

3. Neither of the two RHR suction valves are provided with "auto-closure" interlocks. The RHR pressure is controlled by the RCS pressure and RHR pump performance when the two systems are connected. Alarms are provided on the RHR system (high pressure) and RHR relief valve (high discharge temperature) which alert the control room operator that pressure is approaching RHR design pressure. To insure the RHR is not overpressurized, the RCS overpressure mitigating system (OMS) and the RHR relief valve, RV206, are provided. This is further discussed in Section 4.2.

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One of the following shall be provided on the discharge side of the RHR system to isolate it from the RCS:

1. The valves, position indicators, and interlocks described above for the suction valves.

2. One or more check valves in series with a normally closed power-operated valve. The power-operated valve position shall be indicated in the control room. If the RHR system discharge line is used for an ECCS function, the power-operated valve is to be opened upon receipt of a safety injection signal once the reactor coolant pressure has decreased below the ECCS design pressure.

3. Three check valves in series, or

4. Two check valves in series, provided that there are design provisions to permit periodic testing of the check valves for leak tightness and the testing is performed at least annually.

Evaluation

1. The San Onofre Unit 1 RHR discharge line has two power operated isolation valves which have position indications in the control room.

2. The downstream valve, MOV 834 (i.e., closest to the RCS), is provided with an "open permissive" interlock. The interlock, PC-425, prevents opening MOV 834 whenever RCS (pressurizer) pressure is above 399 psig. The other (upstream) RHR discharge valve, MOV 833, has no interlock and is under administrative control only.

The two discharge valves, MOV 833 and MOV 834, are powered from the rear panels of MCC 1 and MCC 2, respectively. Since both valves have "limitorque" type motors, a failure of the power supply (MCC 1 and/or MCC 2) would not cause valve position change (either close-to-open or open-to-close).

3. Neither of the two RHR discharge valves are provided with "auto-closure" interlocks. The RHR pressure is controlled by the RCS pressure and the RHR pump performance when the two systems are connected. To insure the RHR system is not overpressurized, the RCS overpressure mitigating system (OMS) and the RHR relief valve, RV206, are provided (see the following section).

The deviations from the BTP arising from the lack of interlocks on the RHR isolation valves are acceptable because of the combination of administrative controls and alarms provided on the RHR system. These alarms provide additional assurance that the operator action required by procedure will be taken to shut the isolation valves when RCS pressure is increasing towards RHR design pressure.

4.2 Pressure Relief Requirements - Overpressure Protection

To protect the RHR system against accidental overpressurization when it is in operation (not isolated from the RCS), pressure relief in the RHR system shall be provided with relieving capacity in accordance with the ASME Boiler and Pressure Vessel Code. The most limiting

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pressure transient during the plant operating condition when the RHR system is not isolated from the RCS shall be considered when selecting the pressure relieving capacity of the RHR system. For example, during shutdown cooling in a PWR with no steam bubble in the pressurizer, inadvertent operation of an additional charging pump or inadvertent opening of an ECCS accumulator valve should be considered in selection of the design bases.

Evaluation

The RHR and RCS can be connected whenever RCS temperature is below 330°F, and the RCS pressure is below 399 psig (due to the "open permissive" interlock). The RHR system design pressure is 500 psig. The RCS low temperature overpressure mitigating system (OMS) utilizes the two power (air) operated relief valves on the pressurizer with a low pressure (522 psig) manually enabled setpoint (References 5 and 6). The PORVs are switched from their normal high setpoint to the low pressure modes whenever the RCS pressure is below 422 psig. Therefore, the San Onofre Unit 1 OMS is available for both RCS and RHR overpressure protection.

The OMS proposed by the licensee does not take credit for the RHR relief valve, RV206. The staff has not completed its review of the San Onofre Unit 1 OMS equipment, design base scenarios and transient RCS (and RHR) pressure analyses. However, other PWRs have demonstrated adequate RHR overpressure protection by taking credit for the OMS.

Fluid discharged through the RHR system pressure relief valves must be collected and contained such that a stuck open relief valve will not:

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1. Result in flooding of any safety-related equipment,
2. Reduce the capability of the ECCS below that needed to mitigate the consequences of a postulated LOCA, or
3. Result in a nonisolable situation in which the water provided to the RCS to maintain the core in a safe condition is discharged outside of the containment.

Evaluation

1. The RHR relief valve, RV206, discharge is directed to the pressurizer relief tank (PRT) via a 4-inch line. The 4-inch line joins with the 10-inch combined pressurizer safety valves (two) and PORVs (two) discharge before it enters the PRT. Once the 10-inch line enters the 8800 gallon capacity PRT, the fluid (or vapor) is discharged in a header under the water level. The PRT level control system maintains about 7100 gal for steam quenching. An air controlled drain valve directs excess liquid to the containment drain header (2-inch). The PRT rupture disc will prevent overpressurizing the tank, and opens at 100 psig. The liquid will then spill out onto the containment floor, and into the containment sump where the recirculation pumps (two) or containment sump pump can be used to drain the sump.

   If the RHR relief valve stuck open, then a maximum of 783 gpm* would be lost out the RCS and RHR systems. In about 2.20 minutes,

*RV206 relieves 783 gpm at 25% overpressure (625 psig) from Reference ____.

the PRT would be full, and the rupture disc would open. In this situation, the RHR pump flow would decrease, and the "low flow alarm" would alert the operator to an abnormal situation. Since there is no safety-related equipment in the containment sump or on the containment floor, no flooding of ECCS related equipment would result.

2. The RHR system is not utilized during either the injection or the recirculation phases following a LOCA. Therefore, a stuck open RHR relief valve does not reduce the capability of the ECCS equipment.

3. The RHR relief valve and the relief's discharge point, the containment sump, is inside containment. Therefore, there is no net loss of RCS fluid.

If interlocks are provided to automatically close the isolation valves when the RCS pressure exceeds the RHR system design pressure, adequate relief capacity shall be provided during the time period while the valves are closing.

Evaluation

As discussed, the SCS isolation valves (two suction and two discharge) are not furnished with an auto closure feature, therefore, this requirement is not applicable.

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4.3 Pump Protection Requirements

The design and operating procedures of any RHR system shall have provisions to prevent damage to the RHR system pumps due to overheating, cavitation or loss of adequate pump suction fluid.

Evaluation

The RHR pumps have shaft bearings cooled by a lubricating oil system. If the bearing began to wear unevenly, if the shaft began to bind, or if for any reason the bearing began to overheat, the lubricating oil temperature would increase. The licensee intends to add a "HI RHR pump LUBE OIL" alarm which would alarm at 160 °F. However, this alarm may not indicate motor overheating, pump cavitation or loss of suction flow.

Between the RHR system suction and discharge lines, there is an unisolable 3/4" line which would provide small amount of flow if one (or both) of the suction valves shut. SCE states that the flow through this line is sufficient to keep the pump suction flooded, if the suction MOV's were inadvertently shut (e.g., prevent cavitation), or to keep pump temperatures normal.

The RHR system has the following indications which could alert the operator to a problem with RHR flow:

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	Indication or Alarm	Location
1.	MOV 813, 814 Position Indications	Control Room
2.	MOV 833, 834 Position Indications	Control Room
3.	RHR pump motor current (both)	Indication and Alarm in Control Room
4.	RHR pump pump discharge pressure (both)	Local
5.	RHR pump bearing temperature	Local
6.	RHR pump discharge header pressure	Indication Local, Alarm in Control Room
7.	RHR heat exchanger discharge temperature	Control Room
8.	RHR to RCS return flow indication	Control Room
9.	RHR to RCS return flow indication (alarm - LOW)	Control Room
10.	RHR to RCS return flow temperature indication	Local
11.	HCV-602 valve position	Indication in Control Room

There is no automatic RHR pump trip when the RHR system suction valves are not fully open.

The system alarms and indication provide sufficient warning for the operator for protection against RHR pump overheating, cavitation, or loss of suction fluid.

4.4 Test Requirements

The isolation valve operability and interlock circuits must be designed so as to permit on line testing when operating in the RHR mode. Testability shall meet the requirements of IEEE Standard 338 and Regulatory Guide 1.22.

The preoperational and initial startup test program shall be in conformance with Regulatory Guide 1.68. The programs for PWRs shall include tests with supporting analysis to (a) confirm that adequate mixing of borated water added prior to or during cooldown can be achieved under natural circulation conditions and permit estimation of the times required to achieve such mixing, and (b) confirm that the cooldown under natural circulation conditions can be achieved within the limits specified in the emergency operating procedures. Comparison with performance of previously tested plants of similar design may be substituted for these tests.

Evaluation

1. Since the San Onofre Unit 1 RHR system has only one suction line connecting the RCS to the RHR system (i.e., "drop line"), the two suction MOVs can't be checked for operability while the RHR system is in operation without an interruption of RHR flow. However, when the decay heat level has significantly dropped, the RHR flow could be stopped for short intervals for MOV operability tests. This does not seem prudent to the staff since MOV testing can result in valve failure with a potential long term loss of RHR cooling. (The RHR system MOVs only have an "open permissive" interlock, which could, if necessary, be checked along with the MOV operability.)

2. The licensee conducted natural circulation tests and included the test findings in the FSAR. These tests conclusively showed the presence of natural circulation in the RCS, but did not address either the assumed cooldown rate in the emergency operating procedures or the adequacy of mixing of borated water being added during a cooldown. However, the staff believes that, with the boric acid concentrations used for shutdown, adequate boron mixing will occur under natural circulation flow.

4.5 Operational Procedures

The operational procedures for bringing the plant from normal operating power to cold shutdown shall be in conformance with Regulatory Guide 1.33. For pressurized water reactors, the operational procedures shall include specific procedures and information required for cooldown under natural circulation conditions.

Evaluation

Operational procedures reviewed in this comparison of the San Onofre Unit 1 plant to BPT RSB 5-1 are discussed in Section 2.0. All of the procedures require the use of nonsafety-grade equipment for portions of the shutdown operation. No procedures exist for shutdown and cooldown using safety-grade equipment only. Also, the licensee's procedure for shutdown with loss of offsite power does not provide instructions for switching to alternate sources of auxiliary feedwater after the CST supply is exhausted, nor does it provide the steps required to achieve cold shutdown conditions. The need for the procedural steps identified above is not identified in Regulatory Guide 1.33 but stems from the provisions of BTP RSB 5-1 and SEP Topic VII-3. The staff will consider requiring the licensee to develop these procedures during the SEP integrated assessment of the facility. We have concluded that the procedures for safe shutdown and cooldown at San Onofre Unit 1 are in conformance with Regulatory Guide 1.33.

4.6 Auxiliary Feedwater Supply

The seismic Category I water supply for the auxiliary feedwater system for a PWR shall have sufficient inventory to permit operation at hot shutdown for at least 4 hours, followed by cooldown to the conditions permitting operation of the RHR system. The inventory needed for cooldown shall be based on the longest cooldown time needed with either only onsite or only offsite power available with an assumed single failure.

Evaluation

The RCS cooldown rates and AFS inventories under varying conditions are discussed in Section 3.2.

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5.0 RESOLUTION OF SEP TOPICS

The SEP topics associated with safe shutdown have been identified in the INTRODUCTION to this assessment. The following is a discussion of how San Onofre Unit 1 meets the safety objectives of these topics.

5.1 Topic V-10.B RHR System Reliability

The safety objective for this topic is to ensure reliable plant shutdown capability using safety-grade equipment subject to the guidelines of SRP 5.4.7 and BTP RSB 5-1. The San Onofre Unit 1 systems have been compared with these criteria, and the results of these comparisons are discussed in Sections 3.0 and 4.0 of this assessment. Based on these discussions, we have concluded that the systems fulfill the topic safety objective subject to the resolution of the following in the SEP integrated assessment:

1. The requirement for including, in plant operating procedures, procedures for shutdown and cooldown using safety-grade equipment only.

2. The need for provisions, in the shutdown with loss of offsite power procedure, to identify alternate sources of auxiliary feedwater and to achieve cold shutdown.

5.2 Topic V-11.A Requirements for Isolation of High and Low Pressure Systems

The safety objective of this topic is to assure adequate measures are taken to protect low pressure systems connected to the primary system from being subjected to excessive pressure which could cause failures and in some cases potentially cause a LOCA outside of containment.

This topic is assessed with regard to the isolation requirements of the RHR system from the RCS. As discussed in Section 4.2, during RHR cooling of the RCS, the RHR relief valve itself does not provide sufficient relief capacity to protect the RHR system from overpressure by the most severe postulated transients. However, our reviews of other PWRs have shown that the RHR system is provided adequate overpressure protection if credit is taken for the reactor vessel overpressure mitigating systems (OMS). The San Onofre Unit 1 OMS is currently under design review by the NRC staff. The review is scheduled for completion in the near future. Based on the previous success in applying credit for the OMS to RHR overpressure protection, we determined that it is acceptable to postpone resolution of this issue until the OMS is reviewed.

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5.3 Topic V-11.B RHR Interlock Requirements

The safety objective of this topic is identical to that of Topic V-11.A. The staff conclusion regarding the San Onofre Unit 1 RHR valve interlocks, as discussed in Section 4.1, is that adequate interlocks exist.

5.4 Topic VII-3 Systems Required for Safe Shutdown

The safety objectives of this topic are:

1. To assure the design adequacy of the safe shutdown system to (a) initiate automatically the operation of appropriate systems, including the reactivity control systems, such that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences or postulated accidents, and (b) initiate the operation of systems and components required to bring the plant to a safe shutdown.

2. To assure that the required systems and equipment, including necessary instrumentation and controls to maintain the unit in a safe condition during hot shutdown, are located at appropriate locations outside the control room and have a potential capability

for subsequent cold shutdown of the reactor through the use of suitable procedures.

3. To assure that only safety-grade equipment is required for a PWR plant to bring the reactor coolant system from a high pressure condition to a low pressure condition.

Safety objective 1(a) will be resolved in the SEP design basis event reviews. These reviews will determine the acceptability of the plant response, including automatic initiation of safe shutdown related systems, to various design basis event, i.e., accidents and transients (Reference 8).

Objective 1(b) relates to availability in the control room of the control and instrumentation systems needed to initiate the operation of the safe shutdown systems and assures that the control and instrumentation systems in the control room are capable of following the plant shutdown from its initiation to its conclusion at cold shutdown conditions. The ability of San Onofre Unit 1 to fulfill objective 1(b) is discussed in the preceding sections of this report. Based on these discussions, we conclude that safety objective 1(b) is met by the safe shutdown system at San Onofre Unit 1 subject to the findings of related SEP electrical, instrumentation and control topic reviews.

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Safety objective 2 requires the capability to shut down to both hot and cold shutdown conditions using systems instrumentation, and controls located outside the control room. Emergency Operating Instruction (EOI) S-3-5.28, Revision 3, "Fire in the Control Room or Forced Evacuation of Control Room," defines the equipment available and the auxiliary control panel, assigns tasks to specific positions on the operating staff, and describes the step-by-step actions required to shut down and cool the plant to approximately 400 psig main steam pressure (450°F).

If the auxiliary control panel is operable, the following components will be in service at the panel:

Cold leg temperature indicators 402B, 421B and 422B

Pressurizer pressure from PI 434A

Pressurizer level from LI 451C

Steam generator levels from LI 450C, 451C and 452C

Reactor power level indication from fission chamber with range from 10-7 to 100% power and a startup rate meter from -1 to 7 decades/minute.

A steam dump selector switch with "off-local" position and local control for steam dump to atmosphere with 0% to 100% valve position indication.

A feedwater control transfer switch with "off-local" position and local control for auxiliary feedwater regulators with 0% to 100% valve position indication.

An electric auxiliary feedwater pump "start-stop" switch.

The following steps have been taken from EOI S-3-5.28, Revision 3, to describe the sequence of operations:

Control Room Evacuation

1. If control room evacuation becomes necessary, trip the reactor. If unable to trip the reactor before the control room is evacuated, trip it from either the 4 kV switchgear room or the DC distribution switchgear room.

2. If auxiliary control panel is operable, proceed with the following:

   a. Watch Engineer: Proceed to auxiliary control panel and unlock door.

   b. Plant Equipment Operator: Open discharge valve on auxiliary feedwater pump and verify auxiliary feedwater pump running either from auxiliary control panel or local breaker operation.

   c. Control Operator: Operate feedwater control switch to "local" and stabilize steam generator levels.

      Operate steam dump transfer switch to "local" and maintain reactor coolant temperature at approximately 535°F with steam dump to atmosphere.

   d. Assistant Control Operator: Stop east and west feedwater pumps and verify heater drain pumps tripped.

      Verify unit PCBs have opened by position relay 452AX at south auxiliary relay panel in 4 kV room.

3. If the auxiliary panel is not operable, the following steps will be done:

   a. The Plant Equipment Operator:

      (1) Start electric auxiliary feedwater pump by manual breaker operation (ACB-52-1306). If electric pump is not available, start steam-driven pump. Open discharge valve. Report to feedwater mezzanine.

(2) Maintain steam generator levels using handjack control on auxiliary feedwater regulator.

(3) Close pressurizer steam space sample return to volume control tank, valve 999; RCS pressure will be indicated on PI 905 in the sample room.

b. Control Operator: With auxiliary feedwater pump running, stop east and west feed pumps and verify heater drain pumps are off. Verify unit PCBs have opened by position relay 452AX at south auxiliary relay panel in 4 kV room.

c. Watch Engineer: Report to the feedwater mezzanine and monitor steam generator level and steam temperature.

4. Periodic inspection of FIT 1112 and PI 905 will be made to assure pressurizer level and pressure are maintained or by pressurizer level indication at auxiliary control panel.

The above procedure places the plant in a hot shutdown and partially cooled down condition (to 450°F). Information gathered at the SEP safe shutdown site visit and information presented in References 9 and 10 show that the capability exists to continue the plant cooldown to cold shutdown conditions using systems described in Section 3.2 from outside the control room. We therefore conclude that San Onofre Unit 1 meets safety objective 2 of Topic VII-3 with the exception of the lack of a written procedure to achieve cold shutdown conditions. The need for such a procedure will be evaluated in the SEP integrated assessment of the plant.

The adequacy of the safety-grade classification of safe shutdown systems at San Onofre Unit 1, to show conformance with safety objective C, will be completed in part under SEP Topic III-1, "Classification of Structures, Components and Systems (Seismic and Quality)," and in part under the design basis event reviews. Table 3.1 of this report will be used as input to Topic III-1.

5.5 Topic X Auxiliary Feed System (AFS)

The safety objective for this topic is to assure the AFS can provide adequate cooling water for decay heat removal in the event of loss of all main feedwater using the guidelines of SRP 10.4.9 and BTP ASB 10-1.

The San Onofre Unit 1 AFS is described in Section 3.2. This system has been compared with SRP 10.4.9 and BTP ASB 10-1 with the following conclusions:

1. The San Onofre Unit 1 plant, including the AFS, will be reevaluated during the SEP with regard to internally- and externally-generated missiles, pipe whip and jet impingement, quality and seismic design requirements, and the effects of earthquakes, tornadoes and floods.

2. The AFS conforms to General Design Criterion (GDC) 19, "Control Room," GDC 45, "Inspection of Cooling Water Systems," and GDC 46, "Testing of Cooling Water Systems." GDC 5, "Sharing of Structures, Systems and Components," is not applicable.

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3. The AFS meets the requirements for power diversity, but manual operation of valves is required to operate the system. In this case, manual valve operation is permissible because, with no feed, the steam generator water inventory can remove decay heat for at least 15 minutes.

4. The San Onofre Unit 1 AFS is not automatically initiated and the design does not have capability to automatically terminate feedwater flow to a depressurized steam generator and provide flow to the intact steam generator. The effect of this design will be assessed in the design basis event evaluations for San Onofre Unit 1.

5. The AFS control system deviates from the provisions of Regulatory Guide 1.62 regarding manual actuation at the system level from the control room. The turbine-driven pump must be started locally, from outside the control room. Although the motor-driven pump can be started from the control room, manual valves located outside the control system must be opened to align the pump discharge to the steam generators. The significance of this deviation will be reevaluated in the SEP design basis event evaluation of accidents and transients for the plant.

6. The licensee has made several design and procedural changes to limit the occurrence of waterhammer. The staff is continuing to evaluate feed system waterhammer for the plant on a generic basis. SEP Topic V-13, "Waterhammer," applies.

7. A failure of the single pump suction from the CST would prevent the AFS from supplying feedwater to the steam generators even without an assumed concurrent single active failure. Also, such a break could lead to the failure of an AFP from lack of suction fluid because insufficient instrumentation is available in the control room to detect significant suction line leakage. Should this pipe failure occur, an alternate method of steam generator feeding, using the main feed pumps as described in Section 3.2, exists. Even though this alternate method is available and its existence alleviates the need for any immediate corrective measures, the staff intends to examine the need for a long-term improvement in the redundancy of the AFS at San Onofre Unit 1. This will be considered in the SEP integrated assessment of the plant.

8. The technical specifications for the AFS will be reevaluated against current requirements under SEP Topic XVI, "Technical Specifications."

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6.0 REFERENCES

1. Staff Discussion of Fifteen Technical Issues Listed in Attachment to November 3, 1976 Memorandum from Director, NRR, to NRR Staff, NUREG-0138, November 1976.

2. San Onofre Nuclear Generating Station, Unit 1, Final Engineering Report and Safety Analysis, attached to SCE letter dated November 19, 1965, as amended.

3. Appendix A to Part 50 of the Code of Federal Regulations, Title 10.

4. Proposed American Nuclear Society Standard 5.1, "Decay Heat Release Rates Following Shutdown of Uranium-Fueled Thermal Reactors," 1973.

5. SCE letter, K. Baskin to A. Schwencer, dated October 12, 1977.

6. SCE letter, K. Baskin to D. Ziemann, dated March 7, 1978.

7. SCE letter, K. Baskin to A. Schwencer, dated May 2, 1977.

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8. Systematic Evaluation Program, Status Summary Report, NUREG-0485, November 17, 1978.

9. "Fire Protection Program Review, BTP APCSB 9.5-1, San Onofre Nuclear Generating Station, Unit 1," March 1977, transmitted by SCE letter dated March 16, 1977.

10. SCE letter, K. Baskin to D. Ziemann, dated October 13, 1978.

plants. Construction of an ethnobotanical model with the hope of stretching inferences back prior to Spanish contact is tenuous, at best. The following discussion should be viewed as possible prehistoric uses of flora within the region.

The single most important food source for the Late Milling peoples was the acorn. Although nearby stands of coast live oak and scrub oak provide a substantial quantity of acorns, the black oak, growing in the upland mountain regions, was preferred. Acorn collection and processing involves a series of specialized activities, ranging from scheduling (knowledge of when acorns are ripe and easiest to harvest), to shelling, grinding and leaching (Bean and Saubel 1972:121-1129; Hedges 1967:4-8; Lee 1937:241; Cuero 1968:30-31).

Ethnohistorical and ethnographic data indicate the importance of females in procuring and preparing foodstuffs in aboriginal hunting and gathering societies. One early visitor (Bartlett 1854:122) to the village of San Felipe noted: "The women appear to be the chief laborers, the men lounging about the camp most of the day." Moving on to the *rancheria* of Vallecitos, Bartlett (1854:125) noted much the same about Diegueños residing there: "The laboring or preparing them [the acorns] for food is, like almost all other labor, performed by the women, who were to be seen in front of every hut wielding their heavy stone pestles."

Preparation of acorns requires specialized activities requiring technological diversity through the use of certain tools (i.e. hammerstone, mano, pestle) and specific grinding platforms (i.e. metates, mortars, slicks). The presence of all these implements and features within the area is evidence for acorn processing and use.

Although the nutritional value of acorns varies with species, size and preparation method, Bean and Saubel (1972: 125-126) have noted that acorns are very high in fat content and caloric value, but contain less protein and carbohydrates than most cereal grains. Seasonal variation in acorn availability, accessibility of alternate food sources, and time of the year determine the relative importance of acorns at any given time. White (1963:121) has suggested that acorns comprised almost 50% of the Luiseño diet.

The inhabitants of the study area would have had access to a wide variety of native fruits that are ethnographically recorded as edible. Manzanita and holly-leaf cherry provided a fruit and a seed that could be ground into a meal (Hedges 1967:34; Bean and Saubel 1972:41; Cuero 1968:31; Sparkman 1908:194-230). Prickly pear and elderberry were consumed fresh or were dried for storage (Hedges 1967:24, 44; Sparkman 1908:195; Bean and Saubel 1972:77, 138; Lee 1937:138-142, 155-156). Toyon berries were eaten fresh or were dried or parched before consumption (Bean and Saubel 1972:77; Sparkman 1908:194). Spanish dagger served as a fruit that was usually roasted prior to being eaten, although sometimes it was eaten raw.

Many of the plants comprising the Chaparral community have edible seeds that are easily harvested. Black and white sage seeds and leaves were ground into a meal that was made into mush or used to supplement other foods such as acorns (Sparkman 1908:229; Spier 1923:335; Hedges 1967:31; Lee 1937: 63; Bean and Saubel 1972:136-138). Besides providing fruit, both prickly pear and Spanish dagger generate seeds that can be used as food (Sparkman 1908:230; Lee 1937:41; Spier 1923:336).

The riparian habitats along adjacent streams were a favored exploitation area for greens and native vegetables to supplement the native diet (Cuero 1968:33-34). Bartlett (1854:122) noted that the Diegueños at San Felipe waded "about the marsh gathering roots and seed..." Many of these greens were eaten raw; others were boiled or dried for later use. New leaves and tender shoots of white sage were eaten raw; blossoms of Spanish dagger were parboiled, and prickly pear pads were boiled (Hedges 1967:24, 31; Sparkman 1908:195-196; Lee 1937:126, 243; Spier 1923:336).

Beverages serve an important role in any diet, as sources of water, sugars, nutrients, and refreshment. Native Americans in the San Diego area soaked manzanita pulp and/or the whole fruit in water to produce a beverage (Cuero 1968:31; Bean and Saubel 1972:40-41). Lemonadeberry was mixed with water to produce a slightly acidic beverage (Bean and Saubel 1972:132). Cana was often boiled to produce a tea that served as a refreshment and a medicinal tonic (Hedges 1967:19; Bean and Saubel 1972:70).

Beverages were also made from berries of the sugar bush and basketweed (Bean and Saubel 1972:132).

Many plants that were used as food sources also provided medicines. White sage, one of the most important curative plants, doubled as a medicine and a purifier (Cuero 1968: 50; Hedges 1967: 31; Bean and Saubel 1972:136; Sparkman 1908:1-9). White sage and California sagebrush were smoked or consumed as a cure for colds. White sage leaves were also used in a sweathouse as a vapor-producing medicinal (Bean and Saubel 1972:136, 138; Hedges 1967:44; Lee 1937:214, 243).

Teas containing medicinal herbs and spices were a common method for treating colds, influenza and respiratory problems. Medicinal teas were made from white sage (Hedges 1967: 31), elderberry blossoms (Bean and Saubel 1972:138), and holly-leaf cherry bark (Bean and Saubel 1972:120). Fevers were cured by drinking tea made from elderberry blossoms (Hedges 1967:44; Bean and Saubel 1972:138; Lee 1937: 214, 243). Teas made by boiling buckwheat leaves or flowers (Bean and Saubel 1972:72) or manzanita leaves (Bean and Saubel 1972:41) were also used as a treatment for gastric disorders and diarrhea.

Washes and antiseptic solutions were made from buckwheat, scrub oak, white sage, mistletoe, and chamise (Hedges 1967:38, 43; Bean and Saubel 1972:72, 129, 136). Poultices made from boiled cottonwood leaves were used for sprains, sore muscles, minor cuts, and headaches (Hedges 1967:39; Bean and Saubel 1972:106).

Construction materials for houses, fiber and thatching came from willows, oak, manzanita, deer weed, and chamise (Bean and Saubel 1972:29-31; Lee 1937:59; Cuero 1968:25; Spier 1923:338). Spanish dagger was the most commonly used source of fiber because of its pliable yet strong nature, plus its resistance to moisture and rotting (Cuero 1968:25, 31; Bean and Saubel 1972:152; Lee 1937:58-60; Spier 1923:338).

Firewood was derived from oak timbers and bark (Bean and Saubel 1972:130). Chamise roots were used in roasting pits; chamise branches were tied together to make torches (Bean and Saubel 1972:30). Manzanita served as a major fuel source, especially for indoor use, because of its clean burning (Spier 1923:41, 339).

Local floral resources could have provided a viable source of basket or thatching material, including basket weed, bunch or deer grass, willow, and juncus (Merrill 1973:13-16). Storage vessels or granaries were made of scrub oak, chamise and coffeeberry (Cuero 1968:31; Hedges 1967:13, 38, 40; Bean and Saubel 1972:135; Lee 1937:79-81). Dyes for baskets came from elderberry (Bean and Saubel 1972:138).

Soap was derived from a variety of plants, depending upon the season and availability. Spanish dagger root was culturally preferred and usually accessible (Bean and Saubel 1972:151-152; Cuero 1968:33). Sea-blite was another source of natural soap (Cuero 1968:33).

In summary, the area in and around the project area could have afforded native Americans a veritable garden-storehouse of foods, medicines, condiments, and construction materials. Although ethnographic data cannot be directly applied to the prehistoric period, it may be inferred that at least some of the above data would apply to the aboriginal people who inhabited the study area.

3. Ethnographic/Ethnohistoric Data

The area in and around the Mission San Luis Rey de Francia was apparently heavily populated by the Late Milling Luiseño peoples. In a dialogue reportedly dictated about 1835 by Pablo Tac, a Luiseño neophyte, the Luiseño name of *Quechla* was given for San Luis Rey (Tac 1958:19). Pablo Tac stated that *quechlam* was the plural form of a native word for a certain kind of stone and that *quechla* was the singular form. A recent historian (Hudson 1964) noted that *Keish, Qee'sh*, and *Quechla* are orthographic variances for the same Luiseño village/placename. In his 1908 study of the Luiseño, Sparkman (1908:191) reported that his informants called San Luis Rey *Keish*.

The San Luis Rey area contained 21 different Luiseño clans, indicating a dense and diverse population, equalled in numbers of clans only by the *rancheria* at Pechanga (Strong 1929:276-277). Based on Kroeber's estimate (1970:686) that a clan was comprised of 25 to 30 persons, a population of between 525 and 630 Luiseños can be suggested for the San Luis Rey area.

Kroeber (1970:Plate 57) recorded four villages in the vicinity of Mission San Luis Rey: *Keish* (at San Luis Rey); *Wiasamai* and *Wahaumai*, located west of San Luis Rey; and *Kwalam*, located halfway between San Luis Rey and Pala.

The presence of Luiseños throughout the lower portions of the San Luis Rey River is well-documented by historians, early explorers and ethnographers. In July 1769, a Spanish exploring party led by Don Gaspar de Portolá crossed the wide San Luis Rey River Valley on their way to Monterey (Carrico 1977). Portolá and his men found the valley floor "so green that it seemed to us that it had been planted" (Palou 1926:116). It was also noted that two large Luiseño villages were situated on both sides of El Camino Real at opposite ends of the valley.

The Spaniards found the natives to be friendly, outgoing and prepared for their arrival. Because of the water supply, lush vegetation and large numbers of natives, it was recommended that the San Luis Rey Valley, originally named San Juan Capistrano, be considered as a potential mission site. Twenty-nine years later, in 1798, a mission was officially founded at San Luis Rey, although a church would not be built until 1802. The present mission structure was begun in 1811 and completed in 1815. Mission San Luis Rey de Francia was one of the most successful California missions in terms of converting natives and development of a farming/grazing subsistence.

Secularization of the mission, circa 1829, left the church without funds to support its large gardens, to maintain the thousands of heads of livestock or its converted native population. Gradually, the mission fell into a dilapidated state and the natives drifted away from the mission system. The American takeover of California, which was finalized by statehood in 1850, led to further deterioration of the church.

Although Cave Couts had settled at Rancho Guajome and a fellow named Dunn controlled the nearby Rancho Buena Vista, the San Luis Rey River Valley remained sparsely populated well into the 1870s. In 1860 the Tibbetts family was apparently the only white settlers in the valley (Elliott 1883:180). P.A. Graham farmed the valley in the late 1860s and ultimately established a thriving mercantile business with J.L. Nugent (Elliott 1883:169).

By the 1870s the Hubberts, Goldbaums, Crouchs and other pioneer families had settled in the valley. Benjamin Hubbert and his father grazed cattle and raised cereals in and around the present study area. Simon Goldbaum owned and farmed land east of the project site; Herbert Crouch was a successful sheep rancher. The old El Camino Real crossed the San Luis Rey River Valley immediately east of the current project site (San Diego County maps 1877 and 1879). Many a traveller traversed the old dirt road through San Luis Rey on their way to, or from, Los Angeles. Judge Benjamin Hayes (1929:117-118, 141, 144) among others often commented on the lushness or harshness of the river bottom land, depending upon the season. In May 1860, Hayes reported that the hills were covered with rows of golden oats and that a Luiseño *rancheria* was still occupied near the mission (1929:201).

Over the years many of the larger ranches throughout the valley have been replaced by smaller spreads or commercial/urban development. The remains of individual ranch structures and of the old American village of San Luis Rey have either been destroyed or covered over with later improvements, although scattered traces of early San Luis Rey still remain.

REFERENCES CITED

Bada, Jeffrey R.

1974 Racemization of amino acids: a new dating technique. *Science*, May 1974.

Bancroft, Hubert H.

1886 *The History of California: the works of Hubert Howe Bancroft*. The History Company, San Francisco.

Barrows, David Prescott

1900 *Ethnobotany of the Cahuilla Indians of southern California*. University of Chicago Press, Chicago.

Bartlett, John R.

1854 *Personal narrative of explorations and incidents in Texas, New Mexico, California, Sonora, and Chihuahua*. D. Appleton and Company, New York.

Bean, Lowell John, and Katherine Siva Saubel

1972 *Temalpakh: Cahuilla Indian knowledge and usage of plants*. Malki Museum Press, Banning, California.

Carrico, Richard L.

1975 The archaeological excavation and salvage of the Rimbach Site (W-654). Unpublished manuscript on file at County of San Diego.

1977b Portola's 1769 trek and the native Americans of coastal San Diego County. *Journal of California Anthropology*, 4(1):31-41.

Carter, George F.

1957 *Pleistocene man at San Diego*. Johns Hopkins Press, Baltimore.

Caughey, John W. (ed.)

1952 *The Indians of southern California in 1852*. Huntington Library, San Marino, California.

Childers, Morlin

1974 The Yuha burial, a paper presented at the Society for California Archaeology annual conference, 1974, Riverside.

Cuero, Delfina

1968 *The autobiography of Delfina Cuero, as told to Florence Shipek.* Dawson's Book Shop, Los Angeles.

Elliott, Wallace

1883 *History of San Bernardino and San Diego Counties.* Wallace Eliott and Publishers, San Francisco.

Ezell, Paul H.

1974 Personal communication, San Diego, California.

Gifford, Edward W.

1918 Clans and moieties in southern California. *University of California Publications in American Archaeology and Ethnology*, 14:167-174. Berkeley.

Harding, Mabel

1951 La Jollan Culture. *El Museo I* (1). San Diego.

Hayes, Benjamin Ignatius

1929 *Pioneer notes from the diaries of Judge Benjamin Hayes, 1849-1875.* Los Angeles: private printing.

Hedges, Ken

1967 Santa Ysabel ethnobotany. Unpublished manuscript on file at San Diego Museum of Man.

Heizer, Robert F., and M.A. Whipple

1957 *The California Indians.* University of California Press, Berkeley.

Hooper, Lucille

1920 The Cahuilla Indians. *University of California Publications in American Archaeology and Ethnology*, 16:315-380. Berkeley.

Hudson, Tom

1964 *Three paths along a river: the heritage of the Valley of San Luis Rey*. Southwest Publishers, Palm Desert.

Kaldenberg, Russell L., and Paul H. Ezell

1974 Results of the archaeological mitigation of Great Western sites A and C, located on the proposed Rancho Park North Development near Olivenhain, California. Manuscript in hands of the authors and on file at San Diego State University, Department of Anthropology.

Kroeber, Alfred L.

1970 *Handbook of the Indians of California*. (3rd edition) California Book Company, Berkeley.

Lee, Melicent

1937 *Indians of the oaks*. Privately published, San Diego.

Lewis, Henry T.

1973 *Patterns of Indian burning in California: ecology and ethnohistory*. Ballena Press, Ramona, California.

Meighan, Clement W.

1954 A late complex in southern California prehistory. *Southwestern Journal of Anthropology*, 10:215-227.

Merrill, Ruth Earl

1973 *Plants used in basketry by the California Indians*. Ballena Press, Ramona, California.

Moriarty, James R.

1965 Cosmogony, rituals and medical practices among the Diegueño Indians of southern California. *Anthropological Journal of Canada*, 3(3):216.

Moriarty, James R.

1966 Culture phase divisions suggested by typological change, coordinated with stratigraphically controlled radiocarbon dating at San Diego. *Anthropological Journal of Canada*, 7(3):1-18.

1969 The San Dieguito complex: suggested environmental and cultural relationship. *Anthropological Journal of Canada*, 7(3):1-18.

Moriarty, James R., George Shumway, and Claude Warren

1959 Scripps Estates Site I (SDi-525): a preliminary report on an early site on the San Diego coast. *University of California Archaeological Survey 1958-1959 Annual Report*, pp. 185-216, Los Angeles.

Palou, Francisco

1926 *Historical memoirs of new California.* Herbert E. Bolton (ed.), 4 volumes, University of California Press, Berkeley, 2:116-121.

Rogers, Malcolm

1939 Early lithic industries of the Lower Basin of the Colorado and adjacent desert regions. *San Diego Museum Papers, No. 3* (May 1939).

1945 An outline of Yuman prehistory. *Southwestern Journal of Anthropology*, 1(1):167-198.

1966 *Ancient hunters of the far west*, Richard F. Pourade (ed.), Copley Press, San Diego.

San Diego County

1877
1879
1879 Plat maps of San Diego County, maps on file with the County of San Diego.

Shipek, Florence

1974 Personal communication, San Diego, California.

Sparkman, Philip Stedman

1908 The culture of the Luiseño Indians. In *University of California Publications in American Archaeology and Ethnology*, 8(4):187-234.

Spier, Leslie

1923 Southern Diegueño customs. In *University of California Publications in American Archaeology and Ethnology*, 20(16):292-358.

Strong, William D.

1929 Aboriginal society in southern California. *University of California Publications in American Archaeology and Ethnology*, 26(1):1-358. Berkeley.

Tac, Pablo

1958 *Indian life and customs at Mission San Luis Rey*. Privately published at Old Mission, San Luis Rey, California.

Treganza, Adan

1947 Possibilities of an aboriginal practice of agriculture among the Southern Diegueño. *American Antiquity*, 12:169-173. Salt Lake City.

True, D.L.

1959 An early complex in San Diego County, California. *American Antiquity*, 23(3):255-264.

1966 Archaeological differentiation of Shoshonean and Yuman speaking groups in southern California. Unpublished doctoral dissertation, University of California at Los Angeles.

1970 Investigation of a late prehistoric complex in Cuyamaca Rancho State Park, San Diego County, California. *Monograph Series of the Archaeological Survey*. University of California at Los Angeles.

Wallace, William J.

1955 A suggested chronology for southern California coastal archaeology. In *Southwestern Journal for Anthropology*, 11:214-230.

1960 Archaeological resources of the Buena Vista watershed, San Diego County. *University of California, Los Angeles Annual Survey Report, 1959-60*, pp. 277-366. Los Angeles.

Warren, Claude N.

1961 The San Dieguito complex and its place in San Diego County prehistory. *University of California, Los Angeles Annual Survey Report, 1960-61*, pp. 246-201.

Warren, Claude N., D.L. True, and A. Eudey

1961 Early gathering complexes of western San Diego County. *University of California, Los Angeles Archaeological Survey Annual Report, 1960-61*, Los Angeles.

White, Raymond C.

1963 Luiseño social organizations. *University of California Publications in American Archaeology and Ethnology*, 48(2):1-194.

APPENDIX D

ARCHAEOLOGICAL RECORD SEARCHES

SAN DIEGO MUSEUM OF MAN

1350 El Prado, Balboa Park, San Diego, California 92101, Telephone (714) 239-2001

REPORT ON ARCHAEOLOGICAL SITE FILES RECORD SEARCH

Source of Request: WESTEC Services, Inc. - William T. Eckhardt

Date of Request: 7 July 1978 (x)Letter ( )Telephone ( ) In Person

Date Request Received: 10 July 1978 (x)Map Received (x)Map Returned

Name of Project: SDG&E Transmission Line Survey

( ) The Museum of Man files show no recorded sites for the project area.

(x) The Museum of Man files show the following sites (x)within (x)in the vicinity of the project area.

Site No. W-116 Culture(s): San Dieguito II, La Jolla II, Yuman III

Description: Highland accretion camp; many cobble hearths and some platforms; many manos, metates, and lithics; very large Yuman midden over La Jollan level; quarry area in bed of cobbles. Recorded by: M.J.Rogers 1929

Site No. W-117 Culture(s): La Jolla II, trace of Yuman III

Description: Highland camp; hearth stones, midden, shell; numerous metates and artifacts; hearths and traces of shell extend ½ mile north. Recorded by: M.J.Rogers 1929

Site No. W-118 Culture(s): San Dieguito II, La Jolla II, possible La Jolla I

Description: Slough terrace permanent site; cobble hearths; burial; intrusive Channel Island artifacts; shell and charcoal in midden; San Dieguito materials below La Jolla midden on sandstone. Burial found in suspected La Jolla I level. Recorded by: M.J.Rogers 1929

Site No. W-119 Culture(s): La Jolla II, traces of San Dieguito II, La Jolla I, Yuman III

Description: Highland slough terrace midden, permanent type; cobble hearths; one cobblestone sweathouse; burial uncovered near sweathouse; basal La Jolla I midden layer with 2-layer La Jolla II midden above; charcoal and shell; numerous metates and manos; flaked stone not common. Recorded by: M.J.Rogers 1929

Site No. W-120 Culture(s): San Dieguito III, La Jolla II, Yuman III

Description: Highland permanent camp; hearths; primarily a La Jollan site; manos and metates. Recorded by: M.J.Rogers 1929

Site No. W-121 Culture(s): San Dieguito II, La Jolla II, Yuman III, possible La Jolla I

Description: Large, important site recommended by M.J.Rogers for stratigraphic study. Permanent slough terrace midden; cobble hearths not common; burials indicated by fragments of bone; Channel Island intrusives; high shell and charcoal content in main midden level (LJII); fish bone; manos and metates, sandstone grinding slabs, flaked stone. Recorded by: M.J.Rogers 1929

Please note: The project area may contain archaeological resources in addition to those noted above. This report is made from San Diego Museum of Man files only and may not include data pertaining to localities other than those covered in previous Museum of Man surveys or gathered by other institutions or by individuals.

Record check by: Ken Hedges

Date: 11-12 July 1978

Signed: Lowell E. English

SAN DIEGO MUSEUM OF MAN

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REPORT ON ARCHAEOLOGICAL SITE FILES RECORD SEARCH

Source of Request: WESTEC Services, Inc. - William T. Eckhardt

Name of Project: SDG&E Transmission Line Survey

Site No. W-123 Culture(s): La Jolla I & II, Yuman III

Description: Slough margin stratified midden in a lateral canyon; cobble hearths; cremation burial in Yuman section; shell and charcoal; sherds, arrowpoints, ceramic pipe. Recorded by: M.J.Rogers 1929

Site No. W-124 Culture(s): La Jolla II, trace of San Dieguito II and Yuman III

Description: Scattered winter camps; many cobble hearths and some platforms; burial; shell occurs in patches without much midden development; 2 sherds. Recorded by: M.J.Rogers 1929

Site No. W-125 Culture(s): San Dieguito II, La Jolla II

Description: Highland camps without midden development; numerous cobble hearths; no shell deposits; numerous manos, metates, flaked stone, and hammerstones. Recorded by: M.J.Rogers 1929

Site No. W-127 Culture(s): San Dieguito II, La Jolla II

Description: Slough terrace camps; buried evidence of camps over a wide area; medium shell and charcoal content; metates and manos not common; re-worked San Dieguito tools. Recorded by: M.J.Rogers 1929

Site No. W-128 Culture(s): La Jolla I & II, trace of Yuman III

Description: Highland accretion midden; high shell and low charcoal content in LJI level, medium shell content in LJII level; cobble hearths; 2 sherds; manos, flaked stone, hammerstone; bedrock metates. Recorded by: M.J.Rogers 1929, J.Moriarty 1974

Site No. W-129 Culture(s): La Jolla II, Yuman III

Description: Highland camps; many cobble hearths and large cobble platforms (10' diam.; probable sweathouses); scattered shell patches with low shell and charcoal content; metates common; sherds, flaked stone, steatite slab. Recorded by: M.J.Rogers 1929

Site No. W-130 Culture(s): La Jolla II, trace of San Dieguito II

Description: Slough terrace accretion camp; hearths; high shell and charcoal content; flaked stone not common; manos and metates. Recorded by: M.J.Rogers 1929

Site No. W-132/132-A Culture(s): San Dieguito II, La Jolla II, Yuman III

Description: Slough terrace midden (highland accretion type); many cobble hearths; burial; flaked stone, metates, sherds, manos, cores, hammerstones, shell, bone; locus A is a related concentration to the east. Recorded by: M.J.Rogers 1929, E.L.Davis 196[illegible]

Site No. W-133 Culture(s): La Jolla II, traces of San Dieguito II and Yuman III

Description: Highland accretion midden; many cobble hearths and some platforms; one large sweathouse located and excavated; La Jollan midden under aeolian deposit with Yuman on top; manos, metates, flaked stone, hammerstone, sherds, Channel Island point. Recorded by: M.J.Rogers 1929, E.L.Davis 196[illegible]

SAN DIEGO MUSEUM OF MAN

1350 El Prado, Balboa Park, San Diego, California 92101, Telephone (714) 239-2001

REPORT ON ARCHAEOLOGICAL SITE FILES RECORD SEARCH

Source of Request: WESTEC Services, Inc. - William T. Eckhardt

Name of Project: SDG&E Transmission Line Survey

Site No. W-134 Culture(s): San Dieguito II, La Jolla II, possible La Jolla I

Description: Slough margin midden; many cobble hearths; shell and charcoal; flaked stone tools, metates and grinding slabs.

Recorded by: M.J.Rogers 1929

Site No. W-136 Culture(s): La Jolla II, trace of Luiseño

Description: Highland winter camp; many cobble hearths;metates and manos; flaked tools not common; no shell present; arrowshaft straightener.

Recorded by: M.J.Rogers 1929

Site No. W-137 Culture(s): Luiseño, trace of La Jolla II

Description: Highland accretion midden; few cobble hearths; sherds, pipe, metates, arrowpoints, mortar, flaked stone; recent excavation revealed a large roasting pit feature; site now destroyed.

Recorded by: M.J.Rogers 1929

Site No. W-139 Culture(s): La Jolla II, Luiseño, trace of San Dieguito II

Description: Highland accretion midden; many cobble hearths; low shell and charcoal content; mortar and pestle cache; metates, arrowpoints, mortar, sherds, bowling stones, Channel Island artifacts.

Recorded by: M.J.Rogers 1929

Site No. W-140 Culture(s): La Jolla II, Luiseño

Description: Highland intermittent camps; cobble hearths; small tanks cut into sandstone; shell and charcoal; sherds common.

Recorded by: M.J.Rogers 1929

Site No. W-141/141-B Culture(s): La Jolla II, Luiseño, trace of San Dieguito II, possible LJI

Description: Slough terrace concentrated midden; scattered cobble hearths; ring stones, curing stone, sherds, metates, flaked stone; bird, fish, and some mammal bone; W-141 is La Jollan & Luiseno midden with trace of San Dieguito; locus B is La Jollan midden with trace of Luiseño.

Recorded by: M.J.Rogers 1929

Site No. W-1172 Culture(s): Possible PaleoIndian or Early Milling

Description: Extensive shell midden with hearths; cores, flakes, fire-cracked rock; shell.

Recorded by: C.Bull 1977

Site No. W-1283 Culture(s): Historic Spanish-Colonial

Description: Possible Spanish cistern or well with adjoining trough.

Recorded by: J.Ford 1977

Site No. W-1293 Culture(s): Late Prehistoric

Description: Site area encompassing four loci containing shell scatter and lithics: hammerstone, core, flakes, fire-cracked rock, chopper.

Recorded by: M.Cassiola 1977

SAN DIEGO MUSEUM OF MAN

1350 El Prado, Balboa Park, San Diego, California 92101, Telephone (714) 239-2001

REPORT ON ARCHAEOLOGICAL SITE FILES RECORD SEARCH

Source of Request: WESTEC Services, Inc. - William T. Eckhardt

Name of Project: SDG&E Transmission Line Survey

Site No. W-1330 A-C Culture(s): Late Prehistoric

Description: Extensive village site and lithic workshop; deep shell midden; numerous hammerstones, cores, flakes, manos, fire-cracked rock, and shell; site has three loci representing concentrations within total area.

Recorded by: R.Norwood 1977

Site No. W-1331 Culture(s): Late Prehistoric

Description: Extensive village site; shell midden deposit; hammerstones, cores, flakes, scrapers, manos, shell.

Recorded by: R.Norwood 1977

Site No. W-1361 Culture(s): Encinitas Tradition

Description: Extremely large site with widespread distribution of manos, metates, choppers, scrapers, flakes; shell midden.

Recorded by: C.Drover 1977

Site No. W-1362 Culture(s): Mexican-American Historic

Description: Eroded adobe structure on small bench with adjacent burned wood house and separate cement/rock foundation.

Recorded by: C.Drover 1977

Site No. W-1363 Culture(s): Encinitas Tradition (?)

Description: Localized area of shell fragments and a few lithics.

Recorded by: C.Drover 1977

Site No. W-1364 Culture(s): Mexican-American Historic

Description: Several adobe structures and well; associated 19th-20th century artifacts; located within W-1361 site area.

Recorded by: C.Drover 1977

Site No. W-1430 Culture(s): La Jollan

Description: Shell midden; flakes, manos, metates, fire-cracked rock, shell, bone, charcoal.

Recorded by: R.May 1977

Site No. W-1445-B&C Culture(s): Unknown

Description: Isolated finds: B) 2 utilized flakes; C) projectile point fragment.

Recorded by: L.Eckhardt 1977

Site No. W-1528 Culture(s): Unknown

Description: Surface scatter of artifacts in disturbed area: 2 manos, 10 flakes, 2 flaked stone tools.

Recorded by: R.Norwood 1978

SAN DIEGO MUSEUM OF MAN

1350 El Prado, Balboa Park, San Diego, California 92101, Telephone (714) 239-2001

REPORT ON ARCHAEOLOGICAL SITE FILES RECORD SEARCH

Source of Request: WESTEC Services, Inc. - William T. Eckhardt

Name of Project: SDG&E Transmission Line Survey

Site No. W-1539 Culture(s): Not stated

Description: Site area on a long ridge; choppers, scrapers, mano fragments, points.

Recorded by: J.Edwards 1977

Site No. W-1540 Culture(s): Historic

Description: Spanish style house and pump house; historic artifacts.

Recorded by: J.Edwards 1977

Site No. W-1632 Culture(s): Not stated

Description: Light, ill-defined scatter of artifacts; cores, flakes.

Recorded by: R.Norwood 1978

Site No. No number Culture(s): La Jollan

Description: La Jollan camps. (shown on map--La Jolla Quad--as "un-numbered site location")

Recorded by: M.J.Rogers

Site No. Culture(s):

Description:

Recorded by:

Site No. Culture(s):

Description:

Recorded by:

Site No. Culture(s):

Description:

Recorded by:

Site No. Culture(s):

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Recorded by:

Site No. Culture(s):

Description:

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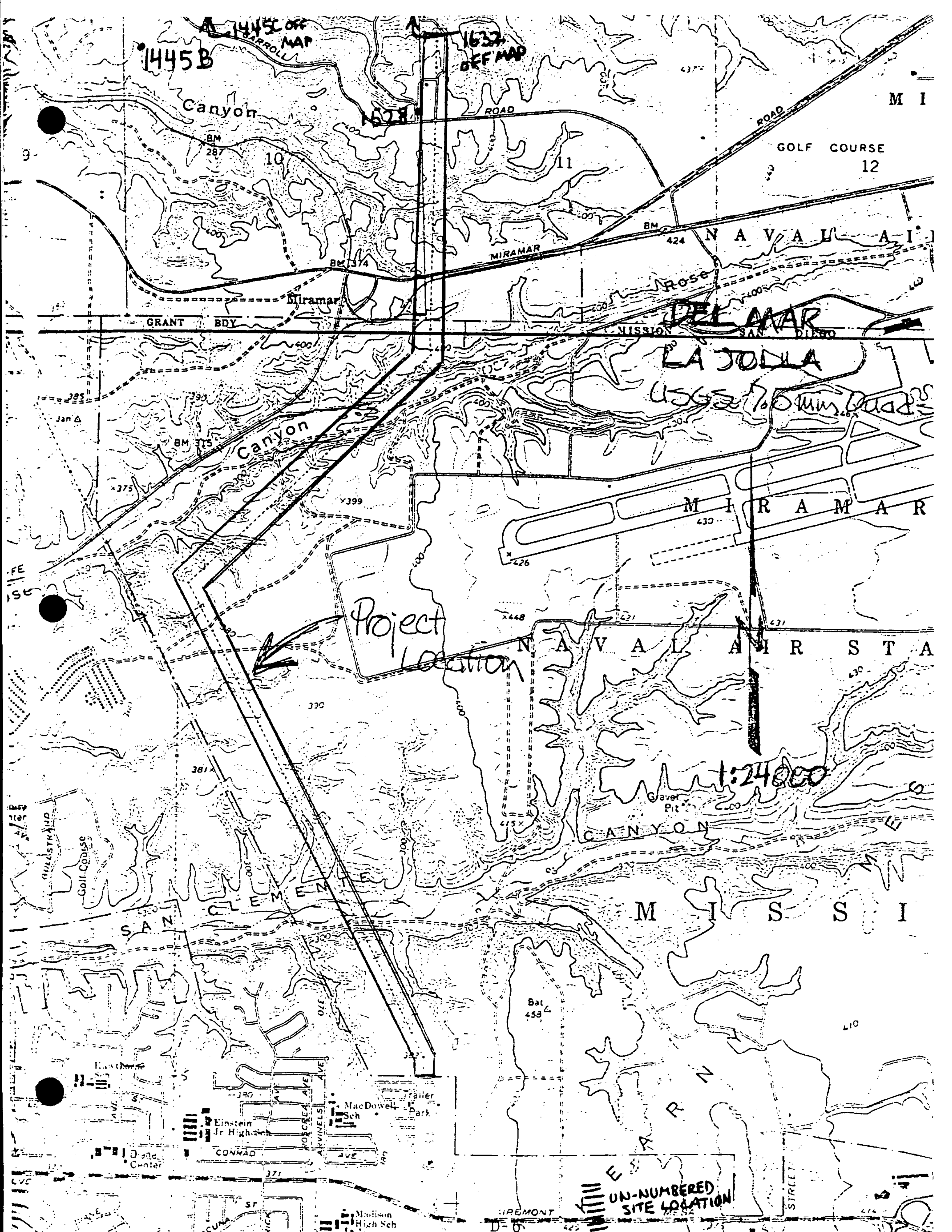
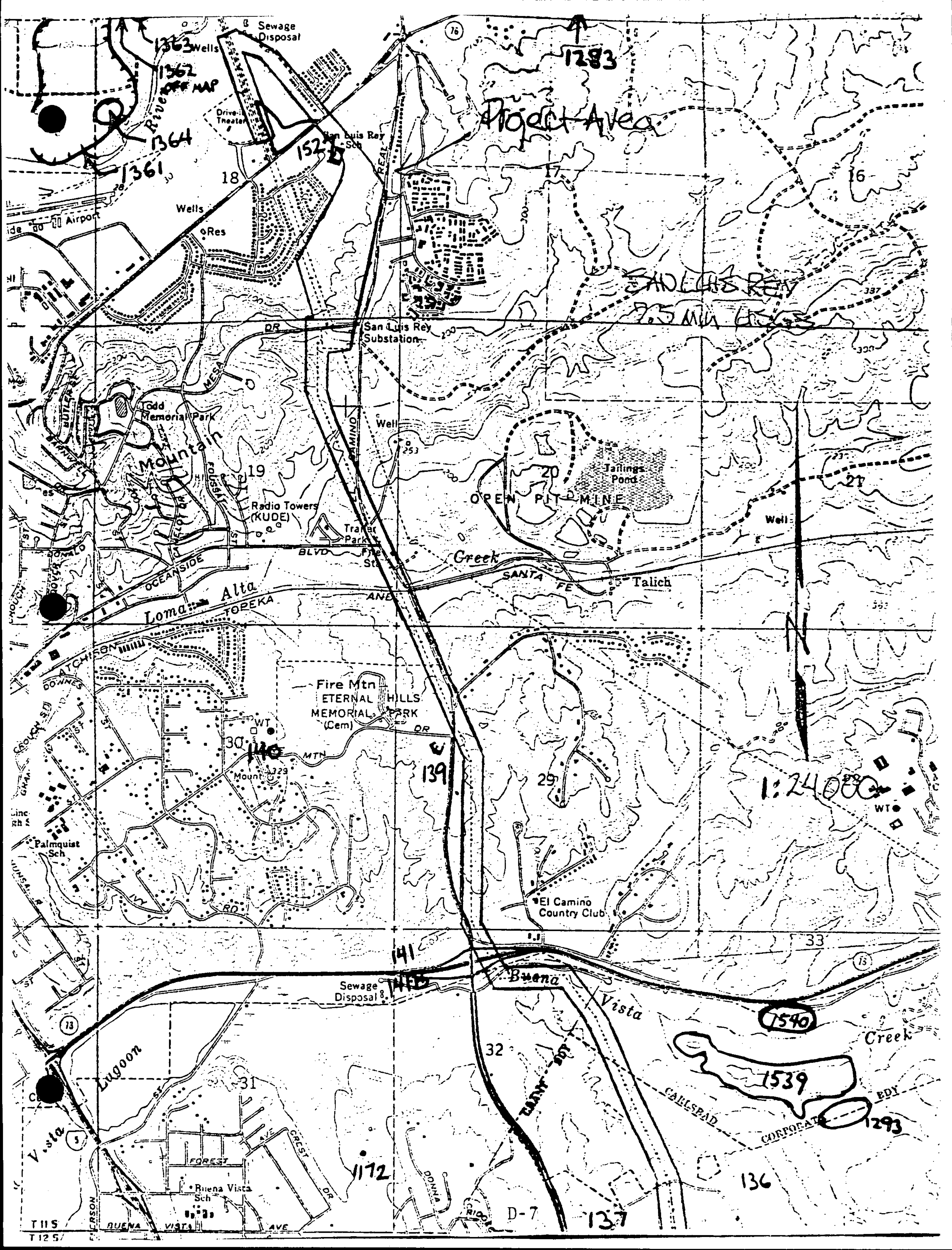
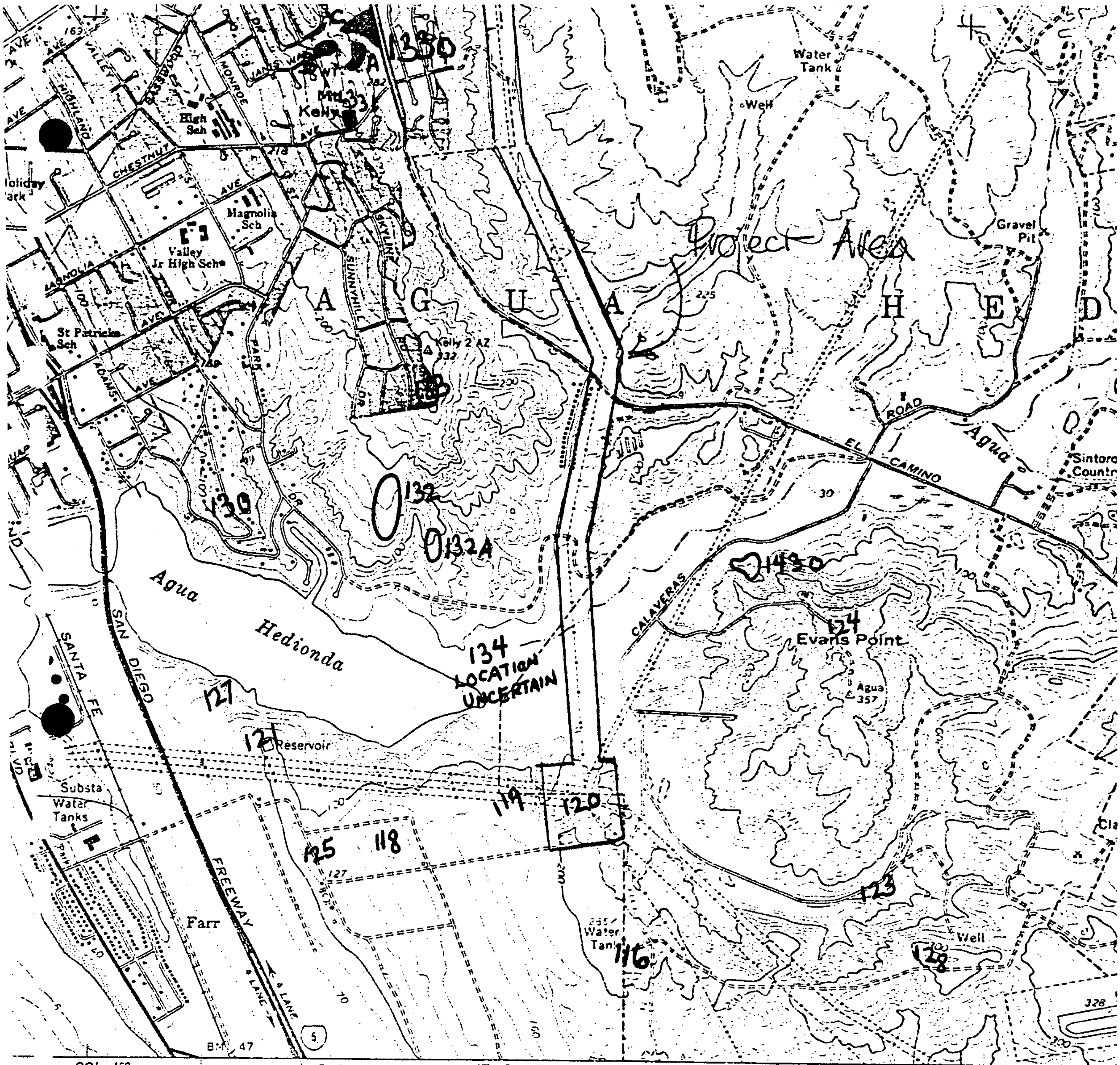


1445C OFF MAP
1445B
1632 OFF MAP
1628
Canyon
ROAD
GOLF COURSE
MIRAMAR
Miramar
GRANT BDY
MISSION SAN DIEGO
DEL MAR
LA JOLLA
USGS 7.5 Min Quads
Canyon
N A V A L A I R S T A
M I R A M A R
Project Location
1:24000
Gravel Pit
C A N Y O N
S A N C L E M E N T E
M I S S I
Golf Course
Bat 458
K E A R N
MacDowell Sch
Trailer Park
Einstein Jr High Sch
CONRAD AVE
Madison High Sch
UN-NUMBERED SITE LOCATION


Sewage Disposal
Wells
1363
1362 OFF MAP
1364
1361
Drive-in Theater
San Luis Rey Sch
152
1283
Project Area
Airport
Res
San Luis Rey 7.5 Min USGS
San Luis Rey Substation
Todd Memorial Park
Mountain
Radio Towers (KUDE)
Trailer Park
Well
Tailings Pond
OPEN PIT MINE
Creek
SANTA FE
Talich
OCEANSIDE BLVD
Loma Alta
TOPEKA
ATCHISON
Fire Mtn ETERNAL HILLS MEMORIAL PARK (Cem)
WT
140
139
1:24000
Palmquist Sch
El Camino Country Club
141
Sewage Disposal
Buena Vista
1540
Creek
Lagoon
1539
CARLSBAD CORPORATE BDY
1293
1172
136
Buena Vista Sch
D-7
137
T 11 S
T 12 S



20' 469 | ENCINITAS 6 MI. SAN DIEGO 32 MI. | (ENCINITAS) 2550 III SE | 472 | 17'30" 473

SCALE 1:24 000 129

1 ½ 0 1 MILE

117

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 4 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

SAN LUIS REY

DEPARTMENT OF ANTHROPOLOGY

San Diego State University
San Diego, CA 92182
(714) 286-6300

REPORT ON ARCHAEOLOGICAL SITE FILES RECORD SEARCH

Source of Request WESTEC Services

Date of Request July 7, 1978 (X) Letter ( ) Telephone ( ) In Person

Date Request Received July 10, 1978 (X) Map Received (X) Map Returned

Name of Project SDG&E Transmission Line Survey, Job #3519

( ) The San Diego State University files show no recorded site for the project area.

(X) The San Diego State University files show the following sites ( ) within (X) in the vicinity of the project area.

Site No. SDI-209 Culture(s): Unknown
Description: Not described. (Treganza, n.d.)

Site No. SDI-630 Culture(s): Unknown
Description: Large campsite with heavy shell concentration. Artifacts - mano, 11 hammers, chopper. (Wallace, 1958)

Site No. SDI-631 Culture(s): Unknown
Description: Large campsite, slight midden discoloration. Artifacts incl. 22 manos, metate frag., 11 choppers, 3 cobble pestles, 12 hammerstones, shaped pestle frag. (Wallace, 1958)

Site No. SDI-634 Culture(s): Unknown
Description: Large campsite, seems to be under surface, artifacts found in erosion channels. 22 manos, 6 hammerstones, 4 polishing pebbles, no shell or chips. (Wallace, 1958)

Site No. SDI-1014 Culture(s): Unknown
Description: No information sheet about site.

Site No. SDI-4990 Culture(s): Unknown
Description: Site mitigated by salvage excavation. Fire hearth, cobble cores, scrapers, few manos, metate frag, flakes, few hammerstones, drills, blades, clay pipe frags, shell fishhooks, olivella beads, points, Tizon & Colorado buff sherds, rodent, bird, fish and shell remains. (Ike and Kardash, 1977)

Note: *This report includes only that information available from the San Diego State University files and may not include data on file at other institutions. A lack of sites recorded in our files cannot be taken as assurance of the absence of archaeological materials. If it should occur that any cultural remains are encountered during the course of construction, a qualified archaeologist should be notified.*

Record check by Kaye Miller

Date July 12, 1978 Signed Larry L. Leach

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Site No. SDI-5077 Culture(s): Unknown

Description: Extensive shell deposit with assoc. deflated hearths. Artifacts incl. cores, flakes/debitage, thermal fractured rock. (Hatley, 1977)

Site No. SDI-5130 Culture(s): "Encinitas"

Description: Widespread (ca.15-20 acres) distribution of discolored soil, artifacts including mano-metate frags, choppers, worked & utilized flakes and shell. Also has an historic adobe on site. Subsurface features expected due to theamount of lithic material on surface. (Drover, 1977)

Site No. SDI-5131 Culture(s): "Mexican-American Historical"

Description: Several structures observable incl. melted adobe structure, burned wood house, cement & rock floor of 3rd structure. Early-Late 20th Century artifacts. (Drover, 1977)

Site No. SDI-5132 Culture(s): "Encinitas?"

Description: Localized area of shell fragments and few exotic lithics, one chopper. (Drover, 1977)

Site No. SDI-5133 Culture(s): "Mexican-American Historical"

Description: Two or three melted adobe structures in center of SDI-5130 and well. Floor tiles,ceramics, glass,butchered animal bone suggest late 19to early 20 century occupation(Drover, 1977)

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Site No. SDI-5213A,B,C Culture(s): Unknown

Description: Extensive shell midden with cobbles and lithics incl. 10 hammerstones 20+ cores, 500+ flakes/debitage,100+ mano frags or cobbles, 100+thermal fractured rock. Dark soil present.(Norwood, 1977

Site No. SDI-5214 Culture(s): Unknown

Description: Midden site with lithics incl. 3 hammerstones, 5 cores, 20+ flakes/ debitage, 2 scrapers, 5+ mano frags, 1 retouched tool. (Norwood, 1977)

Site No. SDI-5353 Culture(s): "La Jollan, possibly San Luis Rey I"

Description: Shell midden with artifacts incl. Portable metates, manos, thermal fractured rock, flakes osteological remains, charcoal. Very significant site. (May, 1977)

Site No. SDI-5416 Culture(s): Unknown

Description: Consists of several flakes, at least 3 potsherds and light amount of shell. (Hatley, 1977)

Site No. SDI-5444 Culture(s): Unknown

Description: No discernable midden, few scattered artifacts incl. 2 manos, approx. 10 flakes, 2 flaked stone tools. (Norwood, 1978)

Site No. SDI-5445 Culture(s): Unknown

Description: Light shell scatter over an extensive area, no other cultural material observed (weed cover heavy). (Norwood, 1977)

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Site No. SDI-5455 Culture(s): Unknown

Description: Light, ill defined surface scatter of artifacts incl. 2 cores and approx. 15 flakes. (Norwood, 1978)

Site No. SDI-5601 Culture(s): Unknown

Description: 4 areas of concentration of shell remains andlithic artifacts incl. hammerstone, flakes, thermal fractured rocks, chopper, battered core. (Graham, 1977)

Site No. Culture(s):

Description:

Site No. Culture(s):

Description:

Site No. Culture(s):

Description:

Site No. Culture(s):

Description:

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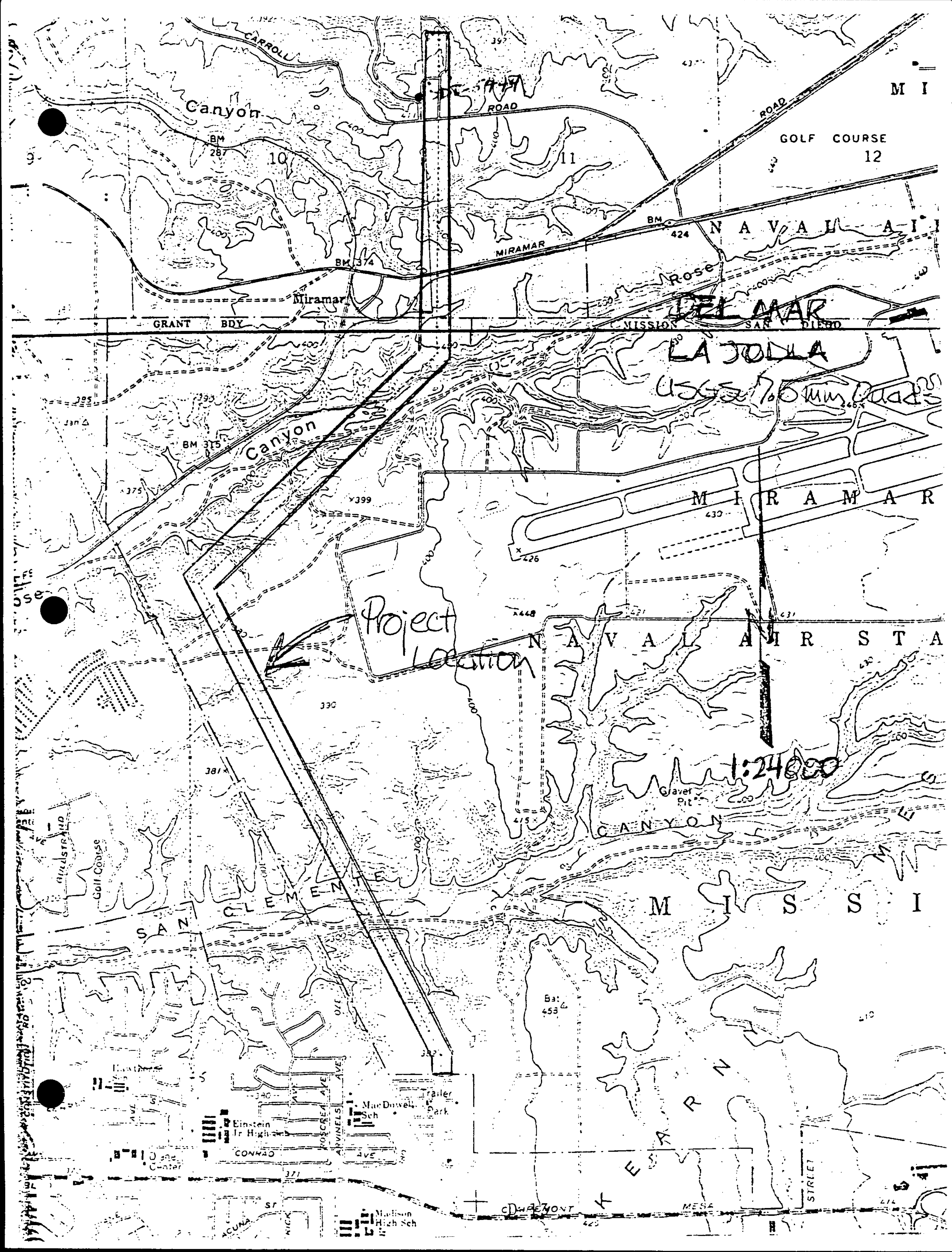
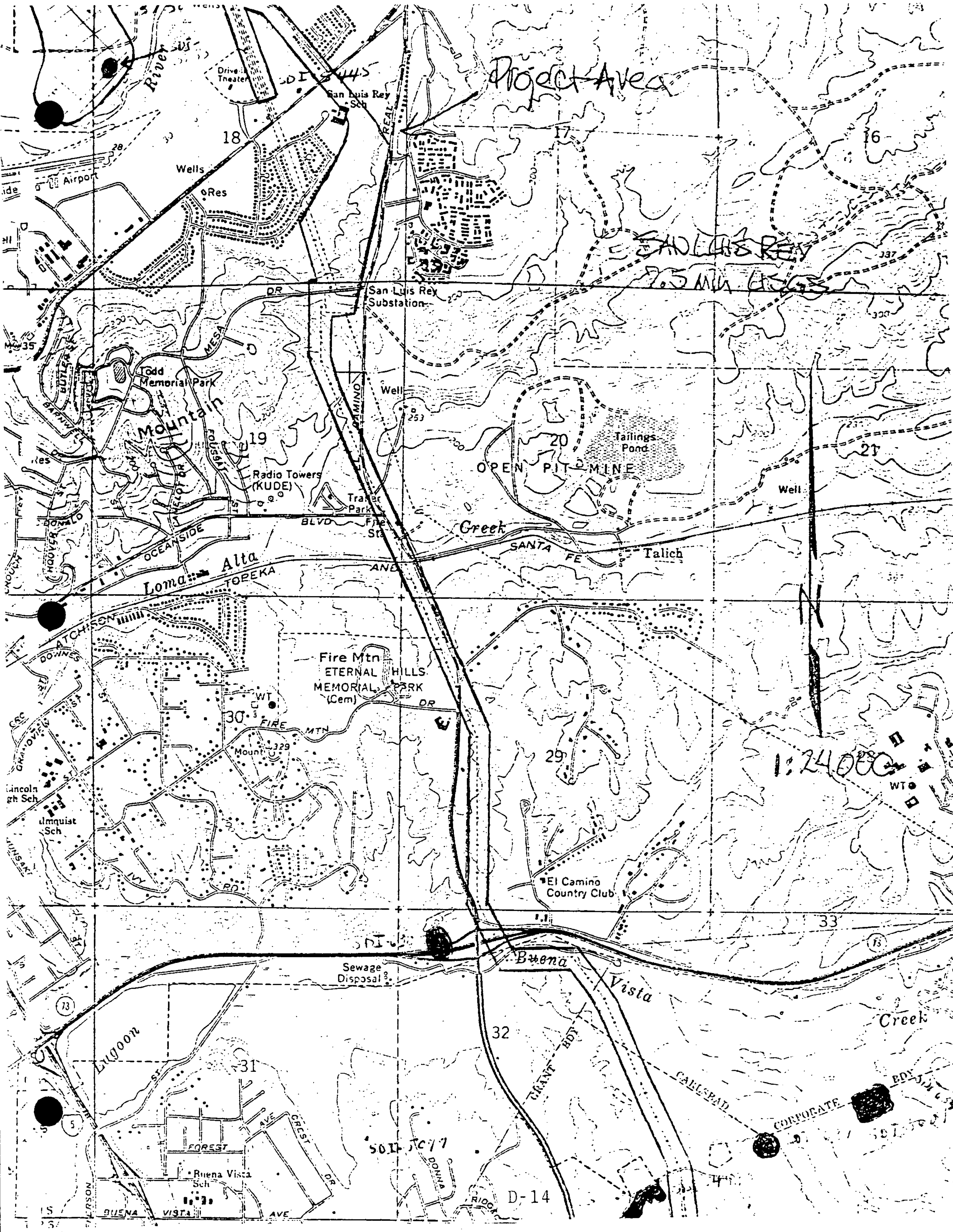
Record check by

Date July 12, 1978 Signed



CARROLL
Canyon
ROAD
BM 287
10
11
ROAD
GOLF COURSE
12
MI
BM 424
N A V A L A I
MIRAMAR
BM 374
Miramar
Rose
GRANT BDY
MISSION SAN DIEGO
DEL MAR
LA JOLLA
USGS 7.5 min Quads
Canyon
BM 315
M I R A M A R
Project Location
N A V A L A I R S T A
1:24000
Gravel Pit
CANYON
SAN CLEMENTE
M I S S I
Golf Course
Bat 455
K E A R N
Trailer Park
MacDowell Sch
Einstein Jr High Sch
CONRAD AVE
Madison High Sch
STREET
MESA


Project Area
SAN LUIS REY
7.5 MIN USGS
1:24000
Drive-in Theater
San Luis Rey Sch
River
Airport
Wells
Res
San Luis Rey Substation
Todd Memorial Park
Mountain
Radio Towers (KUDE)
Trailer Park
Fire Sta
Well
Tailings Pond
OPEN PIT MINE
Creek
SANTA FE
Talich
OCEANSIDE
BLVD
Loma Alta
ATCHISON
TOPEKA
AND
Fire Mtn
ETERNAL HILLS MEMORIAL PARK (Cem)
FIRE MTN DR
Lincoln High Sch
Almquist Sch
El Camino Country Club
Sewage Disposal
Buena Vista
Creek
Lagoon
GRANT BDY
CARLSBAD CORPORATE BDY
FOREST
Buena Vista Sch
BUENA VISTA AVE
CREST DR
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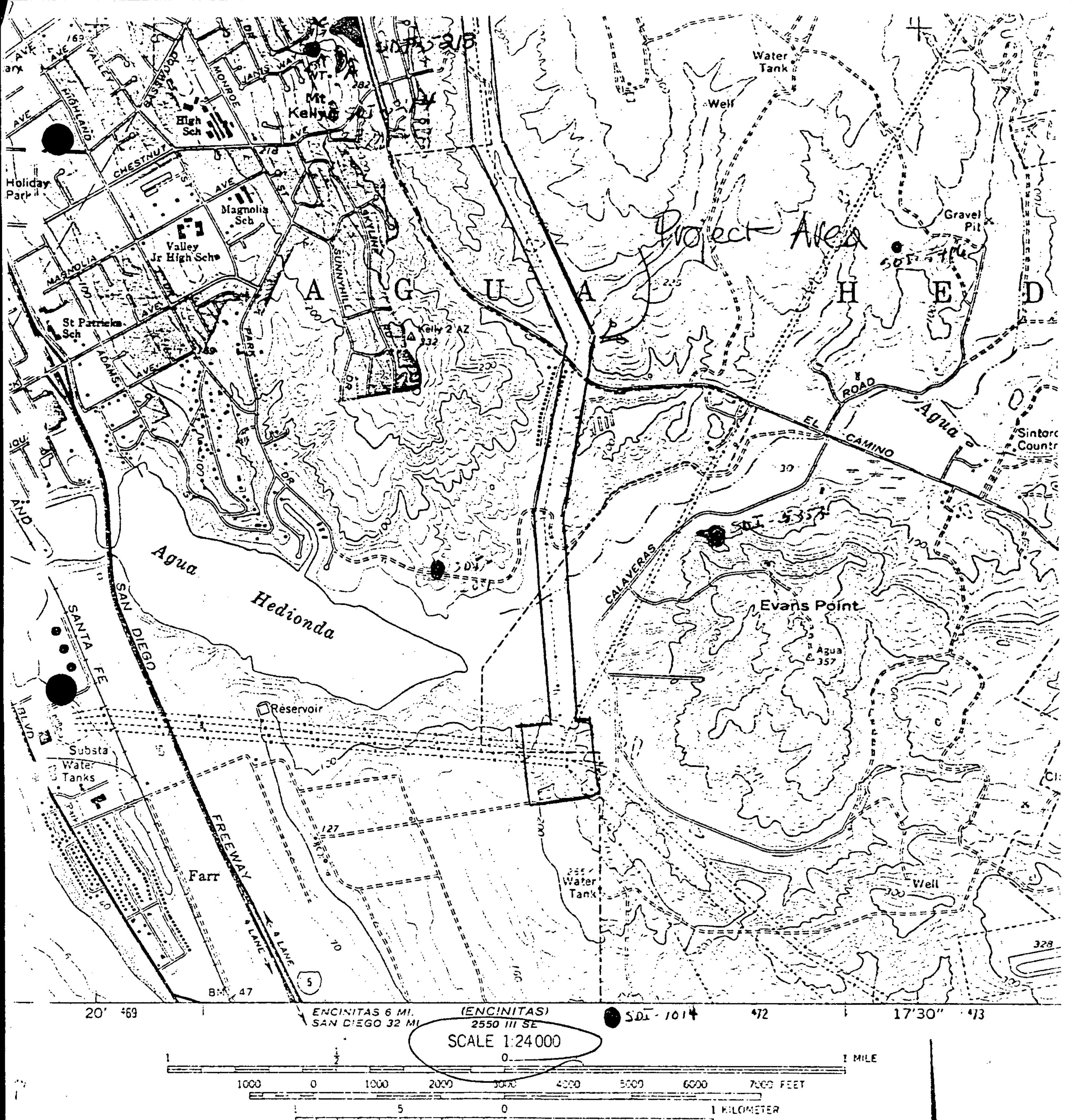

CONTOUR INTERVAL 20 FEET
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SAN LUIS REY
7.5 MINUTES

APPENDIX E

ACOUSTICAL ANALYSES

SDA SAN DIEGO ACOUSTICS

July 17, 1978
Job No 2237

ENVIRONMENTAL DATA STATEMENT

San Onofre To Encina 230 KV Circuit

I. INTRODUCTION

Noise impacts related to the installation of new transmission lines are a function of 1) installation equipment type, 2) schedule of operations, 3) present environmental setting, and 4) proximity of populated areas to the rights of way along which installation operations will occur.

Three specific installation tasks which are to be performed between San Onofre and the Encina Substation have been examined for their noise impact. The San Onofre to Encina line is the westerly right-of-way.

II. PROJECT DESCRIPTION

The tasks and potential noise problems are summarized below:

1. Addition of one circuit to the vacant position on existing double circuit steel towers from San Onofre to Encina Substation (24 miles).

   Primary noise sources will be from the helicopter used to pull cable, pulling and tensioning equipment, bucket truck and various trucks.

2. Installation of new wood structures for a 0.6 mile segment of the route opposite Oceanside Airport. Noise sources for this task include an augering machine, caterpillar, large crane, semi trucks and concrete truck.

3. Installation of one steel tower at the Encina Hub to facilitate arrangements of new conductors.

   Primary noise sources are the same as those described in 2 above.

III. PRESENT ENVIRONMENT

That portion of the right-of-way extending from San Onofre to just north of the Oceanside Airport is through uninhabited areas of Camp Pendleton. Thus the ambient noise levels along the right-of-way is a function of Marine Corps training activities on the base. In the absence of training exercises the hourly ambient noise levels are on the order of 35 dB(A) as measured in similar territory in Reference 1.

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The right-of-way to the east of the Oceanside Airport passes southward through developed area for an approximate distance of one mile.

This area has an ambient noise level governed by operations from Oceanside Airport and traffic on Mission Avenue. Oceanside Airport noise contours developed by San Diego Acoustics for the Comprehensive Planning Organization (Reference 2) show CNEL's of 60 over the right-of-way area. Traffic noise on Mission Avenue is due to some 22,400 Average Daily Trips. The Day Night Level (LDN) calculated using the method of Reference 3 yields noise levels given in Table 1.

Table 1 - Mission Ave. Traffic Noise

Distance From Roadway (feet)	CNEL/LDN dB(A)
50	70
100	65.5
500	55
1000	50.5

The resulting ambient noise level in the area is on the order of 60 to 63 dB(A).

The Encina Hub is located in an uninhabited area and hence the hourly ambient noise levels are on the order of 35 dB(A) (Reference 1).

IV. NOISE IMPACT

Of the activities planned only items 1 and 2 above have the potential for impacting upon a populated area. Thus, the noise levels for a typical construction scenario have been developed and are described in the following sections.

As previously mentioned the noise level at a particular site will be a function of the noise source and its operational mode. Installation of new structures and wire stringing involves the operational functions given in Table 3.

Table 3 - Operations Data For Installation of New Structures & Wire Installation

Noise Source	Operation	Operational Time on Site
Augering Machine	Hole Drilling	4 hours/site
Semi Truck	Pole Delivery	1 hour/day
Equipment Trucks	Personnel & Equip.	1 hour/day
40 Ton Crane	Pole Setup	4 hours/site
Concrete Truck	Cement Footings	1-1/2 hours/day
Caterpillar	Push/Pull	1 hour/day
Helicopter	Rope Pulling	1 hour/day
Pickup Trucks	Personnel & Equip.	1/2 hour/day
Flat Bed Trucks	Small Equip.	1/2 hour/day
Semi Trailer	Conductor Delivery	5 minutes/day
Tensioners	Wire Puller	1 hour/day
Bucket Truck	Wire Installation	4 hours/day

Noise levels for each of these sources were obtained from the literature (Reference 4, 5, and 6) and are given in Table 4.

Table 4 - Equipment Noise Levels

Item	Noise Level	References
Augering Machine	80 @ 50 ft.	4
Semi Truck	81 @ 50 ft.	6
Equipment/Pickup Trucks	70 @ 50 ft.	4
40 Ton Crane	83 @ 50 ft.	4
Concrete Truck	85 @ 50 ft.	4
Caterpillar	80 @ 50 ft.	4
Helicopter	87 @ 150 ft.	5
Tensioner	80 @ 50 ft.	4

The method used to determine the noise impact involves a comtutation of the Community Noise Equivalent Level (CNEL) based upon the hourly noise levels. The appropriate mathematical relationships are as follows:

$$HNL = 10 \log \frac{1}{60}\left[\Sigma\left(10^{NL/10} \cdot \Delta t\right)\right]$$

where NL = noise level, (dB(A)
t = duration, minutes

$$CNEL = 10 \log \frac{1}{24}\left\{\Sigma\left[10^{HNLD/10} + 3\cdot(10^{HNLE/10}) + 10\cdot(10^{HNLN/10})\right]\right\}$$

where HNLD = hourly noise level (0700-1900 hours)
HNLE = hourly noise level (1900-2100 hours)
HNLN = hourly noise level (2100-0700 hours)

For the purposes of this analysis, operations do not occur during the evening and nighttime hours. Operations have been combined to yield a CNEL value for the structure installation and for the wire stringing. The resulting levels are 79 CNEL at 50 feet for the structure installation and 76 CNEL at 50 feet for the wire stringing. Propagation of these levels to greater distances is a function of distance and atmospheric absorption. The distance affect is equal to 20 $\log_{10} D_1/D_2$ and the atmospheric absorption is equal to the absorption coefficient times the distance traveled. The absorption coefficient is normally given in terms of decibels per 1000 feet. The absorption coefficient is a non-linear function of frequency and the temperature and humidity. An approximation may be made by assuming that the absorption coefficient at 1000 hertz for a standard day is typical. That value is 1.4 dB/1000 for 59^{o}F and 70% relative humidity. The combined corrections were used to generate the noise level curves in Figure 1. Right-of-way widths may vary up to several hundred feet, thus the noise can be generated anywhere on the right-of-way.

Typical sturcture installation takes two to three days at a site. Wire stringing takes an additional two to three days per mile. Thus the total impact at any one site will occur for a two to three day time period. This impact will be negligible for those areas which are inunhabited. In the inhabited areas, the prevailing noise levels must be compared with the noise generated by the structure installation and wire stringing operations. The prevailing levels are in terms of annual Community Noise Equivalent Level. The annual level for the structure and wire installations will, of course, be low since the entire sequence of events takes place over a small period of time. Table 5 presents a comparison of the annual CNEL values for the proposed construction activity and that currently prevailing at the sites near inhabited areas.

Table 5 - Annual CNEL

	Existing	Structure SDG&E	Wire Stringing SDG&E
Uninhabited	45	58	55
East of Oceanside Airport	60	58	55

Thus the annual impact of the proposed operations is negligible in the habitable areas.

Since the proposed operations will occur within several municipalities and the County of San Diego, the noise ordinances of these jurisdictions were examined. The County Noise Ordinance specifies for construction equipment:

> No such equipment, or combination of equipment regardless of age or date of acquisition; shall be operated so as to cause noise at a level in excess of seventy-five (75) decibels for more than 8 hours during any twenty-four (24) hour period when measured at a distance of one hundred (100) feet from such equipment or corresponding sound level at some other distance.

These sound levels shall be corrected for time duration in accordance with the following Table:

Total Duration in 24 hours	Decibel Level Allowance	Total Decibel Level
Up to 15 minutes	+15	90
Up to 30 minutes	+12	87
Up to 1 hour	+ 9	84
Up to 2 hours	+ 6	81
Up to 4 hours	+ 3	78
Up to 8 hours	0	75

The structure and wire stringing operations at 100 feet are 73 and 70 dB respectively.

Oceanside does not have a separate noise ordinance thus it is assumed the County Ordinance will prevail.

In addition to the construction noise, the new transmission line will generate noise due to arcing from the high voltage line. This phenonenom normally occurs under high humidity conditions. Levels measured at the base of a tower by Southern California Edison on a foggy day were 42 to 45 dB(A) from a 220 KV line. Due to the weather variations expected along the transmission line, this noise is not expected to cause a problem.

V. SUMMARY

In summary, the annual noise levels in residential areas resulting from structure installation and wire stringing will be no louder than those currently present. Additionally, the daily noise impact for the 2-3 day duration will be less than the limit established in local noise ordinances. Therefore, it is concluded that a negative declaration is warranted.

Carole S. Tanner, P.E.

REFERENCES

1. "Community Noise", U.S. Environmental Protection Agency, Report NTID 300.3, December 31, 1971.

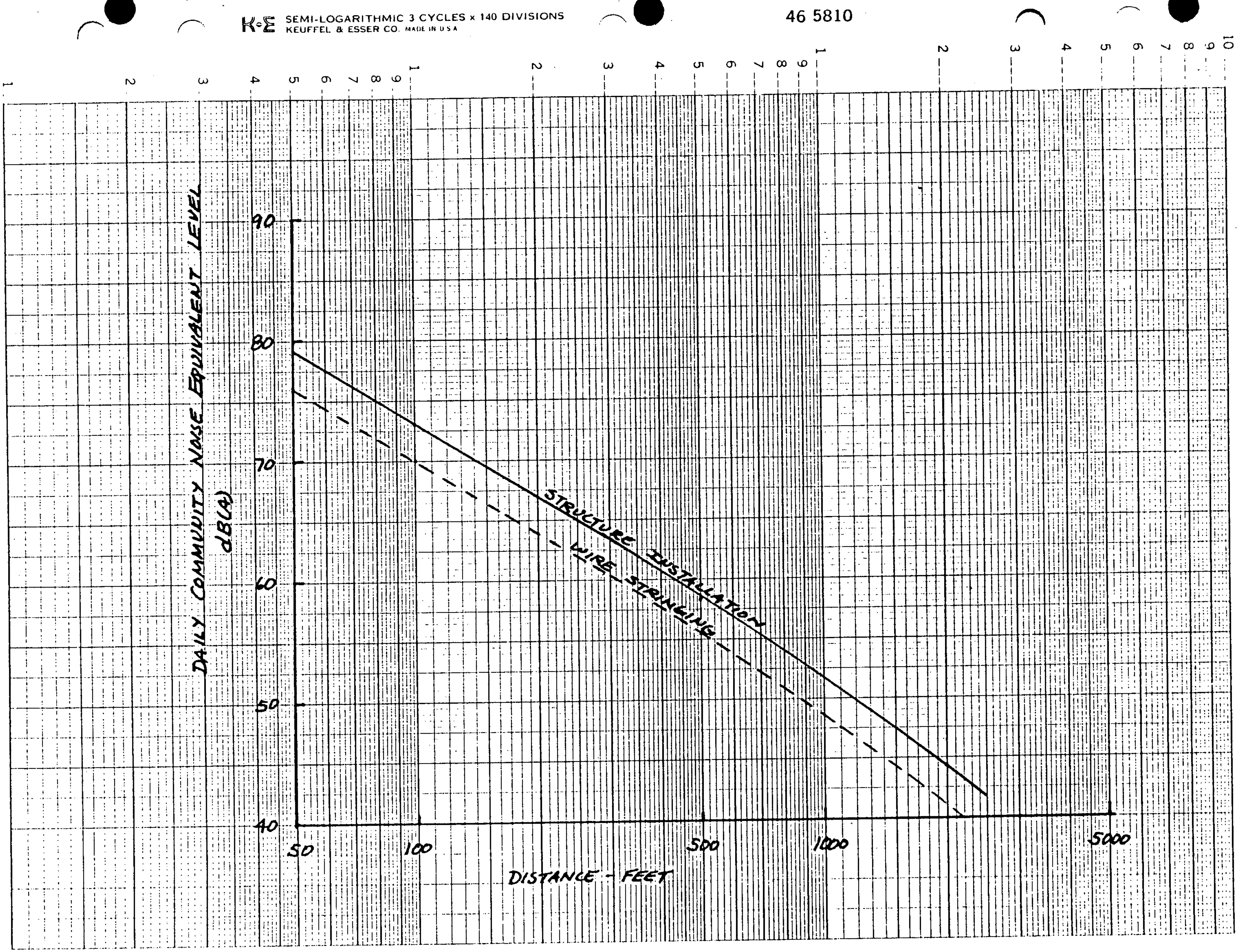
2. "Oceanside Airport Noise Contours", San Diego Acoustics Report 2049, January 1978.

3. "Development of Ground Transportation Systems Noise Contours for the San Diego Region," Jack W. Swing, Wyle Research Report WCR-73-8, December, 1973.

4. "Noise From Construction Equipment and Operations, Building Equipment and Home Appliances," U.S. Environmental Protection Agency, Report NTID 300.1, December 31, 1971.

5. "Noise Level of Nine Helicopters During Flyby and Hovering Operations," Ray E. Glass, EG&G, for Federal Aviation Administration, September 1974.

6. "Traffic and Noise Analysis, Taylor Borrow Pit Operations", San Diego Acoustics report 2219, July 1978.


K+E SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5810
DAILY COMMUNITY NOISE EQUIVALENT LEVEL
dB(A)
90
80
70
60
50
40
STRUCTURE INSTALLATION
WIRE STRINGING
50
100
500
1000
5000
DISTANCE - FEET

SAN DIEGO ACOUSTICS

July 17, 1978
Job No 2237

ENVIRONMENTAL DATA STATEMENT

San Onofre To Mission 230 KV Circuit

I. INTRODUCTION

Noise impacts related to the installation of new transmission lines are a function of 1) installation equipment type, 2) schedule of operations, 3) present environmental setting, and 4) proximity of populated areas to the rights of way along which installation operations will occur.

Four specific installation tasks which are to be performed between San Onofre and the Mission Substation have been examined for their noise impact. The San Onofre to Mission line is the easterly right-of-way.

II. PROJECT DESCRIPTION

The tasks and potential noise problems are summarized below:

1. Addition of one circuit to the vacant position on existing structures from San Onofre to Mission Substation (53 miles). Primary noise sources will be from the helicopter used to pull the cable rope, pulling and tensioning equipment, bucket truck and various trucks.

2. Installation of new wood structures on a one mile segment of the route opposite Oceanside Airport. Noise sources for this task include an augering machine, caterpillar, large crane, semi trucks, and concrete truck.

3. Replacement of existing 138 KV wood structures with double circuit 230 KV steel towers on a 5.6 mile segment of the route parallel to and contiguous with an existing double circuit 230 KV steel tower line between San Luis Rey substation and Encina Hub. Noise sources for this task will be the same as described above.

4. Installation of new wood structures adjacent to existing wood structures on a 4.2 mile segment of the route opposite the Miramar Naval Air Station. Noise sources

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again include those described above.

III. PRESENT ENVIRONMENTAL SETTING

That portion of the right-of-way extending from San Onofre to just north of the Oceanside Airport is through uninhabited areas of Camp Pendleton. Thus the ambient noise levels along the right-of-way is a function of Marine Corps training activities on the base. In the absence of training exercises the hourly ambient noise levels are on the order of 35 dB(A) as measured in similar territory in Reference 1.

The right-of-way to the east of the Oceanside Airport passes southward through developed area for an approximate distance of one mile.

This area has an ambient noise level governed by operations from Oceanside Airport and traffic on Mission Avenue. Oceanside Airport noise contours developed by San Diego Acoustics for the Comprehensive Planning Organization (Reference 2) show CNEL's of 60 over the right-of-way area. Traffic noise on Mission Avenue is due to some 22,400 Average Daily Trips. The Day Night Level (LDN) calculated using the method of Reference 3 yields noise levels given in Table 1.

Table 1 - Mission Ave. Traffic Noise

Distance From Roadway (feet)	CNEL/LDN dB(A)
50	70
100	65.5
500	55
1000	50.5

The resulting ambient noise level in the area is on the order of 60 to 63 dB(A).

Right-of way south of the Oceanside Airport to Miramar Naval Air Station is though relatively uninhabited territory and the hourly ambient noise would be on the order of 35 CNEL (Ref 1).

South of Miramar the right-of-way passes through a trailer park and terminates to underground lines at Clairemont Mesa Blvd. The ambient noise along this right-of-way is dominated by aircraft noise from operations at Miramar Naval Air Station and noise from traffic on Interstate 805.

Maps prepared by the Comprehensive Planning Organization in 1976 show noise levels along the right-of-way varying from a high of 71 to a low of 61 CNEL. Noise from I-805 is due to 69,000 ADT's and when calculated according to the method of Reference 3 result in noise levels given in Table 2.

Table 2 - I-805 Traffic Noise

Distance from Roadway (feet)	CNEL/LDN (dB(A)
50	77
100	72
500	62
1000	57.5

IV. NOISE IMPACT

Of the activities planned only items 2 and 4 above have the potential for impacting upon a populated area. Thus, the noise levels for a typical construction scenario have been developed and are described in the following sections.

As previously mentioned the noise level at a particular site will be a function of the noise source and its operational mode. Installation of new structures and wire stringing involves the operational functions given in Table 3.

Table 3 - Operations Data For Installation of New Structures & Wire Installation

Noise Source	Operation	Operational Time on Site
Augering Machine	Hole Drilling	4 hours/site
Semi Truck	Pole Delivery	1 hour/day
Equipment Trucks	Personnel & Equip.	1 hour/day
40 Ton Crane	Pole Setup	4 hours/site
Concrete Truck	Cement Footings	1-1/2 hours/day
Caterpiller	Push/Pull	1 hour/day
Helicopter	Rope Pulling	1 hour/day
Pickup Trucks	Personnel & Equip.	1/2 hour/day
Flat Bed Trucks	Small Equip.	1/2 hour/day
Semi Trailer	Conductor Delivery	5 minutes/day
Tensioners	Wire Puller	1 hour/day
Bucket Truck	Wire Installation	4 hours/day

Noise levels for each of these sources were obtained from the literature (Reference 4, 5, and 6) and are given in Table 4.

Table 4 - Equipment Noise Levels

Item	Noise Level	Reference
Augering Machine	80 @ 50 ft.	4
Semi Truck	81 @ 50 ft.	6
Equipment/Pickup Trucks	70 @ 50 ft.	4
40 Ton Crane	83 @ 50 ft.	4
Concrete Truck	85 @ 50 ft.	4
Caterpillar	80 @ 50 ft.	4
Helicopter	87 @ 150 ft.	5
Tensioner	80 @ 50 ft.	4

The method used to determine the noise impact involves a comtutation of the Community Noise Equivalent Level (CNEL) based upon the hourly noise levels. The appropriate mathmatical relationships are as follows:

$$HNL = 10 \log \frac{1}{60}\left[\Sigma \left(10^{NL/10} \cdot \Delta t\right)\right]$$

where NL = noise level, (dB(A)
t = duration, minutes

$$CNEL = 10 \log \frac{1}{24}\left\{\Sigma \left[10^{HNLD/10} + 3 \cdot \left(10^{HNLE/10}\right) + 10 \cdot \left(10^{HNLN/10}\right)\right]\right\}$$

where HNLD = hourly noise level (0700-1900 hours)
HNLE = hourly noise level (1900-2100 hours)
HNLN = hourly noise level (2100-0700 hours)

For the purposes of this analysis, operations do not occur during the evening and nighttime hours. Operations have been combined to yield a CNEL value for the structure installation and for the wire stringing. The resulting levels are 79 CNEL at 50 feet for the structure installation and 76 CNEL at 50 feet for the wire stringing. Propagation of these levels to greater distances is a function of distance and atmospheric absorption. The distance affect is equal to 20 $\log_{10} D_1/D_2$ and the atmospheric absorption is equal to the absorption coefficient times the distance traveled. The absorption coefficient is normally given in terms of decibels per 1000 feet. The absorption coefficient is a non-linear function of frequency and the temperature and humidity. An approximation may be made by assuming that the absorption coefficient at 1000 hertz for a standard day is typical. That value is 1.4 dB/1000 for 59°F and 70% relative humidity. The combined corrections were used to generate the noise level curves in Figure 1. Right-of-way widths may vary up to several hundred feet, thus the noise can be generated anywhere on the right-of-way.

Typical structure installation takes two to three days at a site. Wire stringing takes an additional two to three days per mile. Thus the total impact at any one site will occur for a two to three day time period. This impact will be negligible for those areas which are uninhabited. In the inhabited areas, the prevailing noise levels must be compared with the noise generated by the structure installation and wire stringing operations. The prevailing levels are in terms of annual Community Noise Equivalent Level. The annual level for the structure and wire installations will, of course, be low since the entire sequence of events takes place over a small period of time. Table 5 presents a comparison of the annual CNEL values for the proposed construction activity and that currently prevailing at the sites near inhabited areas.

Table 5 - Annual CNEL

	Existing	Structure SDG & E	Wire Stringing SDG & E
Uninhabited	45	58	55
East of Oceanside Airport	60	58	55
South of NAS Miramar	72	58	55

Thus the annual impact of the proposed operations is negligible in the habitable areas.

Since the proposed operations will occur within several municipalities and the County of San Diego, the noise ordinances of these jurisdictions were examined. The County Noise Ordinance specifies for construction equipment:

> No such equipment, or combination of equipment regardless of age or date of acquisition; shall be operated so as to cause noise at a level in excess of seventy-five (75) decibels for more than 8 hours during any twenty-four (24) hour period when measured at a distance of one hundred (100) feet from such equipment or corresponding sound level at some other distance.

These sound levels shall be corrected for time duration in accordance with the following Table:

Total Duration in 24 hours	Decibel Level Allowance	Total Decibel Level
Up to 15 minutes	+15	90
Up to 30 minutes	+12	87
Up to 1 hour	+ 9	84
Up to 2 hours	+ 6	81
Up to 4 hours	+ 3	78
Up to 8 hours	0	75

The structure and wire stringing operations at 100 feet are 73 and 70 dB respectively. The City of San Diego Noise Ordinance is identical except the time period is 12 hours and the location is on the nearest property line.

Oceanside does not have a separate noise ordinance thus it is assumed the County Ordinance will prevail.

In addition to the contruction noise, the new transmission line will generate noise due to arcing from the high voltage line. This phenonenom normally occurs under high humidity conditions Levels measured at the base of a tower by Southern California Edison on a foggy day were 42 to 45 dB(A) from a 220 KV line. Due to the weather variations expected along the transmission line, this noise is not expected to cause a problem.

V. SUMMARY

In summary, the annual noise levels in residential areas resulting from structure installation and wire stringing will be no louder than those currently present. Additionally, the daily noise impact for the 2-3 day duration will be less than the limit established in local noise ordinances. Therefore, it is concluded that a negative declaration is warranted.

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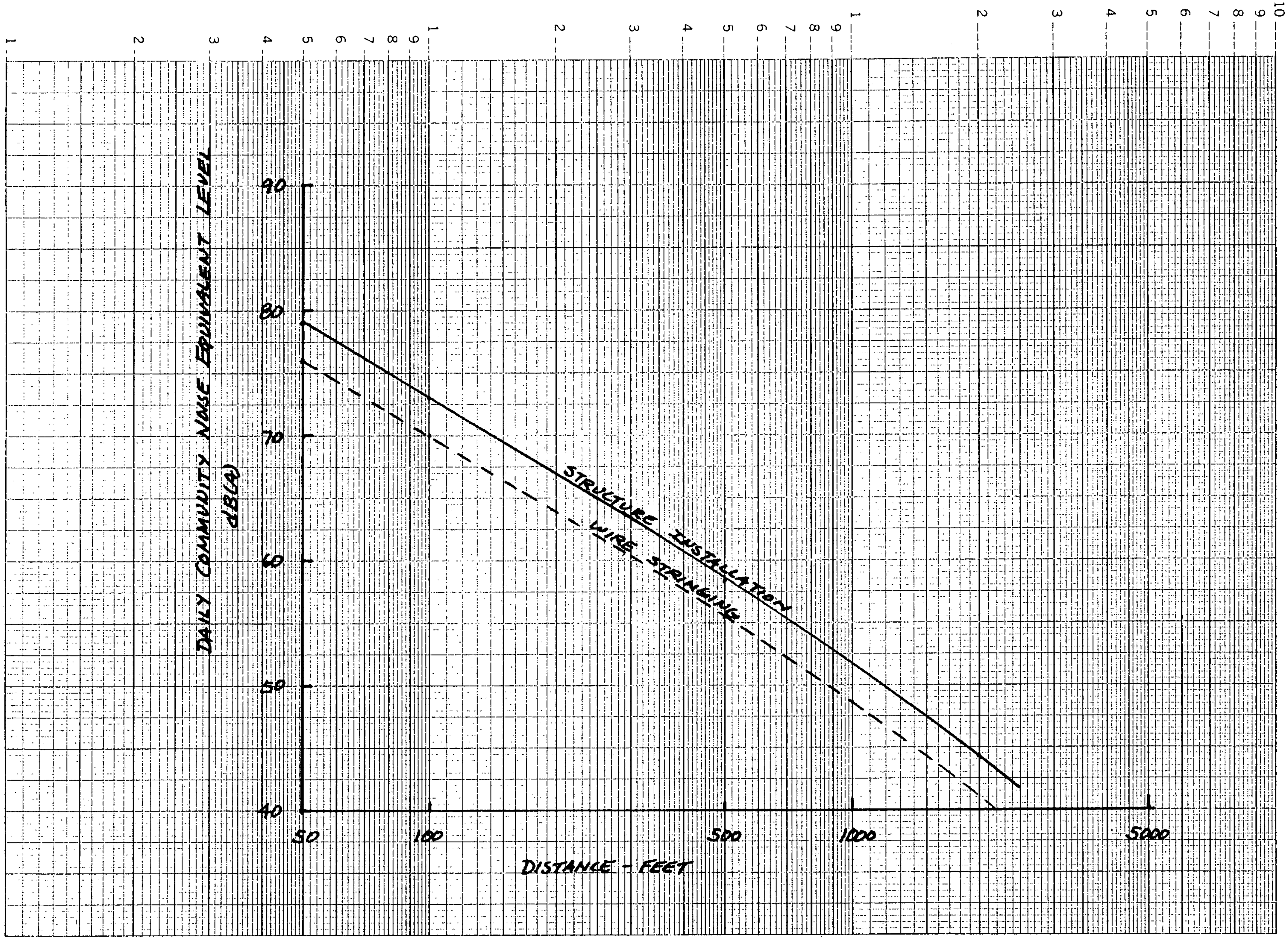
DAILY COMMUNITY NOISE EQUIVALENT LEVEL
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DISTANCE - FEET
STRUCTURE INSTALLATION
WIRE STRINGING

REFERENCES

1. "Community Noise", U.S. Environmental Protection Agency, Report NTID 300.1, December 31, 1971.

2. "Oceanside Airport Noise Contours", San Diego Acoustics Report 2049, January 1978.

3. "Development of Ground Transportation Systems Noise Contours for the San Diego Region," Jack W. Swing, Wyle Research Report WCR-73-8, December, 1973.

4. "Noise From Construction Equipment and Operations, Building Equipment and Home Appliances," U.S. Environmental Protection Agency, Report NTID 300.1, December 31, 1971.

5. "Noise Level of Nine Helicopters During Flyby and Hovering Operations," Ray E. Glass, EG&G, for Federal Aviation Administration, September 1974.

6. "Traffic and Noise Analysis, Taylor Borrow Pit Operations", San Diego Acoustics report 2219, July 1978.