AN EVALUATION OF NEARSHORE SEDIMENT CONTAMINATION DUNGCA'S BEACH, EAST AGANA BAY, GUAM

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I. INTRODUCTION

The Dungca's Beach area, located in East Agana Bay (Figure 1) suffers from the continual degradation of water and environmental quality in the nearshore environment. Raw sewage discharge on the beach and into the lagoon during periods of heavy rainfall from sewerline manholes on the beach, and sediment discharge into the lagoon from stormdrains in the vicinity have resulted in water quality that is continually polluted. Weekly water quality monitoring by the Guam Environmental Protection Agency (GEPA) results in this area being reported as polluted. Consequently, swimmers, fishermen and other water contact recreators are advised not to use the area. The inappropriate placement of a sewerline on the beach, significant increases in the loads on the line and the lack of maintenance over the years have resulted in this problem. This is an environmental and public health problem for all of Guam, particularly affecting those who utilize this beach and lagoon area.

The Onward Agana Beach Hotel is currently under construction along the northeast end of Dungca's Beach (Figure 1). The intertidal and upper subtidal areas of the nearshore lagoon along this site are comprised of a black mucky sediment, contaminated by the overflowing sewerline. The owners of this hotel are particularly concerned with this problem as they would like a clean beach which their guests will be able to use. In conjunction with the hotel development, a 3.3 acre area of nearshore reef flat immediately fronting the hotel site is being dredged for use as a swimming area. Approximately 75 percent of the dredge material is to be used for nourishment of the beach fronting the hotel site.

The owners of the Onward Agana Beach Hotel are active members of DuBAWASA (Dungca's Beach Area Water and Sewer Association) which plans to reverse the flow of sewage in the beach sewerline and reroute this flow so it will be handled in the Camp Watkins sewerline. The sewerline on the beach fronting the Onward Agana Beach will then be removed. The owners of the Onward Agana Beach Hotel further wish to improve the nearshore environment by removing the polluted sediment and replacing it with good quality beach sand.

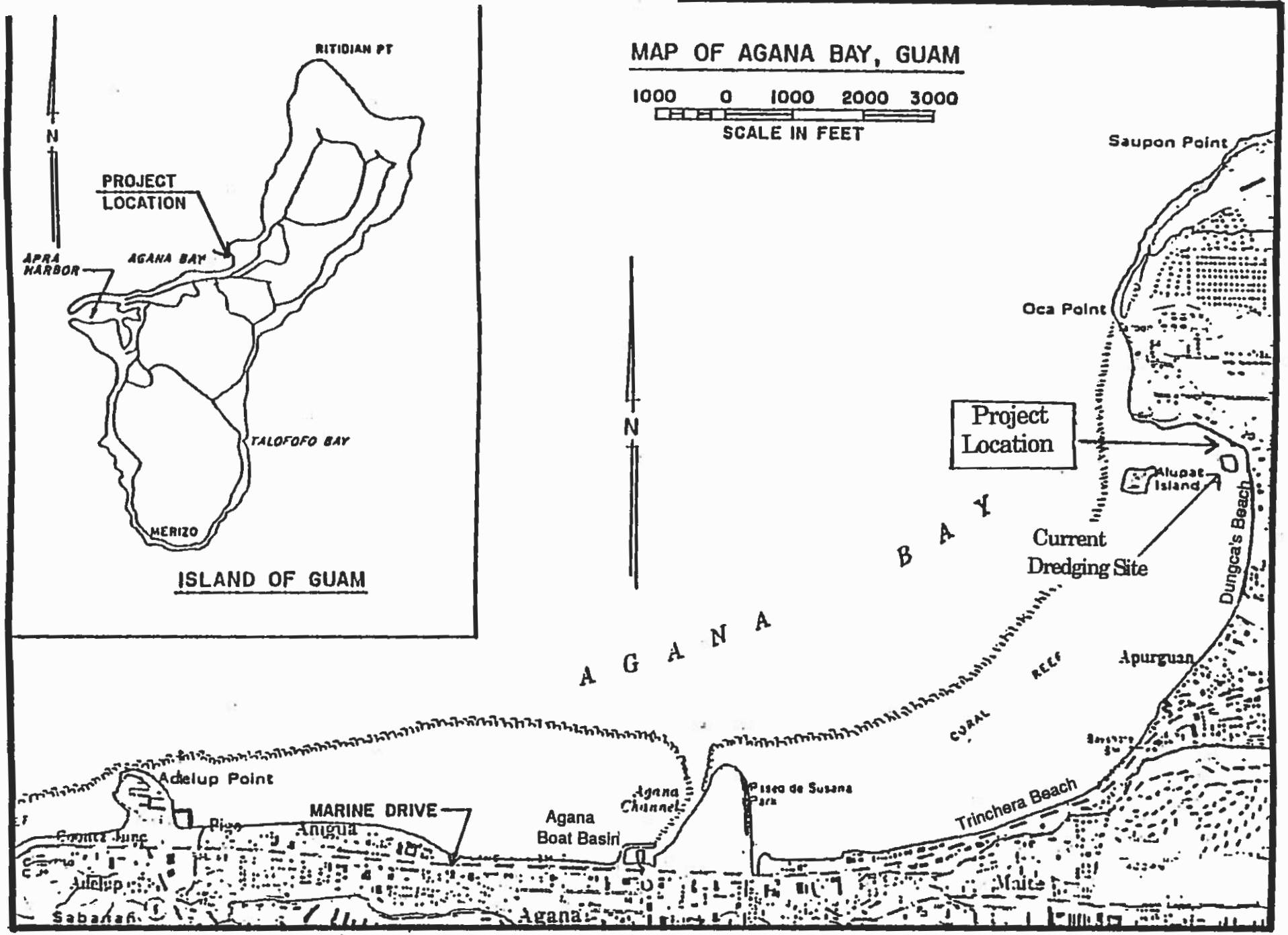

Figure 1: Map of Guam showing location of proposed project.

II. PURPOSE AND NEED

The purpose of the proposed project is to remove polluted sediment from the shoreline and intertidal areas fronting the Onward Agana Beach Hotel and replace it with good quality sand. The presence of a fine black silty muck, with a sulfur-like smell prompted the need for this proposed action.

As previously mentioned, raw sewage discharges onto the beach and into the lagoon which causes the water quality and polluted sediment problem. A separate project is currently under consideration for the reversal/modification of the Alupang-Dungca's Beach Sewer System. The reversal/modification project proposes to deactivate that portion of sewer line routed through the northern portion of the Onward Agana Beach Hotel property and along the shoreline to the southern boundary of Onward Agana Beach Hotel (Figure 2). This project will involve redirecting wastewater flows affected by deactivation of this line from its present gravity route along the Onward Agana Beach Hotel Property and the shoreline to the existing Camp Watkins sewer interceptor. Included in the project will be construction of segments of gravity sewer line, a lift station and force main and removal of manholes and other portions of the deactivated system which project onto the surface. Details of the design for the reversal/modification project are outlined in the design study proposed by Duenas & Swavely (1991). Upon completion of this project, sewage will no longer flow out onto the beach and into the lagoon along this portion of Dungca's Beach.

The proposed beach/lagoon clean-up project is related to the sewer system reversal/modifications project in that both projects propose to resolve the pollution problem in the Dungca's Beach area. However, the proposed clean-up project should be considered independently and should commence regardless of the status of the sewer system project.

In order to determine the nature and extent of the polluted sediments, a survey of the shoreline and nearshore environment fronting the Onward Agana Beach Hotel property was undertaken. This survey is essential to understand the reasons why the contaminated material should be removed. This report also identifies the essential permits that are required to perform this work and how these permits will be acquired.

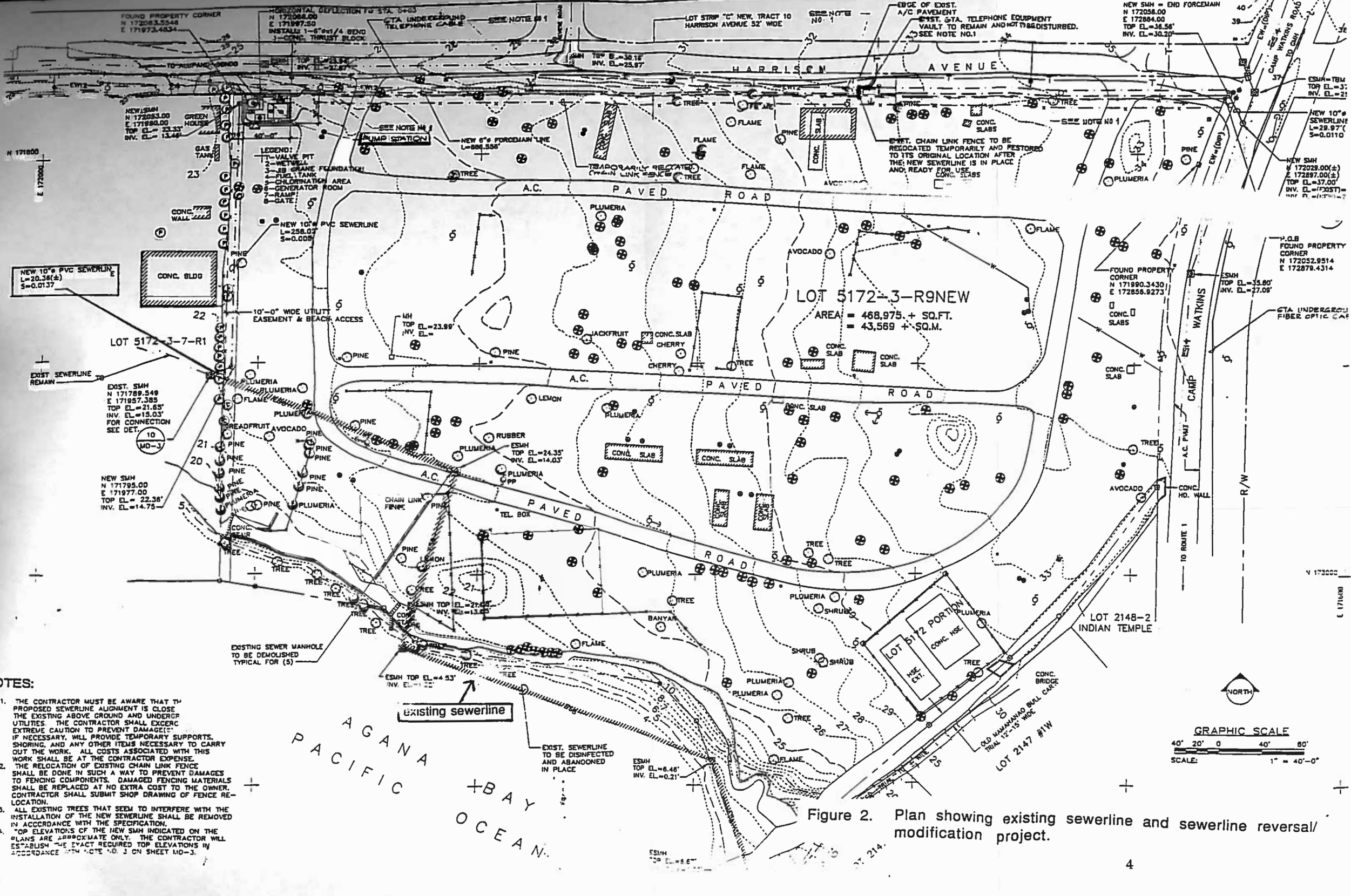

Figure 2. Plan showing existing sewerline and sewerline reversal/ modification project.

III. PERMITS REQUIRED

Several permits are necessary to remove the sewerline on the beach and perform the beach/lagoon clean-up work. These include the following:

A. Sewerline Removal Project

- TSPC Seashore Clearance
- BOP Federal Consistency Review
- GEPA 401 Water Quality Certification

B. Beach/Lagoon Clean-up

- Army Corps of Engineers Permit
  - Section 10 dredging
  - Section 404 filling
- TSPC Seashore Clearance
- BOP Federal Consistency Review
- GEPA 401 Water Quality Certification

IV. METHODOLOGY FOR ACQUIRING PERMITS

All the same clearances required to remove the sewerline and clean-up the beach and lagoon are already in place for the dredging project which is on-going in the area. After careful review of the existing ACOE permit to dredge the swimming zone we found that the Section 404 Fill Permit is included. This was incorrectly reported in the previous letter sent to you from PBEC on July 8, 1991. It is my intention to amend each of these permits to include the work needed to solve the problem mentioned herein. Since the beach/lagoon clean up project is adjacent to the dredge zone and between the shoreline, I would request a modification to the dredging permits to increase its scope to correct this problem. Initial contact with each of the permitting agencies listed above indicate that this is a workable plan.

The two lead permitting agencies are the ACOE at the federal government level and TSPC at the local government level. Each of the other two permitting agencies, GEPA and BOP, and other review agencies would be involved in the review of the amended TSPC Seashore Clearance. The amended TSPC Seashore Clearance application would then be submitted to the Department of Land Management for review and approval. Once it has been approved at the TSPC level results would be sent to the ACOE who would make their final determination.

The following is information on the permits that will require amendment for this work.

PERMIT	LEAD AGENCY	PERMIT NUMBER/DATE	
- Dredging	ACOE	2083	Sept. 10, 1990
- Seashore Clearance	TSPC Dept. of Land Mgmt.		Sept. 11, 1989
- Federal Consistency Review	Bureau of Planning		Sept.14, 1989
- 401 Water Quality Cert.	GEPA		Nov. 16, 1989

V. SURVEY METHODOLOGY

A baseline transect was established at the High Water Line along the beach fronting the Onward Agana Beach Hotel property. Eleven transects (T-0 thru T-10) were run 100 feet apart perpendicular to the shoreline (Figure 3). Each transect extended 100 ft out from the shoreline. Substrate composition along each transect was recorded and samples were taken of representative substrate types. A soil probe was used to determine depth to pavement along each transect. These data were used to compile a profile of the substrate type by sub-area in the area (Figure 4) and to estimate the volume of polluted material that should be removed from this area.

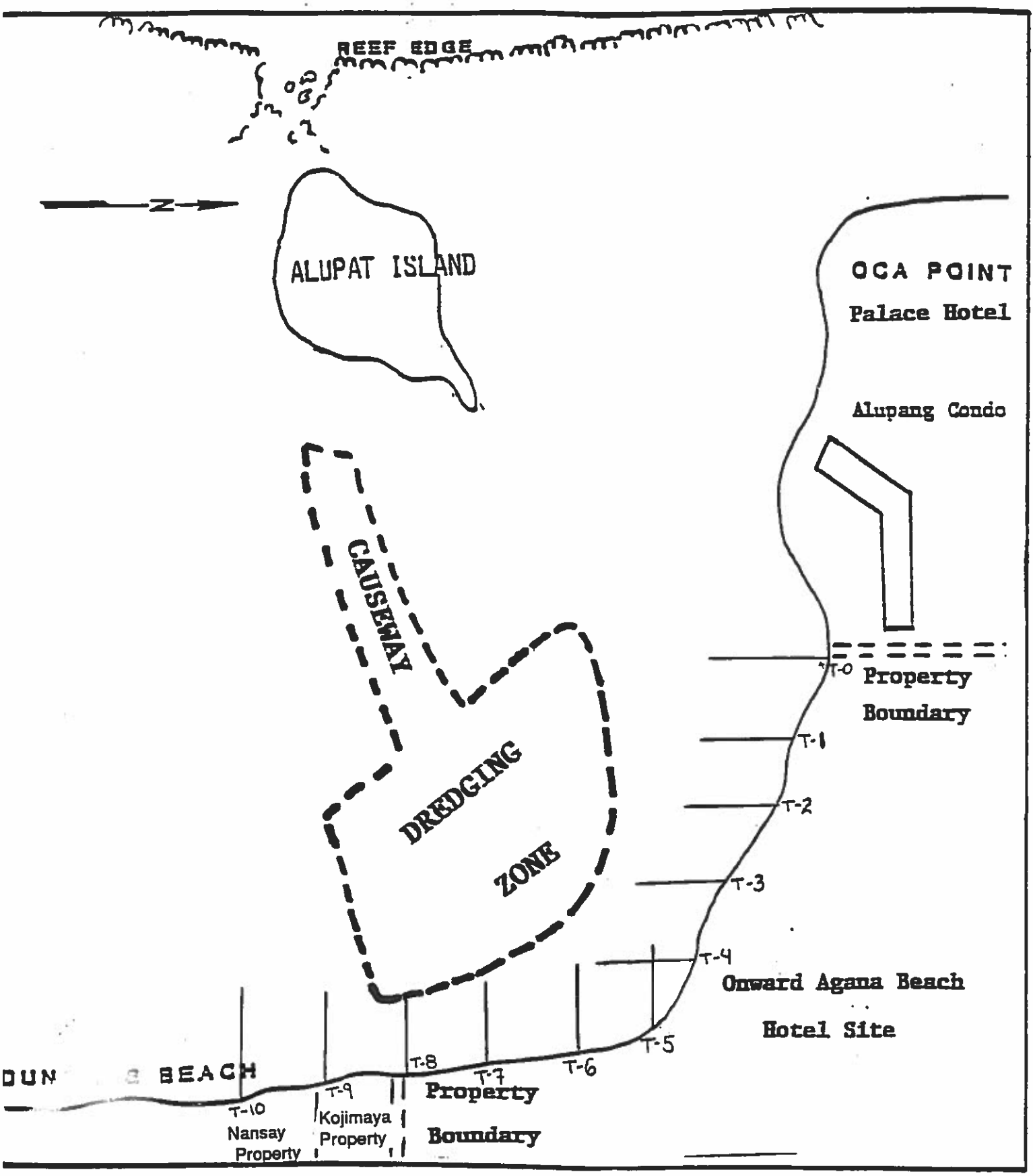

Figure 3. Project site showing approximate loaction of survey transect lines. (Transect lines are labeled T-1, T-2,etc.)

B. Description of Sub Areas

1. Rock & Rubble Area Sub -Area

The upper intertidal area of the northern shoreline, which is approximately 24,994ft^2, is comprised primarily of rocks and rubble (Figure 4, Photo 1). However, algae scum is also present over much of this area, interspersed amongst the rubble (Photo 2). The algae scum consists of Enteromorpha clathrata and Codium sp. Beneath the algae is a layer of black (anaerobic) muck.

2. Sand over Pavement Sub -Area

The lower intertidal and upper subtidal area of the northern shoreline (approximately 34,650ft^2) is predominantly hard pavement covered by a thin layer of sand (Figure 4). Additionally, Enteromorpha clathrata (a species of filamentous green algae) is found floating over the water in much of this portion of the study site.

3. Beach Sand Sub -Area

The section of beach directly fronting the Onward Agana Beach Hotel (approximately 8,655ft^2) contains some rubble, but is mostly coarse beach sand (Figure 4, Photo 3). This sub-area represents the cleanest area along the shoreline.

4. Black Muck Sub Area

Below the MHW level in the section of lagoon fronting the Onward Agana Beach Hotel, the substrate is predominantly a black, silty fine anaerobic muck (Figure 4, Photo 4). The upper subtidal zone in this area is also composed of black muck covered by a thin layer of sand (total area approximately 55,193ft^2) (Photo 5). Sediment samples of this intertidal muck revealed an unidentified organism, possibly a nematode, which thrives in this area. Enteromorpha clathrata was also found scattered throughout this area. This sub-area represents the most polluted area in the study site.

C. Volume of Polluted Sediment

Results of the depth probe investigation reveal that the average depth to hard pavement is three inches in the "Sand over Pavement" sub-area (Figure 4). Depth to pavement varied more along the eastern shoreline. In general, depth to hard pavement ranges from less than one inch in the upper subtidal zones to six inches of muck and 24

VI. RESULTS AND DISCUSSION

A. General Site Description

The project site lies at the extreme eastern end of East Agana Bay along Dungca's Beach (Figures 1 & 3). Alupat Island is located in the lagoon area near the fringing reef west of the project site. Approximately 1,000 ft of shoreline was surveyed for this project, however only 800 ft of shoreline directly fronts Onward Agana Beach Hotel property. The site is located between the dredging area and the shoreline. The additional 200 ft surveyed fronts property owned by Kojimaya and Nansay Guam, Inc. This area is also contaminated, as is the entire nearshore area all along the shoreline to the Alupang Beach Club Condominium Project. However, contamination in the Dungca's Beach area is the worst.

Water quality in this area is poor. Weekly water quality data received from GEPA show that there were only four weeks during the period from January 2, 1991 through July 3, 1991 in which the water quality was not polluted with respect to fecal coliform levels (Table 1 in Appendix B). Weekly sampling for the first 6 months of 1991 resulted in fecal coliform counts which were too numerous to count (TNTC) 50% of the time. The average fecal coliform count for the remaining eight weeks tested during 1991 in which fecal coliform counts indicated polluted conditions is 608.75 per ml, or three times greater than the water quality standard. Fecal coliform counts of greater than 200 per ml are classified as polluted.

Various sediment types throughout the study site were characterized and a map representing these various sub areas was compiled (Figure 4). As can be seen in Figure 4, the northern intertidal zone is predominantly rock and rubble, while the upper subtidal zone consists of a thin sand layer over pavement. The number of large rocks in the intertidal zone decreases proceeding east along the shoreline and rubble becomes dominant. The lagoon area directly fronting the Onward Agana Beach Hotel contains some rubble, but is mostly a coarse beach sand above the Mean High Water (MHW) level. However, below MHW the intertidal substrate in this area is predominantly a black anaerobic muck. Detailed descriptions of sediment types in these sub-areas are further described below.

inches of beach sand in some areas between MHW and Low High Water (LHW).

The "Rock & Rubble Sub-Area" and the "Black Muck Sub-Area" are the areas within the study site that contain polluted sediments. The results of this study indicate that approximately 1.84 acres (80,187ft^2) of polluted material exists within these two sub-areas. (Figure 4 outlines the boundary of these sub-areas). Approximately 2,970 cubic yards (cy) of polluted sediment exists within this boundary. This is the material that must be removed. This estimate also includes removing sediments in an area approximately 200 ft south of the Onward Agana Beach Hotel property boundary (Figure 4). By comparison, removing only the polluted sediment fronting the Onward Agana Beach Hotel property would result in an estimated 2,065 cy of polluted sediments.

VII. CONCLUSIONS

Polluted sediments in the nearshore environment at Dungca's Beach create an environmental and public health problem affecting everyone on Guam, especially those who recreate or work in this area. The owners of Onward Agana Beach Hotel propose to initiate the clean-up process that must take place in this area by amending the existing dredge permits to expand the current dredge area in order to remove the polluted sediments present in the nearshore area and on the beach fronting their hotel. Removal of this polluted sediment is necessary to ensure a healthy beach environment that can be used by swimmers, fishermen and others.

The results of this study indicate that removing sediments along the northern shoreline of the project site is not practical, and an alternative method should be employed to clean up this section of beach, possibly by hand tools such as rakes.

The methodology to remove the polluted sediment along the remainder of the shoreline is not clearly defined at this time. However, the present dredging methodology (suction dredge) will not be employed for two reasons: first and primary is that the suction dredging requires at least three feet of water to float. Because water depth is very shallow in this area, it will not be possible to maneuver the rig close enough to shore to perform the work. Secondly, the removal of contaminated sediments for this project requires a methodology that scrapes off only inches of a thin top layer. The suction dredge rig would cut too deep. At this time we feel the appropriate methodology will involve smaller mechanical means such as a frontend loader, sweepers and hand tools. The appropriate methodology will be studied and determined at the time a contractor is chosen. This methodology will include the use of silt curtains and will be explained in the Environmental Protection Plan.

REFERENCES

Duenas & Swavely. 1991. Final Basis of Design for Alupang-Dungca's Beach Sewer Reversal Project.

Guam Environmental Protection Agency. 1991. Correspondence concerning Weekly Water Quality Data by Recreational Water Station: Dungca's Beach.

Pacific Basin Environmental Consultants, Inc. 1990. Environmental Protection Plan for Agana Beach Hotel Dredging, Swimming and Recreational Zone. Dungca's Beach, East Agana Bay, Guam.

APPENDICES

APPENDIX A

Figure 4. Shoreline Survey Map of Dungca's Beach in the vicinity of Onward Agana Beach Hotel Property.

APPENDIX B

Table 1. GEPA Weekly Water Quality Data for the Dungca's Beach Recreation Station.

GUAM ENVIRONMENTAL PROTECTION AGENCY
AHENSIAN PRUTEKSION LINA'LA GUAHAN
D-107 Harmon Plaza, 130 Rojas St., Harmon, Guam 96911 Tel. No. 646-8863/5 FAX: 646-9402

APPENDIX B

GEPA Water Quality Data

--------------WEEKLY WATER QUALITY DATA BY RECREATIONAL STATION--------------

TODAY'S DATE: 07-10-1991

TOTAL NUMBER OF SAMPLES TO DATE: 26

RECREATIONAL WATER STATION: DUNGCA'S BEACH (J):

01-02-91	9999
01-09-91	9999
01-16-91	9999
01-23-91	20
01-30-91	960
02-06-91	470
02-13-91	NS - Not sampled
02-20-91	9999
02-27-91	9999
03-06-91	390
03-13-91	610
03-20-91	960
04-03-91	630
04-10-91	90
04-17-91	9999
04-24-91	490
05-01-91	9999
05-08-91	9999
05-15-91	9999
05-22-91	9999
05-29-91	9999
06-05-91	9999
06-12-91	30
06-19-91	9999
06-26-91	10
07-03-91	360

Table 1. GEPA Weekly Water Quality Date for the Dungca's Beach Recreational Station.

9999 designates Fecal Coliform counts "Too Numerous To Count" (TNTC).

APPENDIX C

PHOTOGRAPHS

Photo 1: Rock and Rubble area along the northern shoreline.

Photo 2: Intertidal algal scum characteristic of the Rock and Rubble area.

Photo 3: Beach sand along eastern Dungca's Beach Shoreline, directly fronting Onward Agana Beach Hotel.

Photo 4 Black muck sediment representative of intertidal area along the eastern shoreline.

Photo 5: Thin sand layer over black muck. Characteristic of upper subtidal area of eastern shoreline.

Photo 6: Intertidal area of beach directly fronting Onward Agana Beach Hotel.