

Task 1 and 2, Literature Review and Reconnaissance Field Study Design

Long-Term Management Strategy

Alcatraz Marine Habitat Study

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ALCATRAZ MARINE HABITAT STUDY
LITERATURE REVIEW AND RECONNAISSANCE FIELD STUDY,
ALCATRAZ DREDGE MATERIALS DISPOSAL SITE

1.0 INTRODUCTION

The principal objectives of the Alcatraz Marine Habitat Evaluation are to identify the locations of significant fish habitat in the Central San Francisco Bay near Alcatraz Island, to determine if dredged materials discharged at the Alcatraz Disposal Site and transported from the site have degraded fish habitat, and if so to estimate the aerial extent of the degradation. These objectives will be met by a combination of interviews, reviews of scientific literature, reports, and data pertaining to fish habitat, and reconnaissance field studies.

A secondary objective of this project is to design a quantitative study to delineate precisely the aerial extent to which material discharged at Alcatraz has migrated beyond the boundaries of the disposal site and degraded fish habitat in the Central Bay.

The purpose of this report is to discuss progress to date on the first two tasks of the Alcatraz Marine Habitat Evaluation: Task 1, Review of Literature and Pertinent Studies; and Task 2, Design Reconnaissance Field Study.

1.1 TASK 1: REVIEW OF LITERATURE AND PERTINENT STUDIES

1.1.1 Task 1 Requirements: Task 1 is to accomplish two main goals. First is to *review previous major studies in the San Francisco Bay pertinent to the evaluation of effects of Alcatraz disposal to Central Bay fisheries habitat.* Materials of particular interest include historic records of sediment composition in the Bay prior to

disposal at Alcatraz, locations of sediments or rocky outcrops typically identified as fish habitat, and historic collections and surveys focused on fish populations.

Second is to *prepare a preliminary map locating areas of sensitive fish habitat in the Central Bay* to the extent possible with existing information. This preliminary map will be based on existing literature and discussions. Refinement of this map will follow during the reconnaissance field work conducted under this Delivery Order. If desired by the Corps, a final and detailed fish habitat report and map would be prepared based on detailed quantitative studies employing more sophisticated survey techniques and apparatus conducted under a subsequent Delivery Order. Design of this advanced study will be performed as a part of the current work.

Task 1 also includes a discussion of any needs for additional data.

1.1.2 Task 1 Activities: The work to date has focused on identifying, acquiring, and reviewing materials in three main subjects: bathymetry, sediment characteristics, and marine biology. In addition, conversations with those with knowledge of the area have added helpful anecdotal information.

One intent of this review has been to characterize sediments at the disposal site likely to have been suitable fish habitat prior to disposal. Another has been to locate recent bathymetric data pertaining to the disposal mound at Alcatraz, including the approximate boundaries of the Task 3 survey which purpose has been to delineate the extent of habitat modification associated with disposal activities at Alcatraz.

During Task 1 we have tried to gather whatever information is available from biological surveys taken in the vicinity of Alcatraz, as well as to obtain good anecdotal material of past and present fishing activities in the area.

1.2 TASK 2: DESIGN RECONNAISSANCE FIELD STUDY

1.2.1 Task 2 Requirements: There are three principal goals of Task 2. First, *to use the hydrosurvey results developed by Gahagan & Bryant under Delivery Order 0015 to prepare a contour map to overlay the preliminary habitat map developed in Task 1.* This hydrosurvey was not intended to cover the entire area of interest to this habitat study. Nevertheless, it will help delineate the Alcatraz materials including perhaps the extent of the thin apron of deposited material marking the extremes of deposition and associated habitat alteration.

Second, *to design a field reconnaissance study to be conducted during this Delivery Order to estimate the extent and nature of the movement of discharged material away from the Alcatraz disposal site.* During this reconnaissance study sediments from a wide area of the Central Bay will be collected to assess the areal extent of the Alcatraz sediments. Several collection methods will be evaluated including two types of gravity cores and several surface grab samplers.

Third, *to evaluate the best procedures to quantify habitat alterations.* These procedures will be developed for two levels of evaluation: a *general and qualitative* method to be used in this Delivery Order, and a combination of qualitative and remote data methods to be employed if detailed studies are to follow this work.

1.2.2 Task 2 Activities: Although we have received hydrosurvey data for Alcatraz Disposal Site developed by Gahagan & Bryant, we have encountered complications generating contour maps from their data with the Bechtel mapping system. The conversion is proceeding, but is requiring more time than anticipated.

A generalize map of fish habitat in the Central Bay was prepared from exiting data.

A Reconnaissance field study to collect sediment samples from identified fish habitat areas was designed. Details of this study are discussed below.

Prior to conducting the reconnaissance survey, the evidence sought to determine the approximate extent of Alcatraz disposal effects was selected. Evidence for habitat alteration we propose to use are the following:

- Discontinuities in sediment composition within a core sample, especially when evidence exists of freshly deposited materials overlaying historic deposits. The differences between layers may be in particle size distribution, amounts of clay, or levels of total organic carbon.
- Evidence of benthic organisms characteristic of disturbed sediments, or present in far fewer numbers than is characteristic of undisturbed sediments sampled in the Central Bay.
- Surface sediments different from historic descriptions for a locale, i.e. muds where sands were reported.

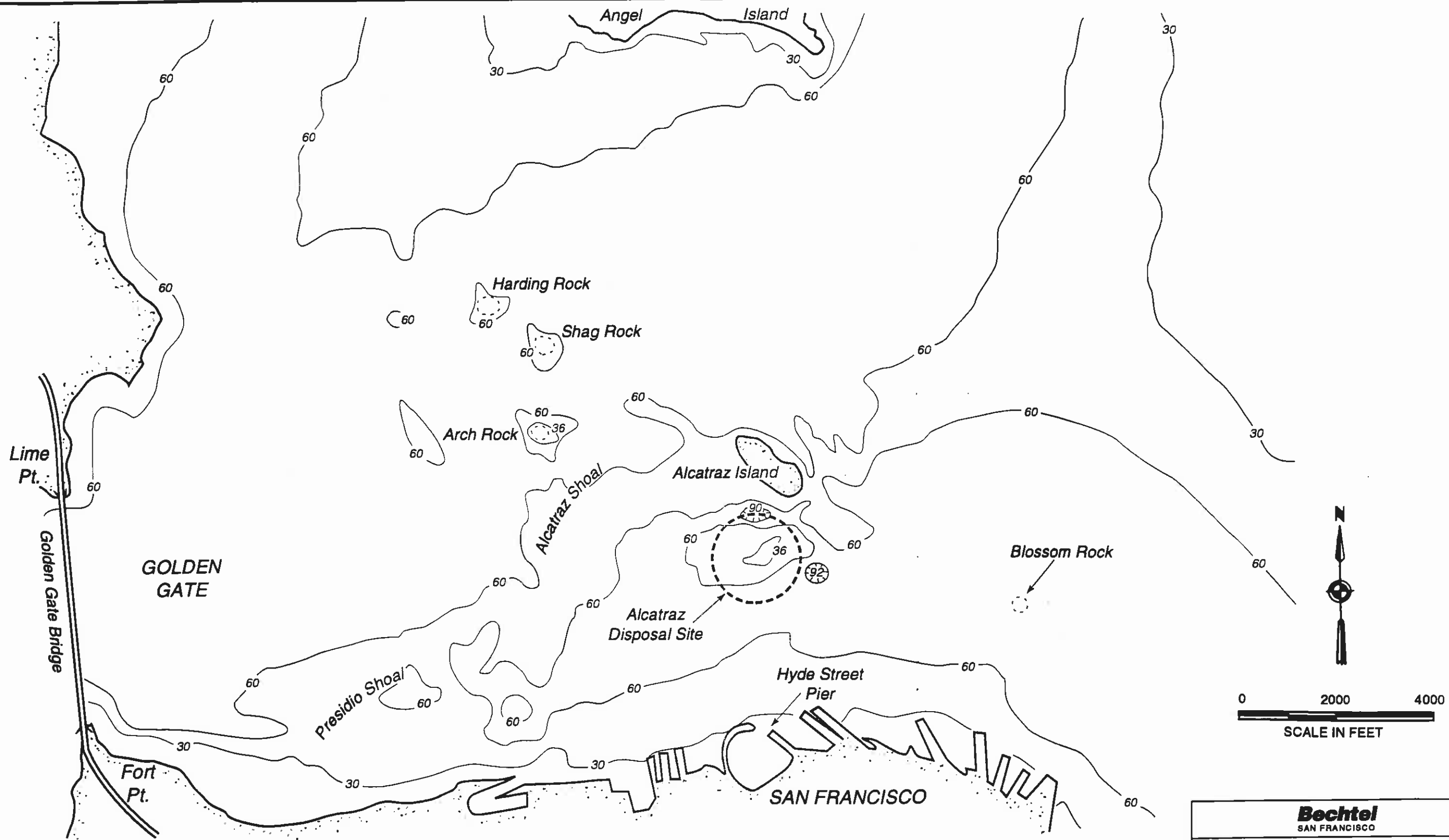
2.0 LITERATURE REVIEW

2.1 BACKGROUND TO THE ALCATRAZ DISPOSAL SITE AND ENVIRONMENT

The Alcatraz Dredge Material Disposal Site is situated within the San Francisco Bay between the Hyde Street Pier and Alcatraz Island (Figure 1). The site is designated as a 2000 foot diameter circle with its geographic center at latitude 37° 49' 17" North, longitude 122° 25' 23" West.

The site has been used as a material disposal site since its designation in 1894. The area between Alcatraz Island and the Hyde Street Pyre was originally designated because of its depth - formally approximately -165 feet Mean Lower Low Water (MLLW) - and the high current velocities. It was assumed that the high current velocities would carry and disperse the sediments out to sea. The currents have proved to be insufficient to transport the volume of material that has been disposed, and a mound with a peak of as high as -30 feet MLLW has recently been surveyed at the site.

Several studies have attempted to determine optimal conditions for current transport of material from the mound to reduce the accumulation of spoils (Tetra Tech, 1984; Winzler and Kelly, 1985, Trawle and Johnson, 1986; Trawle, 1986; Teeter, 1987; Pankow, 1988; and Hauck et al., 1990). Limited attention has been given to the ultimate depositional area of the current redistributed materials and the possible adverse effects to biologic habitat. The redistribution of fine clay and silt by currents or slide transport may be adversely affecting fish habitats by covering the native sandy bottom. In a report on suspended sediment movement within the bay (Hauck et al., 1990), it was recommended that detailed sampling of surface sediments be conducted to track sediment grain size and distribution over an annual cycle. These studies have not been conducted.



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ALCATRAZ HABITAT STUDY			
ALCATRAZ DISPOSAL SITE CENTRAL SAN FRANCISCO BAY			
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A brief historical account of research in the San Francisco and study of man's activities affecting general and sedimentological conditions in the bay is found in Hedgpeth, 1979. In his paper, Hedgpeth makes reference to a study by Gilbert (1917) as "the nearest thing we have to a base line analysis of the physical characteristic of the San Francisco Bay." Gilbert's report on the distribution of hydraulic-mining debris from the Sierra Nevada Mountains also included a study of currents and debris transport into and out of the San Francisco Bay. In that report the general area of the Alcatraz Dredge Disposal Site is shown with a water depth of greater than 20 fathom (approximately -120 feet MLLW). Reference is also made to the volume of material being transported into the Bay system.

2.2 BOTTOM SEDIMENT CONDITIONS WITHIN THE CENTRAL BAY

San Francisco Bay bottom sediments between the Golden Gate and the area around Alcatraz Island are comprised of primarily coarse to fine sand with minor amounts of silt and clay. East of Alcatraz, sediment particle size generally becomes finer towards the interior of the bay. Goldman (1967; 1969) provides generalized geologic maps of the San Francisco Bay area which indicate sandy bottom conditions with relatively shallow, to exposed bedrock surfaces.

Sand waves were identified throughout most of the Central Bay area during a hydrographic survey using echo-sounding equipment (Gibson, 1951). A detailed bathymetric map was contoured for the Alcatraz shoal area which shows sand waves up to six feet high.

The Wave Research Laboratory of the University of California at Berkeley conducted a core penetration study of sediments in San Francisco Bay in 1953 (Trask, et al., 1953; Trask, 1954). The study indicated that in the area of strong tidal action delineated by Angel Island, Treasure Island, and the Golden Gate, core penetration

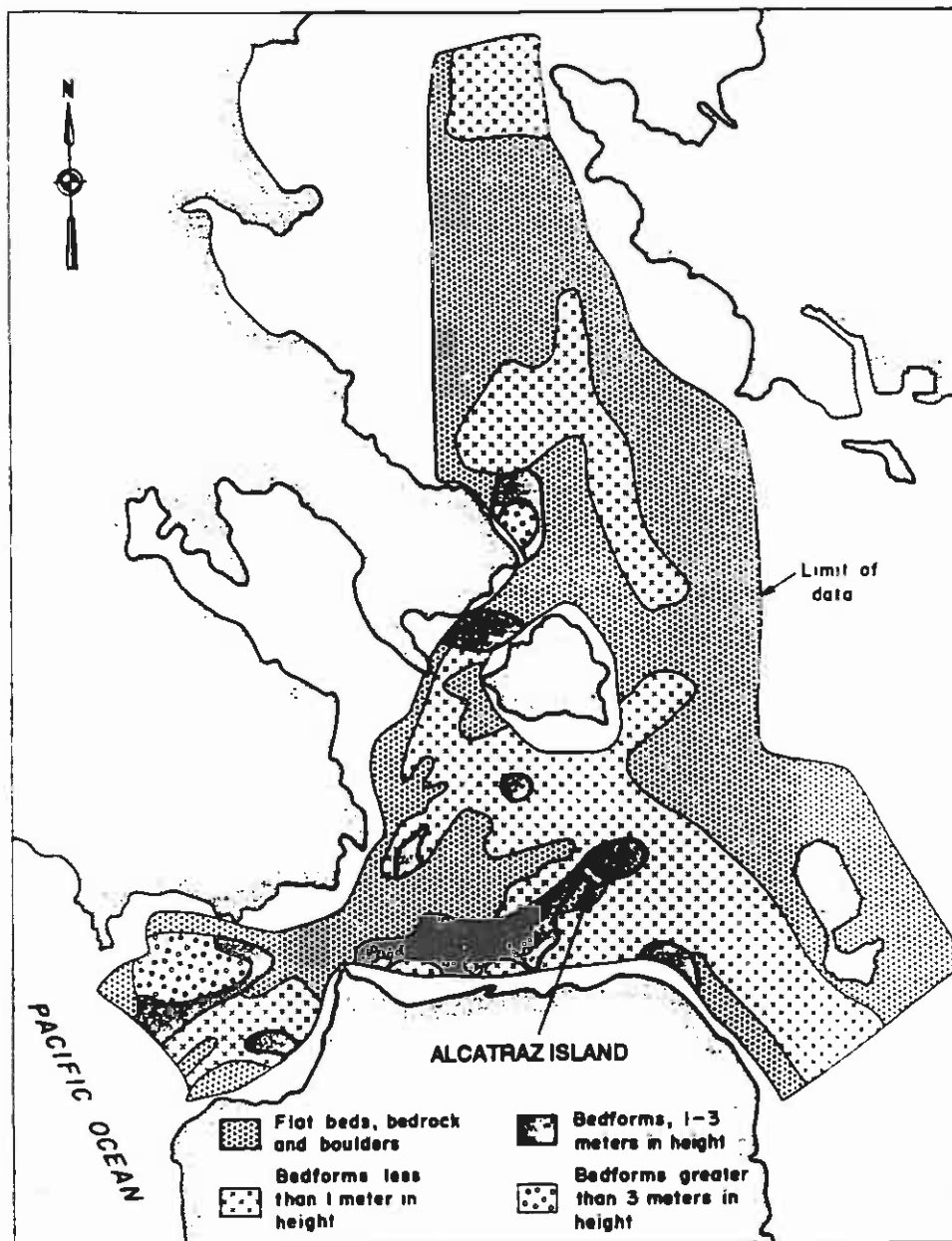
generally ranged from two to four feet. Cores were collected using a piston core (Kullenberger) sampler. Sediment from nine cores (Sample numbers 139 - 141 and 146 - 151) recovered in the area between Alcatraz Island and the San Francisco shoreline contained primarily fine to medium sands with some shell material. One Core (151) on the Alcatraz Shoal contained gravel.

Johnson (1971) determined grain size of several cores collected from the 1953 survey. Data indicate that sand between Alcatraz Island and The San Francisco Bar is fine to coarse grained (125-1000 microns). A later study by Thompson (1981) along a coring transect from the offshore area, through the Golden Gate, to the Central Bay indicated a similar trend, with coarse sands in the Golden Gate region fining inward to the east.

A detailed study of bedforms within the Central Bay using side-scanning sonar was reported by Rubin & McCulloch (1979). They describe three types of bedform topography (Figure 2) around the disposal site area:

- Flat bed with bedrock and boulders located just south and southwest of Alcatraz Island,
- Sandwaves 1 - 3 meters high located southwest of Alcatraz Island, primarily along the Alcatraz shoal, and
- Sandwaves less than 1 high meter located south of Alcatraz Island and east of the Alcatraz Shoal. The junction point of the three bedforms is in the vicinity of the Alcatraz Disposal Site.

A general study of spoils and natural sediment characteristics within the Alcatraz Dredge Disposal Site area was performed by Farmer (1985). His report included an appendix by Subsurface Consultants which contained boring logs from six holes



Distribution of bedforms in San Francisco Bay mapped by side-scan sonar.

REFERENCE: Rubin and McCulloch, 1979.

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ALCATRAZ HABITAT STUDY			
BEDFORMS IN SAN FRANCISCO BAY			
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drilled by rotary methods in and around the Alcatraz disposal mound. Some of the significant findings of Farmer's report include:

- The former depth of the dredge disposal site area was approximately -165 feet (MLLW).
- Recent dredge spoils are composed of a mixture of ≈75% highly plastic clays and ≈25% clayey sands. Older dredge spoils are predominantly highly plastic clays.
- Recent shoal deposits are comprised of relatively clean dense fine sands. In some places the shoal deposits have covered the older dredge spoils.
- Natural pre-dump site deposits were encountered in one bore hole at a 85 foot sub-bottom depth (SBD). Approximately four feet of dense clayey sands were found to overlie a graywacke sandstone bedrock at 89 feet SBD (-129 MLLW).

The results of Farmer's investigation of natural deposits around the site are generally consistent with other reports which indicate sandy-bottom conditions around the area and on the Alcatraz Shoal (Trask, 1954; Goldman, 1969; Johnson, 1971 and Thompson, 1981). The thin sediment cover overlying bedrock also corresponds well to shallow bedrock depths (-100 to -200 feet MLLW) indicated on top of bedrock contours (Goldman, 1967; Carlson and McCulloch, 1970).

Currently, the Corps of Engineers has designated eight sampling stations (Alcatraz Environs Stations) around the Alcatraz Disposal Site as a reference for determining suitability for dredge spoils disposal. Grain size data from the sites are available (USACE, 1993) for the sites, however the sediments are composited. Analyses of the sediments indicate 81-98% sand with up to 17% gravel and 0-6% silt and clay.

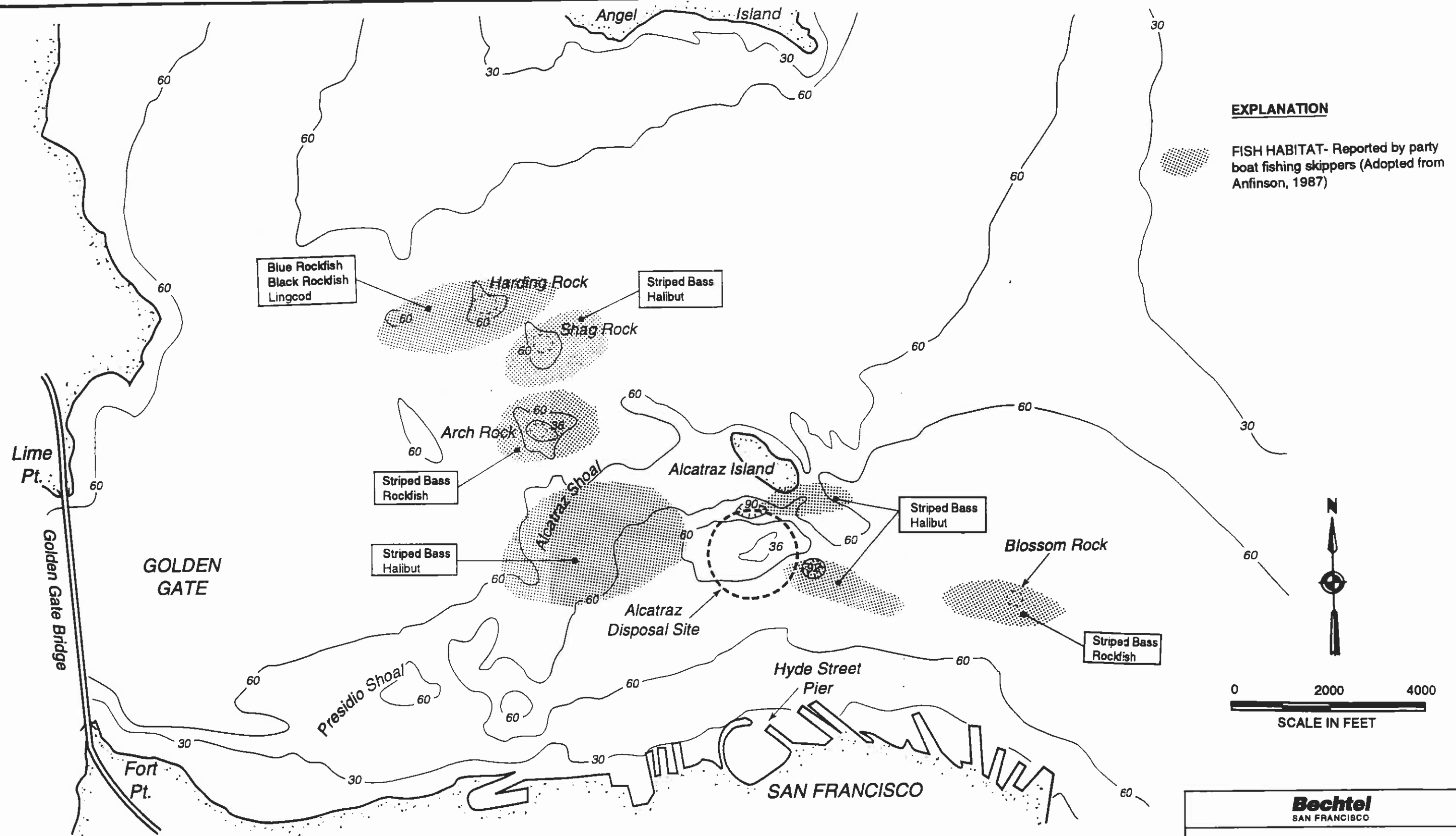
2.3 FISH DISTRIBUTION AND HABITAT USE NEAR THE ALCATRAZ DISPOSAL SITE

To determine the extent of information pertaining to fisheries and habitat near the Alcatraz Disposal Site, consultations were conducted with the Aquatic Habitat Institute (AHI; (Bruce Thompson and Ted Daum); University of California at Berkeley (UCB; Don Weston); San Francisco Estuary Project (SFEP; Marsha Brockbank); and the California Department of Fish and Game (CDFG; Robert Tasto at Menlo Park, and Kathy Hieb at Stockton). Literature recommended by these individuals to be reviewed for related information are listed at the end of this report. The AHI Scientific Information Network for the Bay and Delta (SINBAD) database was also reviewed for any reports or literature that could be useful.

It appears that very little is known of verified fish habitat that may have existed at and near the Alcatraz Disposal Site prior to disposal activities. Literature review and personal communications with the aforementioned individuals revealed little evidence of work done to characterize important fish habitat that may be influenced by sediment transport from the site.

Habitats of particular concern for the present study are sandy shoals and rocky outcrops. Much of the shallow Central Bay is dominated by mudflats and subtidal muds. Sands and rock are found in deeper parts of the bay, primarily west and north of Alcatraz Island. Fine sands also occur in areas east of Alcatraz Island. These substrates can support recreational fish (Figure 3) such as halibut, striped bass, rockfish (blue, black, and brown), and lingcod (Tasto, pers. comm., 1993). It appears that at least the adult forms are found near these habitats; little is known about the larval and juvenile use of or dependence on these substrates.

Skinner (1962) described the Alcatraz area as historically supporting a commercial fishery for bottomfish, such as sablefish, lingcod, hake, and rockfish. Later accounts



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ALCATRAZ HABITAT STUDY			
REPORTED FISH HABITAT			
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by Aplin (1967) described the west edge of Treasure Island as mostly homogeneous sand and mud. Some of the more common fishes present included: Pacific herring, northern anchovy, jacksmelt, English sole, tomcod, speckled sanddab, shiner perch, white croaker, starry flounder, northern midshipmen, pile perch, Pacific staghorn sculpin, and tonguefish.

Compendia of fisheries and aquatic resources of San Francisco Bay by Herbold et al. (1992), Monroe et al. (1992), WESCO (1988), as well as discussions of turbidity effects to the biota (O'Connor, 1991) provide more comprehensive descriptions of presence, distribution, and possible causes of population fluctuation of fisheries in the Bay. However, there is little information available focusing on habitats or habitat modification as related to changes in Bay substrate. Much of the work related to declines in fish populations and catches is directed at water column effects such as changes in Delta outflows, and turbidity and pollutant effects.

The CDFG Bay Study is the only on-going biological monitoring program that has been conducted in the Central Bay (it also includes other stations within the Bay). CDFG has been sampling selected sites since 1980. Otter trawls have been used at stations near the Alcatraz site, although no trawls have been taken at the mound itself. It is generally considered that the active disposal site is a constantly changing environment with little demersal fisheries value remaining.

The fish habitat data generated by this program are biased by gear type. Otter trawls tend to capture the slower moving bottom fishes, and can be deployed most successfully on even or softer bottoms. Areas of exposed rocks are not satisfactorily sampled by this method. A cursory examination of the CDFG data suggests that the fishes near the Alcatraz area tend to more marine than estuarine in preference. Some of the more common fish encountered, include northern anchovy, Pacific herring, longfin smelt, white croaker, English sole, and marine surfperches. It is expected that data we have requested from past surveys will confirm this trend.

A hydroacoustic survey was conducted in 1991 at the Alcatraz site immediately before, during, and after a disposal event on a flood tide (MEC, 1991). Survey transects were located around the site and tracked both fish movement and plume dynamics. The study determined that the plume was dense and sank slowly. Fish near the site (herring, butterfish, and anchovies) left the area during the event. The schools returned two to three hours later. Monitoring of additional disposal events would have been necessary to provide better definition in the tracking system. However, this survey was not repeated.

It is the contention of local party-boat operators that sediments migrating from the Alcatraz site have affected adversely prime fishing sites in the Central Bay, including Harding Rock, Shag Rocks, Arch Rock, Alcatraz Shoal, and Blossom Rock (Tasto, pers. comm., 1993). These operators speculate that fine materials from sediment disposal have begun to smother these rocky habitats and sandy shoals, reducing the available habitat preferred by their recreational fisheries, and subsequently reducing their catch. No direct evidence of this process is available.

Representatives of the National Parks Service on Alcatraz Island believe that tidepool habitats facing the disposal site (on the south shore of the island) may be silting in due to disposal practices (Tasto, pers. comm., 1993). We are awaiting verification of this from Nancy Horner, National Parks Service. However, no data to confirm or refute these statements has been uncovered.

Information useful in determining habitat conditions in the vicinity of Alcatraz is widely distributed and of varying quality; much is anecdotal. We expect that our knowledge of habitat conditions will continue to grow as past studies come to light, and as field work progresses. However, at this time, we must base our estimates more on extrapolation from approximate aerial distributions of sediment characteristic of fish habitat (i.e. clean, coarse sands; exposed rock). It is expected that

the reconnaissance studies will give more information of use in locating these habitats.

3.0 RECONNAISSANCE FIELD STUDY PLAN

3.1 PURPOSE

Sediment sampling will be conducted to assess the presence and distribution of fine-grained dredge materials that may be covering fish habitat near the disposal site. However, it is not within the scope of this task to fully evaluate the potential impact on all of the unique Central Bay fish habitat. The initial goal will be to evaluate the approximate boundaries of disposed sediments and use that information to develop a more comprehensive plan to assess habitat impacts at a later date if desired.

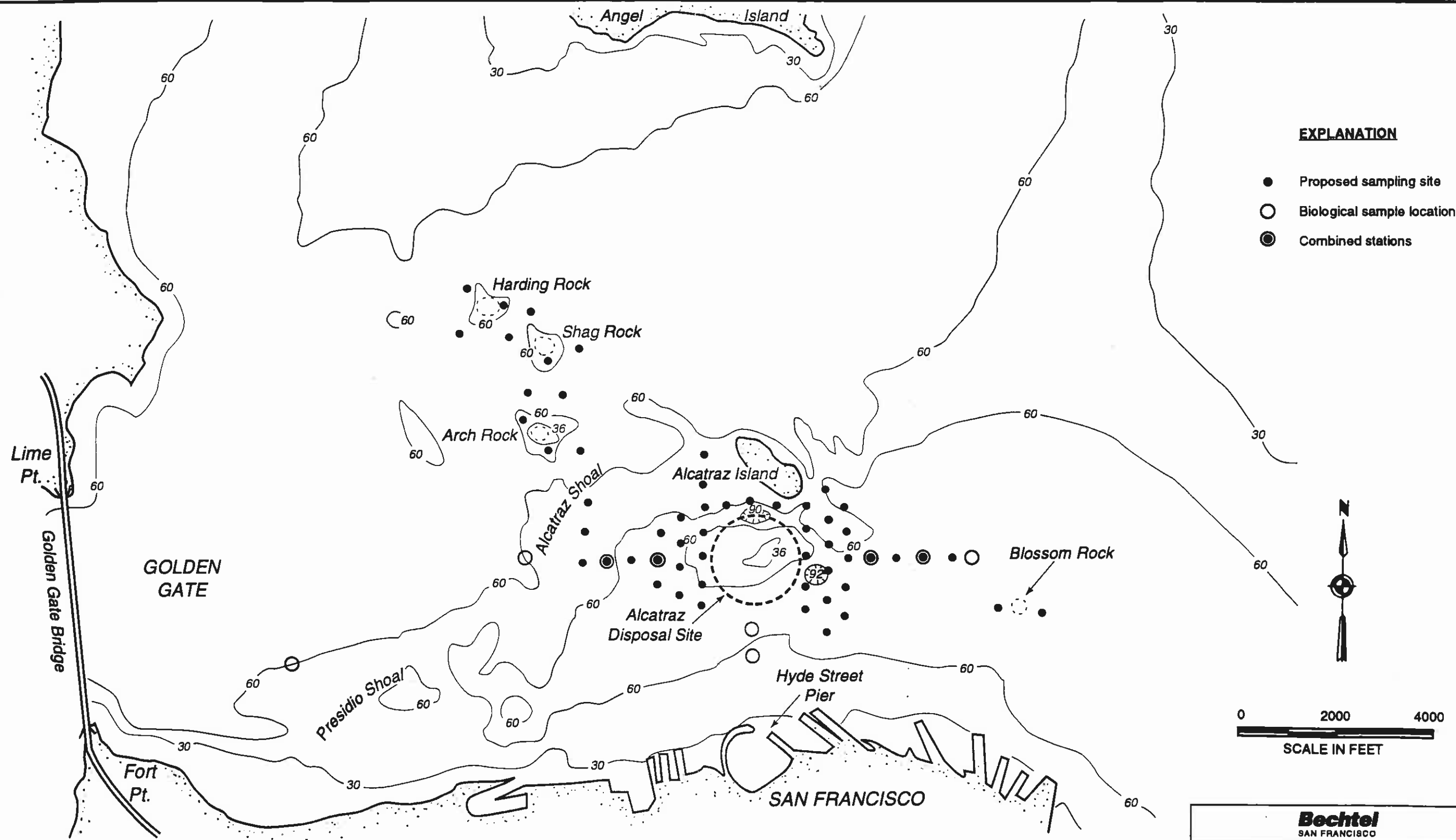
3.2 METHODS

3.2.1 *Sampling Coverage*

Proposed sampling stations are presented in Figure 4. A series of general north-to-south sampling transects will be made along the east and west margins of the disposal site. An east-to-west transect will be made on both sides of the dredge disposal area to the point where sediments appear to be natural, as was discussed under Bottom Sediment Conditions above.

Sampling stations will be approximately 500 feet apart along the transects. Sampling stations will be offset 250 feet between each transect to increase north-south sampling point coverage.

Additional points will also be picked from anomalous bottom features identified during the field study. Selected points may also be sampled around Harding Rock, Shag Rocks, Arch Rock, Blossom Rock, and along the Alcatraz Shoal if time permits.



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ALCATRAZ HABITAT STUDY		
PROPOSED SAMPLE SITES ALCATRAZ DISPOSAL SITE		
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3.2.2 *Sampling Vessel*

We propose to use the San Francisco State University research vessel Questuary. This vessel is well-equipped including a 3,000-ton A-frame hoist capable of gravity coring and grab sampling in the open Bay. We have inspected this vessel and it appears well-suited for this work in every respect.

3.2.3 *Sampling Methods and Quality Control*

Shallow core samples will be collected using a gravity driven device capable of approximately six feet of sub-bottom penetration, depending on sediment type. If the bottom sediment proves to be too dense for sufficient gravity core penetration, or if sediment recovery is not adequate, other sampler types may be used depending on cost and time allowed.

Samples from the gravity core barrel will be recovered within an acrylic liner or other suitable liner material. Grab samples will be transferred to plastic bags or containers as appropriate. After sediments are recovered, the station number, location, water depth, and length of recovered volume will be recorded. Shipboard logs will be maintained and any geologic and biologic notes made on board will be recorded. The core liners and bag samples will be sealed after initial observations are made and the samples will be transported to Bechtel's sediment lab in San Francisco for further study. The core samples will be opened (sectioned) after shipboard procedures are completed and detailed sediment logs will be generated.

Biological samples will be collected by surface grab at approximately 10 stations (Figure 4). Sediments will be passed through a 1 mm sieve on board and retained organisms preserved in 10% buffered formalin. These will later be identified to genus, and to species when possible. A sub-sample for particle-size-distribution and

total-organic-carbon analysis will be collected at this time and placed in labeled and jars pre-cleaned and provided by the analytical laboratory.

3.2.4 Data Analyses

Physical: It is anticipated that the dredge spoils material should be discernable from natural deposits by visual identification (sediments type, color, grain size, and sorting). In samples where origin (natural or dredged material) cannot be ascertained, sediment will be analyzed for physical parameters such as moisture content, density, and plasticity index.

Biological: Samples will be evaluated qualitatively and a description of the benthic invertebrate assemblage presented. Difference in physical, chemical, and biological characteristics at the 10 stations will be considered. Directional trends and changes will be discussed and compared in an attempt to correlate benthic community structure with changes associated with transport of sediments from the Alcatraz site.

The limited number of samples collected, together with variability among stations expected at these locations, makes it unlikely that meaningful statistical analysis of the biological data will be possible. However, attempts will be made to compare information among the stations, including for instance the "ABC" process using cumulative percentages of species abundance.

4.0 REPORTING AND CONCLUSIONS

All observations made and data generated during this reconnaissance study will be presented in a Final Report. The data will be compared to existing studies and will be used to design a quantitative field study. Maps will be used to present the information obtained from the activities of the Alcatraz Marine Habitat Study.

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*Task 1 and 2, Literature Review and Reconnaissance
Field Study Design*

Long-Term Management Strategy

Alcatraz Marine Habitat Study

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