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Leeds, Hill & Jewett, Inc.
~~609 South Grand Avenue~~
Los Angeles 17, California

Attention: Mr. Omar J. Lillevang

Gentlemen:

Three copies of our report "Preliminary Engineering and Geologic Investigation, Two Proposed Harbor Sites, Near Point Sur, California" are submitted. The investigation was conducted during the summer and fall of 1963.

Early in the investigation, it was determined that construction at the Little Sur site would be quite expensive. However, conditions at the Big Sur site were not well known due to the absence of exposed rock. Therefore, most of this investigation was devoted to the Big Sur site.

Please contact us if you have any questions regarding this report.

Very truly yours,

DAMES & MOORE

Vernon A. Smoots

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PRELIMINARY ENGINEERING AND GEOLOGIC INVESTIGATION

TWO PROPOSED HARBOR SITES

NEAR POINT SUR, CALIFORNIA

DAMES & MOORE JOB NO. 4963-003-02

PRELIMINARY ENGINEERING AND GEOLOGIC INVESTIGATION
TWO PROPOSED HARBOR SITES
NEAR POINT SUR, CALIFORNIA

INTRODUCTION

This report presents the results of our preliminary engineering and geologic investigation of two sites being considered for a proposed harbor near Point Sur, California. One site is located at the mouth of the Big Sur River, south of Point Sur. The other site is located at the mouth of the Little Sur River, north of Point Sur. These sites are indicated on Plate 1, Vicinity Map. A Site Plan of the Big Sur site is presented on Plate 2 and a Site Plan of the Little Sur site is presented on Plate 3.

A previous diving reconnaissance had disclosed ledge rock at the ocean bottom at Little Sur. No evidence of ledge rock was found at Big Sur during this reconnaissance.

SCOPE

The scope of this investigation was agreed upon in consultation with Mr. Omar J. Lillevang of Leeds, Hill & Jewett, Inc. Mr. Ernest Judd of Pacific Towboat & Salvage Company advised on the practicability of off-shore probing and drilling techniques.

The scope was to make preliminary explorations at each site. These explorations would indicate what problems might be encountered, or avoided, in dredging at either site. It was decided that no further information was

needed below ground surface* at Little Sur, unless and until probings offshore at Big Sur might also encounter ledge rock at the ocean bottom.

The investigation was primarily concerned with the Big Sur site and only limited information was gathered at the Little Sur site.

The procedures then proposed were as follows:

A. Big Sur River

1. Jet probings on a predetermined grid pattern to investigate the offshore area.
2. Jet probings on a less regular pattern to investigate the onshore area.
3. Inspection pits to be excavated onshore.
4. Geologic mapping of the rock ridge at the location of a proposed deep channel cut, utilizing bulldozer stripping to expose the bedrock along the east side.
5. Shallow refraction seismic lines along the top of the rock in the vicinity of the proposed channel cut.

B. Little Sur River

1. Underwater geologic investigation of the offshore area.

The scope of investigation of the Big Sur site was modified during the investigation. Jet probing was unsuccessful because of large amounts of cobbles. Land title and leasehold provisions were such that the owner-tenant could not permit the tentatively approved bulldozer stripping, nor some of the inspection pits planned. A limited number of pits were to be allowed, but the crane provided for the work had too short a reach to permit safe excavation of unsupported holes to the depth necessary.

*The term "below ground surface" applies equally to soil and rock conditions, offshore below the ocean bottom, and onshore below the ground surface.

The investigation of the Big Sur site was modified to include:

1. Driving test piles onshore as a means of exploring for bedrock.
2. Geophysical seismic explorations of the depth to which dredging might be desired.

Several alternate methods of exploration were considered. One of the most desirable methods would have been test borings, drilled with suitable equipment. Although drilling contractors visited the site and prepared cost proposals, no drilling was done due to the desire to limit costs during this preliminary investigation.

The desired data was to include the following:

1. Site Plan showing locations of exploratory work.
2. Logs of exploratory work.
3. Geologic interpretation of data.
4. Opinions regarding:
   - A. Problems in dredging of the proposed sites.
   - B. Areas of bedrock above dredge depth.
   - C. Problems in excavating the deep channel cut.

EXPLORATIONS

Jet probings were made offshore and two probings were attempted onshore. The details are described in the appendix. The results of the jet probings are shown on Table 1, Jet-Hole Information.

Test piles were driven at several locations onshore as shown on Plate 2. The driving records are shown on Table 2, Penetration Record of Piles.

During this investigation, we were assisted by Mr. Neill Martin, Geologist and SCUBA diver. Mr. Martin was present during most of the jet probings, during the seismic explorations, and during the underwater mapping of the Little Sur site. Mr. Martin supervised and observed the inspection pit excavation and the driving of test piles.

Details of the exploration of the site are presented in the appendix to this report.

GENERAL SITE CONDITIONS

The mouth of the Big Sur River is located approximately three miles southeast of Point Sur. The mouth of the Little Sur River is located approximately two miles north of Point Sur. The two sites are shown on Plate 1, Vicinity Map.

The dominant topographic feature in the area is the rugged Santa Lucia Mountains which trend north-northwest. The crest of the mountains is approximately eight miles east of the area investigated. In most areas, these mountains rise abruptly out of the sea as cliffed headlands. The mouth of the Little Sur River is cut directly through these cliffs. However, a broad terrace between Elevations 40 to 80 feet extends from Point Sur to several hundred feet south of the mouth of Big Sur. This terrace separates the mouth of the Big Sur River from the abrupt rise of the Santa Lucia Mountains. This terrace averages 3,000 feet in width. It was originally cut by waves at a time when the sea level was higher with respect to the land than it is today. Non-marine deposits or alluvium now cover this old wave-cut terrace or bench. The terrace is terminated abruptly by a cliff along the coastline.

In general, the streams and rivers which cut through the Santa Lucia Mountains are confined by a valley with a V-shape. However, the last five miles of the Big Sur River valley and the last one mile of the Little Sur River valley, before each enters the sea, is much broader.

The coastline is very irregular. Resistant bedrock projects out of the water as "stacks" or "chimneys". Many similar resistant projections from the floor of the sea do not break the water surface.

SITE CONDITIONS - MOUTH OF THE BIG SUR RIVER

The surface and subsurface conditions described in this report for the mouth of the Big Sur River have been interpreted from information obtained from the geologic literature, geologic field mapping, and air photo interpretation, the seismic refraction lines, one clamshell test pit, and the jetting and pile driving records. A detailed description of these investigations is attached as an appendix to this report.

The mouth of the Big Sur River apparently was cut much more deeply in the past. This deep cutting may have occurred during one of the last glacial periods when sea level was considerably lower by as much as a few hundred feet. This deep-cut channel was filled with sediment as the ice melted and the water rose, resulting in the present wide stream valley. However, the outlet of the river into the ocean is considerably more narrow than the valley.

This narrowing takes the form of a 60-foot-high ridge which extends almost due west from the east side of the river valley. This ridge abruptly narrows the river valley from 1,800 feet upstream to 800 feet at the mouth of the river. The top of this ridge is flat, representing a remnant of the original wave-cut bench.

This narrowing is due to more resistant bedrock along the present shoreline. The bedrock in the area has geologically been designated as the Franciscan formation. This is a varied formation with several different rock types. Along the narrow ridge the Franciscan formation consists of massive sandstone, fractured shale, and altered volcanic rock known as "greenstone". The sandstone and shale dip approximately 40 degrees to the north-northeast. Twelve to 18 feet of soil and alluvium overlie the bedrock along the narrow ridge.

A sand, gravel and cobble bar extends in a westerly direction from the west end of the narrow ridge. It has forced the Big Sur River against the extreme west side of the valley. A small lagoon has formed in back of this bar.

The present alignment of the channel is slightly different than shown on the Hydrographic & Coastal Beach Survey Map, which was prepared in May of 1958, for the U.S. Army Engineer District in San Francisco and which was used as the base map for this investigation. To the east and west of the small channel in which the Big Sur River now flows, there is an extensive growth of trees and low brush.

Silt, sand, gravel and many cobbles have filled the mouth of the Big Sur, both onshore and for some distance offshore. Due to scouring and erosion of the finer-grained materials, the top several feet consist almost entirely of gravel and cobbles, with some large boulders. This is characteristic throughout the onshore area, and offshore to a water depth of 20 feet below Mean Lower Low Water Datum (-20 feet, MLLW).

The jet probings could not be forced below a depth of six feet either onshore or offshore, except Numbers 5, 8 and 9. These three were located the furthest offshore.

Below this upper zone of very coarse material, evidence from the one test pit and from the pile driving records indicate that the deposits consist of silt and sand in layers, with lenses of gravel and cobbles. The distribution is apparently unpredictable.

To the seaward side of the 20-foot contour, the jet probings did extend below -40 feet MLLW. From the action of the jet pipe, the sediments consist entirely of silt, sand and gravel. Only a few cobbles were encountered.

At the shoreward limit of the western side of the river mouth, the cliff hooks sharply in an easterly direction. A small chimney is exposed approximately 100 feet to the south of this hook. Extending south from this chimney is shallow water, or a shoal. We believe that this shoal represents shallow bedrock offshore.

We found very little basis for assuming attached bedrock or chimneys anywhere east of a line connecting the shoal area, the exposed chimney and the eastern limit of the hook in the cliff. We investigated several hundred feet east of this line. This line is shown on Plate 2. However, between the locations probed, isolated pinnacles may project from the bedrock surface into the overlying alluvium, both onshore and offshore. Some of these may project above -30 feet MLLW.

Offshore, the most likely place for buried pinnacles of bedrock is east of the chimney or hook in the cliff. During the first diving survey, a zone of large angular boulders was found a few hundred feet east of these features. These boulders might be the surface expression of a buried pinnacle from which they were broken. For planning purposes, a buried pinnacle approximately 100 feet in diameter should be considered to rise to elevation

-10 MLLW in this area. Other projections of bedrock to shallow depths may be present below the sand, gravel and cobble bar. These would represent a westerly subsurface extension of the ridge. However, neither the seismic data nor pile driving records confirm this.

Piles 8 and 10 were driven at the locations shown on Plate 2. These penetrated to only -20 feet MLLW. The seismic data indicate that water-saturated sands and gravels extend to below -30 feet MLLW. This indicates that these piles probably split on a zone of boulders rather than bedrock. In such a zone, we would anticipate boulders up to three feet in diameter.

Refusal above -30 feet MLLW was not encountered in any of the other areas in which piles were driven. Of the 11 seismic refraction lines run in the stream valley, only Line 14 indicated possible bedrock above -30 feet MLLW, as shown by Cross Section B-B, Plate 4.

CONCLUSIONS REGARDING BIG SUR SITE

EXCAVATION OF DEEP CHANNEL

From exposures along the seaward side of the narrow ridge, we expect the bedrock to be mostly sandstone and shale. These two rock types appear to be present in nearly equal proportions. In general, the shale is more deeply weathered. Also, the depth of weathering is erratic, being more extensive in highly fractured zones. An average of 15 feet of soil overlies the weathered bedrock surface.

For planning purposes and construction estimates, we estimate that the upper 15 feet of material can be excavated without ripping. The next five feet below this can be ripped economically. The rest of the