

ECONOMIC AND LAND-USE PLAN
FOR
CABRAS ISLAND
AND
SURROUNDING AREA

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AND
SURROUNDING AREA**

**BY
PORT AUTHORITY OF GUAM**

JULY 1979

ACKNOWLEDGEMENT

The preparation of this land-use plan was a joint effort between the Port Authority of Guam and the Cabras Island Task Force, a committee organized at the direction of the Office of the Governor which recognized the need to develop a comprehensive and realistic document to be used as a guiding tool in the proper planning and utilization of land in and around Cabras Island.

The committee members consisted of the following public and private agencies: Bureau of Planning, Department of Commerce, Guam Economic Development Authority, The Guam Growth Council, and members of the Port Authority of Guam Advisory Council.

The Port Authority of Guam acknowledges the fact that this plan could not have been completed without the aid of the committee members who spent many hours discussing the approach and format. Special thanks goes to the Bureau of Planning, Department of Commerce and The Guam Growth Council who contributed the most time and effort in this project.

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DEFINITION OF TERMS

The terms Commercial Port, Port Authority and Port used herein refer to the Port Authority of Guam and the port facilities maintained by the Authority. The Commercial Port of Guam is the predecessor of the Port Authority of Guam.

INTRODUCTION

INTRODUCTION

BACKGROUND

The initial plan for the present commercial port facility was prepared in 1964 by the Tudor Engineering Company in its Study of Apra Harbor, Apra Harbor Military Reservation, Guam. As a result of the Territory's rapid development during the late 1960's, the planned facility was outdated prior to the completion of its construction in December, 1969. Since then, several new plans for the commercial port have been developed for various government entities.

The first of these plans is the 1972 document prepared by the consulting firm of Greenleaf/Telesca-Ahn, entitled Master Plan, Commercial Port of Guam, Phase I. This plan outlines a five-year capital improvement program for the commercial port based on cargo and passenger projections through 1990. Revenue constraints and military land ownership prevented the timely implementation of the plan. Although it has not been officially adopted by the Government of Guam, the plan has been used as a guide for the limited port facility development that has occurred since 1969. One shortcoming of the plan, is the lack of adequate discussion on the economic development potential of water-oriented activities.

In its Program for the Development of Apra Harbor, October 1977, the consulting firm of Overseas Bechtel places a heavy emphasis on the commercial port's economic development potential. The plan includes

four industrial park sites, a marina, a fishing industry and related fish processing industry, additional container yard and docking space, and a roll-on/roll-off wharf. Bechtel projects a direct employment level of approximately 2,500 to 3,000 new jobs if the plan were to be implemented within the five-year planning phase. The major deficiency of the plan is its adverse environmental impact upon the Piti Channels and Sasa Bay areas.

A third plan which involves the commercial port area is the Bureau of Planning's Land-Use Plan, Guam. Although it is not specifically a development plan for the area, the document represents the Government of Guam's land-use policies. Any development scheme for the Commercial Port or the Cabras Island area must conform with the Plan's performance standards for development and conservation of land and water resource areas of particular concerns.

PURPOSE

This document is an interim development plan for Cabras Island and the surrounding area. It is provisional in that no plan can accurately chart the development of a dynamic system. The plan is flexible and will accommodate changes as detailed studies pinpoint the feasibility of the economic activities slated for the area. The 1972 "master plan" and the 1977 Bechtel development plan are to be superseded by this document. This plan is compatible with the Government of Guam's land-use standards as expressed in the Land-Use Plan, Guam in that the ecological concerns of that plan are adhered to in this plan.

ASSUMPTIONS

Certain assumptions have been made to simplify the planning process.

These assumptions are:

1. Port facilities must be developed sufficiently to accommodate current traffic and the expected increases in future years.
2. The Port Authority will coordinate the planning and prioritization of water-oriented activities to be located around Apra Harbor in order to minimize any adverse impact upon port operations.
3. The multiple use of Apra Harbor for shipping, industry, recreation, and conservation is beneficial for all concerns.
4. Waivers on the explosive safety quantity distance (ESQD) zone requirements can be obtained from the Navy for lands which fall between the existing 7,210-foot zone and the preferred 10,400-foot zone for the ammunition wharf. No immediate relocation of the ammunition wharf is expected.
5. Military lands not identified as releasable by the U. S. Navy in its 1977 Guam Land-Use Plan, but which are included in this plan, should be acquired by the Government of Guam.

OBJECTIVES

This plan has been developed along the following three objectives:

1. ECONOMIC OBJECTIVE: TO IDENTIFY AND FOSTER THE ESTABLISHMENT OF WATER-ORIENTED INDUSTRIES WHICH CONTRIBUTE TO THE TERRITORY'S ECONOMIC DEVELOPMENT. The island's service economy has been described as a "veneer economy" in that it lacks a viable base. The economy has experienced a semblance of growth resulting from military- and civilian-related infrastructural construction activities financed by the federal government. Tourism is developing into an essential component of the economy. However, further economic diversification is necessary in order to reduce the economy's sensitivity to fluctuations in tourism and federal government expenditure levels.

2. LAND-USE OBJECTIVE: TO ENSURE THE OPTIMUM CIVILIAN UTILIZATION OF APRA HARBOR AND COMPATIBILITY OF USE WITH MILITARY ACTIVITIES. Because land is a finite resource, the selection of water-oriented activities on and around Cabras Island must be thoroughly planned to ensure the optimum utilization of Cabras Island. The water-oriented activities identified for the area are those economic activities which will contribute to the development of the Territory as a major fishing and transportation center in the Western Pacific.

3. PORT OBJECTIVE: TO ENSURE THE DEVELOPMENT OF ADEQUATE PORT FACILITIES TO MEET CURRENT AND FUTURE NEEDS IN AN EFFICIENT AND COST-EFFECTIVE MANNER. The availability of adequate port facilities at Apra Harbor for civilian use is essential to certain water-oriented economic activities. This plan identifies the Port Authority's immediate and long-range facility requirements. Proper scheduling is necessary in order to avoid excess capacity or congestion.

SCOPE OF THE PLAN

Included within the scope of this plan is the entirety of Cabras Island (excluding the Glass Breakwater) and all the lands, including submerged lands, reef and wetland areas, extending seaward from Route 1, between the Route 1 - Route 11 junction and the Laguas River. (See Map No. 1)

IMPORTANCE OF APRA HARBOR TO THE TERRITORY' S ECONOMY

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ENTRY POINT

Apra Harbor is one of Guam's links to the world. It is a vital lifeline because of the import-dependent nature of the local economy. The costs generated by inefficiencies in Commercial Port operations are borne by all consumers. Likewise, the high transportation charges caused by the miniscule amount of backhaul cargo originating from Guam are passed on to the consumer.

ECONOMIC CATALYST

Much has been written on the need to diversify Guam's economy. The proper development of Cabras Island and the surrounding area to support water-oriented activities can stimulate this diversification and provide new employment opportunities for Guam's expanding labor force. As stated earlier, Overseas Bechtel has estimated that as many as 2,500 to 3,000 new employment opportunities will result from the development of Cabras Island. A more conservative range of 1,000 to 1,450 direct employment opportunities from fish processing, port-service industry and other activities has been developed by Bechtel.

GOVERNMENT REVENUES

Increased private sector activities will result in increased government revenues. Although the Government of Guam's Qualifying Certificate

Program will dampen the increase in some revenue sources, personnel income taxes and consumer purchasing related gross receipts taxes will increase as the number of employed individuals rises.

REGIONAL DEVELOPMENT

Guam has a tremendous potential to become a regional distribution center for the emerging Federated States of Micronesia. Apra Harbor currently functions as a transshipment center for oil products and consumer goods flowing into Micronesia. More transshipment activities can be expected to occur as development capital flows into Micronesia.

DEVELOPMENT CONSTRAINTS

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FEDERAL LAND OWNERSHIP

1. Navy Ammunition Wharf

The Navy maintains an ammunition loading and unloading pier at "H" (Hotel) Wharf along the breakwater at the western end of Cabras Island. Transfer of this wharf is only possible upon relocation of the ammunition wharf. Interim use of this wharf by the Commercial Port for cruise ships, when not in use by the Navy, is being requested.

2. Coast Guard

The Coast Guard has indicated its desire to use approximately one acre of land located at the old seaplane ramp, to build a facility which will accommodate most of the Coast Guard operations on Guam. The Coast Guard already holds title to this land.

3. Naval Ship Repair Facilities

Most of Dry Dock Island, south of the fuel wharves, is designated by the Navy as a Reserve Craft Branch area. The land is presently used for the mooring and

storage of inactive ships and auxiliary craft and a small shop required to maintain dehumidification equipment. Recreational areas are used for picnicking and other passive recreational uses.

The justification for the retention of this land by the Navy is questionable since ship repair facilities can easily be accommodated in the Inner Apra Harbor Area. In light of the scarcity of land for civilian use in Apra Harbor and the fact that this land is highly suitable for civilian ship repair or fishing-related developments, there is a strong argument for redesignating the Reserve Craft Branch area as releasable to the Government of Guam. This area is, therefore, included as a civilian development area in this plan.

4. Navy Fuel Wharf

The Naval Supply Depot (NSD) currently maintains two fuel wharves at the northwestern end of Dry Dock Point. The planned uses in this area are the fuel wharves and associated support facilities such as limited fuel storage, facilities for work

boats and pollution abatement equipment, pumps and pipeline, and minor maintenance facilities. Development within the wharf area will be limited to facilities required to support the fuel wharf operations. Land just south of Wharf "D" is planned for reserve for an additional fuel wharf, if one is required in the future.

The land on the north side of the road on Dry Dock Point is used for an oil pipeline corridor that extends across Marine Drive to the Naval oil storage area. The Navy has indicated that civilian use of this land is possible provided that the necessary easements are given to the Navy and that the costs of pipeline relocation are borne by the Government of Guam.

5. Navy Oil Storage Area

The POL operational area located on the western side of Route 1 just east of the Dry Dock peninsula is the primary administrative, maintenance, testing and fuel dispensing area for the NSD Guam POL operations. Expansion of the operational area is planned to the north of the existing area. Con-

siderable land is planned for existing and future POL storage area. Land south of the operational area is designated as a conservation area. The area is a wetlands involving several small rivers. It is not highly suited to industrial uses and is not considered for civilian use in this plan.

RESTRICTION OF INDUSTRY WITHIN ESQD ARC

Hotel Wharf currently functions under a safety waiver of 3 million pounds of net explosives weight (NEW) justifying a 7,210-foot explosives safety quantity distance arc (ESQD). However, the Navy prohibits construction of habitable buildings on Navy land within 10,400 feet of Hotel Wharf, which is the ESQD arc for 9 million pounds NEW, an amount the Navy claims is needed in the future under contingency conditions.

The Commercial Port (30 acres), the GEDA Industrial Park (32 acres) and several private companies leasing military land are all within the 7,210-foot ESQD arc. These entities function under a disclaimer of liability for damages from an explosion. Most of Cabras Island and Dry Dock peninsula are encumbered by the 10,400-foot ESQD building restrictions.

Expansion of the Commercial Port, involving a lease of 11 acres of military land, is being allowed by the Navy since the expansion

will allow the Port to operate more efficiently. Theoretically, development of the rest of Cabras Island and Dry Dock Island cannot occur within the 10,400-foot ESQD arc.

A report to the Committee on Appropriations, U. S. House of Representatives, on the Guam Explosive Handling Dock by the Committee's Survey and Investigations Staff was highly critical of the Navy's request to build a new ammunition wharf at Orote Point. The report, completed on March 1979, reveals the unlikelihood that an alternative to Hotel Wharf will be forthcoming in the near future, due to high costs and unconvincing economic justification. The project is also a low priority on the Navy's construction program and the Navy does not expect the project to survive cutoff from its Military Construction Program over the next several years. The Investigative Staff recommended that the Navy not exercise its \$700,000 option with the A&E firm for completion of the design of the Orote Point ammunition wharf.

According to the report, the location of the ammunition wharf near the Commercial Port is not unique to Guam. Only one of 24 ammunition ports outside the continental United States operates without a waiver and only three of eight ports in the contiguous U. S. can accommodate nine million pounds NEW without waiver.

The report also questioned the need for a 9 million pound NEW standard for Hotel Wharf. "While it is conceivable that conditions could demand a shipment of that magnitude to pass through Guam at sometime in the future, it can also be visualized that the situation will never arise." The Navy does not have a strong justification for maintaining the 10,400-foot ESQD arc.

For planning purposes, it is assumed that an alternative to Hotel Wharf will not be constructed in the near future. It is also assumed that a 7,210-foot ESQD, rather than an 10,400-foot ESQD should be the applicable arc in determining future construction of habitable buildings.

The Government of Guam will continue to urge relocation of the ammunition wharf. In the interim, however, commercial/industrial development need not be restricted, especially on land located outside the 7,210-foot ESQD arc.

FEDERAL SHIPPING LAWS

The impact of federal shipping laws is discussed in three categories: cargo shipping, fishing and charter boating.

1. Cargo Shipping

Coastwise shipping laws prevent the use of foreign-flag vessels from transporting cargo between Guam and the

United States. The regulations also prohibit U. S. flag carriers on this route from receiving subsidies. It is not clear, however, if these laws seriously affect the potential volume of shipping through the Commercial Port. Guam has repeatedly tried to gain exemption from the Jones Act. The Commonwealth of the Northern Marianas, never having been a territory of the United States, is not bound to these shipping laws. Because of the difference in population size and per capita income between Guam and the Northern Marianas, a comparison between their shipping activities would be meaningless.

2. Fishing

Under the current law, it is legal for foreign flag vessels, built and registered in foreign countries, to off-load fish for sale on the Guam market. Foreign vessels must obtain a permit to fish within the 200-mile Fisheries Conservation Zone. Except for tuna which is considered a migratory species by the federal government, restrictions are attached to the permits issued.

There are legal problems for a person on Guam to purchase a foreign-built boat over five tons and use it to catch fish for sale in the local market. The local Coast Guard has indicated that there are ways of overcoming these problems.

3. Charter Boating

The use of foreign-built vessels for charter boat operations is prohibited where more than six passengers are involved. This also applies to charter fishing. The possibility of amending Federal legislation should be explored. The local Coast Guard is willing to assist in exploring this possibility.

OUTDATED INFRASTRUCTURE

1. Road

Current access to the Commercial Port is provided by Route 11 which runs along the southern end of Cabras Island to the Port. The road must be relocated to the northern side of Cabras Island to allow for maximum development of the limited land for industry and port uses. During typhoons, waves have inundated low-

lying areas on northern Cabras Island. Therefore, a protective seawall and elevated road must be constructed. The seawall can be constructed with large boulders obtained from the hill that is currently being quarried on Cabras and should be constructed above the mean high water mark, thus eliminating the need for an Army Corps of Engineers permit. When the land is transferred to the Government of Guam, the road and seawall will be subject to the Territorial Seashore Protection Act if constructed within the 10 meter seashore reserve.

Access to Dry Dock peninsula is provided by a paved Navy road. The road is adequate for planned use in the area. Should a fish processing plant be constructed on the northern side of Dry Dock Point, relocation of that road toward the south may be necessary to provide adequate land for the plant.

2. Oil Pipelines

On Cabras Island, a GORCO pipeline extends from the fuel pier on the western end of Cabras Island,

through the proposed 11 acre container yard expansion site, across the Piti Channel and south along Route 1. The pipeline should be relocated to skirt the proposed container yard in conjunction with the relocation of Route 11.

Navy oil pipelines run from their fuel wharves on the western tip of Dry Dock peninsula along the northern end of Dry Dock Point to the NSD oil dispensing facility along Route 1. These pipelines must be relocated to allow the civilian development and at the same time allow the Navy access to the pipes for maintenance purposes. Pipeline relocation can be accomplished in conjunction with the installation of water, sewer, power and telephone lines.

3. Water

A Water Facilities Master Plan has been prepared by consultants of GEPA and the Public Utilities Agency of Guam (PUAG). The plan considers the needs of Apra Harbor in harmony with the recommendations of this plan. A larger 16-inch waterline will be needed to

serve the Commercial Port as well as the proposed industrial areas west of Route 1 and on Dry Dock Peninsula.

Water for all of Apra Harbor currently comes from the Navy's Fena Reservoir. The Navy prefers to decrease the amount of water sold for civilian use. PUAG is proposing to extend the 16-inch waterline from Adelup to Asan where it will connect with the existing 12-inch waterline that connects Asan and Piti. Reservoir tanks will be constructed at Piti to provide sufficient water for Apra Harbor during peak hours. Additional deep wells in central Guam will be constructed to provide the major source of water for Apra Harbor area.

4. Wastewater

The Wastewater Facilities Master Plan was developed without considering the industrial development plans for Apra Harbor. Only the expansion needs of the Commercial Port were considered. The plan recommends

that the existing package treatment plant at the Port be phased out in preference to connecting with the main sewer at Piti which runs to the Agana Sewage Treatment Plant. Construction of the sewer collector line should be undertaken in conjunction with the road relocation and PUAG's water pipe replacement program. The 1978 estimated cost of the sewer line is \$378,000.

The Waterwaste Facilities Master Plan must be amended to include a collector line to the industrial areas to be located west of Route 1 and on Dry Dock peninsula. A cannery designed to process 75 to 100 tons of tuna per day will require 120,000 to 150,000 gallons per day, if the plant is designed to minimize the use of fresh water. Waste salt water generated by the canning process will increase the volume of waste water to be disposed.

Construction of holding tanks may be needed as part of the cannery design so that sewage can

be stored during peak periods and released during slack periods. Upgrading the Piti sewer pumps from the present 700 gallons per minute (gmp) capacity to 900 gmp may also be necessary, depending on the extent of the other connections in the area.

The treatment of marine-generated sewage and other shipboard waste is necessary if Apra Harbor water quality is to be maintained for multiple use. Shipboard and on-shore treatment systems are being reviewed. The cost of retrofitting commercial vessels with Coast Guard approved marine sanitation devices can be prohibitive. This is also true of onshore systems which require pumpout and collection facilities.

5. Dredging of Piti Channels

There are two projects involving the dredging of the Piti Channels being studied by the Army Corps of Engineers: dredging for commercial port expansion and dredging to provide access to a proposed harbor of refuge. To accommodate the needs of the commercial port, The Corps intends to deepen the existing channel from the present 35-foot depth to a 36-foot depth. The selected plan calls for a 400-foot extension of the existing

commercial port channel that is 400 feet wide at the downstream end narrowing to 200 feet at the upstream end. The dredging is to coincide with the 400-foot extension of the dock as recommended by the Army Corps.

An estimated 110,000 cubic yards of material would be dredged. Approximately 19,000 cubic yards of dredged material will be utilized to form the bulkhead extension by filling 0.8 acres of submerged land.

The Port Authority is reviewing the feasibility of a 1,000-foot expansion rather than the 400 feet recommended by the Corps. The Corps has rejected the 1,000-foot expansion due to an estimated low benefit-cost ratio. Dredging by the Corps is planned for the mid-1980's.

The Harbor of Refuge study is considering the dredging of the Piti Channel from the Commercial Port to a protected area near the GPA fuel storage tanks. The deeper and straighter channel would provide access for small boats to the proposed Harbor of Refuge during typhoon conditions. The project has a low benefit-cost ratio and may have difficulty in getting funded.

COORDINATION OF INFRASTRUCTURE PLANS

Considerable expense can be saved through the consolidation of infrastructure projects. In Apra Harbor, these projects should be consolidated in two areas: Cabras Island and Dry Dock Peninsula (and adjacent area).

Cabras Island Infrastructure:

1. Road relocation
2. Waterline replacement
3. Sewerline installation
4. Oil pipeline relocation

Dry Dock Peninsula Infrastructure:

1. Waterline installation
2. Sewerline installation
3. Oil pipelines relocation
4. Powerline installation
5. Road resurfacing (possible partial relocation)

This basic infrastructure should be further coordinated with the upgrading of power and telephone service in the area.

PORT DEVELOPMENT REQUIREMENTS

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SHORT-TERM FACILITY DEVELOPMENT

The existing port facilities on Cabras Island have been utilized for the past ten years. Except for the purchase of a second gantry crane and the replacement of some cargo-handling equipment, no major facility development has occurred since construction of the Port was completed in December, 1969. Significant changes have occurred in the island's population and economy which were not anticipated by the designers of the Commercial Port. Since 1964, the year the initial design for the Port was prepared, the island's population has increased fifty percent. This population increase, coupled with the development of a consumptive economy, has resulted in a higher volume of imports than anticipated.

There is an immediate need to implement the following expansion and improvement programs:

1. Container Yard Expansion - Phase 1 (11 acres)

The existing 12-acre container yard was designed to efficiently handle 10,000 containers per year. Over the recent years the yard has handled approximately 50,000 containers annually (see Table 1). Containers are often stacked four high in the yard. This practice increases the time necessary to receive or marshal containers. Expanding the container yard into the 11-acre site to the north of the existing yard will ameliorate terminal congestion and reduce vessel in-port time considerably. Congress has approved the lease

Table 1

REVENUE CARGO HANDLED (1,000 Tons)						
	<u>FY74</u>	<u>FY75</u>	<u>FY76</u>	<u>FY77</u>	<u>FY78</u>	<u>FY79 (estimate)</u>
TONNAGE (B/B & Container)						
Import	669,624	534,250	441,350	549,302	512,703	536,000
Export	84,426	115,405	120,885	107,706	74,857	128,000
Transshipment	<u>104,227</u>	<u>30,997</u>	<u>127,708</u>	<u>177,424</u>	<u>226,771</u>	<u>136,000</u>
TOTAL	858,277	680,652	689,944	834,432	814,331	800,000
% Container Tonnage	71.7	83.9	86.5	84.1	86.1	87.0
% B/B Tonnage	<u>28.3</u>	<u>16.1</u>	<u>13.5</u>	<u>15.9</u>	<u>13.9</u>	<u>13.0</u>
TOTAL PERCENTAGE	100	100	100	100	100	100
NUMBER OF CONTAINERS						
Import	21,478	20,628	21,272	25,718	26,259	23,866
Export	<u>21,208</u>	<u>21,175</u>	<u>20,603</u>	<u>26,099</u>	<u>25,861</u>	<u>24,134</u>
TOTAL	42,686	41,803	41,875	51,817	52,120	48,000

Source: General Manager's Office, Port Authority of Guam

of the federally-owned land to the Port Authority of Guam. Construction of the yard is expected to be completed by late 1981.

Scope of Work

- Level and compact the area in conformity with the existing container yard.
- Relocate the existing highway, utilities and oil pipeline to the north-eastward area.
- Provide water drainage and connect to the existing drainage system.
- Provide underground electrical system for proposed reefer plugs and floodlights.
- Provide lighting and security fencing around the perimeter of the yard.
- Pave the entire 11 acres.

2. Tuna Conveyor System

The Port Authority began handling tuna transshipment operations in June, 1975. The tuna tonnage which passed through the port in the first month was 466.2 tons. The yearly tonnage handled to date are reflected in Table 2.

Table 2

TUNA TRANSSHIPMENT				
	<u>FY76</u>	<u>FY77</u>	<u>FY78</u>	<u>FY79 (est.)*</u>
TONNAGE	10,443.3	13,679.7	16,057.7	16,400

*Total tonnage for 10 months is 13,644.9

Source: General Manager's Office, Port Authority of Guam

The tuna is transferred from the ship to the reefer container by means of a loading ramp. This labor-intensive method is time consuming and costly. The ramp-loading method and the shortage of reefer containers weakens the ability of Guam to compete with other ports in the area for the tuna transshipment market.

An automatic conveyor system will decrease the Port's handling costs associated with the tuna transshipment operations.

Although a tuna cannery is being planned on Dry Dock Island, its market is expected to be limited to the U. S. mainland, leaving the Japanese market available for transshipment operations.

Scope of Work

- Conduct design studies on conveyor systems with a high-lift capacity to permit the loading of reefers on chassis.
- Design and build or modify an existing mobile conveyor system for tuna-handling operations.

3. Fender System Replacement

The existing fender system which protects the dock is ten years old. Composed of creosoted wood mounted on a welded steel assembly, the fender has deteriorated extensively beyond economic repair and must be replaced.

Scope of Work

- Identify an alternate fender material and replace the existing creosoted wood with it.

LONG-TERM FACILITY DEVELOPMENT

The island's population is expected to double itself by the year 2000 based on the 4.3 percent growth rate experienced during the first half of this decade. Even if this population increase does not materialize, an increase in cargo volume generated by a lower population growth will overtax the Port Authority's cargo-handling capabilities. In addition, should efforts to increase transshipment activities and develop export commodities succeed, there will be a greater demand for surface transportation.

The following long-term expansion and improvement programs must be planned by the Port Authority:

1. Dock Expansion and Associated Container Yard Expansion - Phase II (15 acres)

The Port Authority is currently reviewing the desirability of expanding the available docking space for container ships eastward

an additional 1,000 feet as recommended by Greenleaf/Telesca-Ahn. Container tonnage currently represents over 85 percent of the Port's total revenue cargo. In Fiscal Year 1979, container cargo is expected to account for 87 percent of the revenue cargo handled during 1979. With the completion of Phase I of the container yard expansion expected in late 1981, the Port can process two containerships more expeditiously with its two gantry cranes. As the population increases and the planned development of Cabras Island occurs, the number of containership calls will increase. This will necessitate an increase in the number of available berths.

The Army Corps of Engineers has reviewed the proposed dock expansion in its Interim Report, Harbors and Rivers in the Territory of Guam, Apra Harbor. The Corps recommends a dock expansion of 400 feet. This recommendation is based on a cargo demand model which utilizes population and per capita income as independent variables. The Corps also estimates an average berthing space requirement of 532 feet consisting of a 432-foot size vessel and a 100-foot buffer zone.

There are several important uncertainties in the Corps report. The population projections and extrapolations utilized are based on the 1970 census. The accuracy of this census has proven troublesome to government planners. Another problem is the average ship size expected by the Corps. The

carriers and the ships which currently serve the territory will not necessarily be the lines which call at the Port in the future.

Scope of Work

- Develop a cargo demand model utilizing the 1980 census data.
- Compute the average berthing space required for container-ships which will be serving Guam in the future.
- Determine the required dock expansion and negotiate with the Army Corps.
- Secure construction permit clearance from the Army Corps and the Government of Guam.
- Determine the most feasible financing method and secure financing.
- Prepare A&E design utilizing the original dock design.
- Relocate non-related activities such as the feedmill.
- Dredge channel and utilize dredged material for fill.
- Construct bulkhead and fender system to include gantry track and pile support.

- Pave, install utilities, fencing and lighting.

2. Gantry Crane Replacement

The Port's original gantry crane has a remaining economic life expectancy of 10 years. The cost of maintaining the crane in an operable condition is becoming prohibitive. It is necessary to maintain two operable gantry cranes as the percentage of containerized cargo increases. The purchase of a replacement crane is a large investment. Planning will require a three-year lead time to arrange financing and to allow for the shipment of the crane to Guam and its erection at the port.

Scope of Work

- Determine the optimum cargo volume to be handled by each crane.
- Select the most feasible financing scheme and secure financing.
- Advertise, award and monitor the purchase and erection of the gantry crane.

3. Free Trade Zone Warehouse

Guam is a free port in that goods are imported and exported without any required payment of import or export duties. Thus,

the traditional concept of a free trade zone does not apply to Guam. A free trade zone as utilized in this plan refers to the isolation of manufacturing activities exempt from or granted abatements from territorial taxes and license requirements on exported items. This concept is intended to supplement the Government's Qualifying Certificate Program which allows for tax rebates and/or tax abatements for certain business activities newly established on the island.

Scope of Work

- Determine the feasibility of a free trade zone warehouse identifying suitable activities and legal constraints.
- If determined to be feasible, develop an incentive program linked to the Qualifying Certificate Program and resolve legal constraints.
- Identify a site and prepare detailed designs for a free trade zone warehouse.
- Analyze financing methods and secure financing using the method determined to be most feasible.
- Advertise for and confirm the commitment of tenants.
- Advertise, award, and monitor the construction of a warehouse.

4. Container Yard Expansion - Phase III

This third phase will be implemented when containerized cargo volume begins to tax the available storage facility. The Port must avoid the complications caused by the improper siting of facilities which has occurred in the past. Land for the future expansion of the container yard must be identified and reserved at this point in time. Should this expansion phase prove unnecessary, the land will become available for other water-oriented activities.

Given the contours of Cabras Island and the available dock space, expansion is limited to these two areas:

- a. Westward into the existing Cabras Island Industrial Park;
- b. Eastward into vacant land bordering the Piti Channels.

The eastward expansion is preferred as the area is contiguous to the second phase of the container yard expansion area. The westward expansion is not expected to be problematic as the relocation of the Cabras Industrial Park is incorporated into this plan.

Scope of Work

- Determine the necessity to expand the container yard utilizing a cargo demand model.

- Determine the most feasible expansion site based on port operation requirements.
- Analyze the available financing methods and select the most feasible method.
- Secure financing and prepare A&E designs.
- Relocate existing activities if necessary.
- Advertise, award, and monitor construction.

5. Container Yard Control Tower

Controlling the receiving, storage, and issuance of containers becomes complex as the number of containers and the storage area increases. The construction of the second expansion phase will increase the available storage acreage to 38 acres. Visual contact is essential during the loading and unloading operations.

Scope of Work

- Analyze the control methods being utilized and develop alternatives to include facility and equipment requirements.
- Determine the most feasible alternative based on the projected number of containers to be processed, yard operation requirements, and billing operation requirements.

- Analyze and secure available financing methods and secure financing.

- Advertise, award, and monitor implementation.

DEVELOPMENT REQUIREMENTS OF WATER-ORIENTED ACTIVITIES

The establishment of water-oriented activities in the area entails the development of supportive facilities. The activities targeted for the area and their supportive facilities are:

PORT DEPENDENT ACTIVITIES

1. Passenger Terminal

Cruise ships have been calling at the port for several years (see Table 3). The existing passenger lounge is located in a portion of a transit warehouse in the middle of the yard area. Debarking passengers must walk through the yard area to reach the lounge. Permission is being sought from the U. S. Navy to allow cruise ships to utilize their ammunition wharf during peak periods at the port. More permanent facilities will be required should the number of passenger ships calls increase in frequency and regularity.

Table 3

	CALENDAR YEAR 1978				CALENDAR YEAR 1979	
	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>	<u>1st Qtr.</u>	<u>2nd Qtr.</u>
No. of Ship Calls:	5	6	3	2	4	1
Total Passengers:	2,415	3,097	792	1,438	2,167	500

Source: General Manager's Office, Port Authority of Guam

2. Ship Repair Facility

A ship repair yard currently operates in the area adjacent to Wharf F-2. Although the present firm utilizes a floating dry dock for most major repairs, the supportive land operations have taxed the capacity of the dock area. This facility will have to be relocated to Dry Dock Point because of mounting pressures to expand the commercial port westward.

A more efficient ship repair process has been developed which eliminates the costly floating dry dock. A marine railway/repair yard will require approximately nine acres of land with access to the water. Demand for the facilities can be expected to be generated from a fishing fleet and increased transshipment operations to the Federated States of Micronesia.

3. Container Repair Facility

The incidence of container damage will increase as the volume of containerized cargo increases. While the major shipping lines operate their own repair facilities, shipping agents and freight forwarders have no ready access to such a facility. Land must be reserved for a container repair facility.

OTHER WATER-ORIENTED ACTIVITIES

1. Industrial Site Development

There is a need for efficient industrial park facilities. There are several developed sites on the island. The

Cabras Island Industrial Park adjacent to the port is fully utilized by these activities:

- A cold storage warehouse and storage yard;
- A ship repair yard;
- Bulk cement storage;
- Oil terminals and storage facilities.

This industrial park site is a major hinderance to the westward expansion of the commercial port. The relocation of all or most of these activities will facilitate port expansion.

A second site is the Harmon Industrial Park. Its development has been inadequately coordinated by the concerned parties. Non-compatible land uses have occurred. The right-of-way is inefficient and hampers vehicular movement. The location is an ideal site for activities which are dependent on or related to air transportation. Not all the current activities at the park are associated with the nearby airport.

A third industrial site is the E. T. Calvo Memorial Park in Tamuning. It is situated in a prime commercial development area which is incompatible with industrial development. Current utilization of the park is commercial oriented.

Industrial park facilities within the planning area geared to water-oriented development appears to be feasible given the location and utilization of existing industrial parks. Some activities which may be included are:

- Cold storage facility;
- Feed mill (relocation);
- Warehousing and distribution;
- Moving and storage;
- Ancillary activities to a fishing industry, i.e., tuna cannery, can manufacturing, net repair facility, fishing net manufacturing.

2. Power Generation

Both Piti and Cabras power plants and fuel storage areas are within the scope of this plan. Sufficient land for construction of two additional units at the Cabras plant is already under the jurisdiction of the Guam Power Authority. Therefore, the major projected land use for energy facilities involves the proposed location of an OTEC (ocean thermal energy conversion) plant on Cabras Island, adjacent to the conventional Cabras plant.

Projected expansion of two more steam units at the Cabras Power Plant should serve the general population growth; however, it will be costly as this method of power generation is based 100 percent on petroleum. The escalating costs and shortages of petroleum will require Guam to look toward alternate forms of power generation such that power can be supplied at rates which will facilitate rather than constrain industrial development.

Guam has been identified as having the required temperature differential in off-shore depths for development of an OTEC plant. OTEC is a non-fuel based method of power generation and is, thus, non-inflationary. However, this technology is still experimental and will require full backup by the conventional Cabras plant until it becomes proven. Its planned location is adjacent to the Cabras plant due to the site's ready access to the required off-shore thermal gradients for cold water intake. The OTEC plant's cold water discharge can be utilized to increase cooling efficiency at the conventional Cabras plant thus lessen the thermal discharge impact of both plants. The OTEC cold water discharge also contains a rich supply of nutrients, and when balanced with the hot water discharge from the Cabras plant, is highly suitable for mariculture in the Piti Channel and tidal flat area. This area has been identified as only one of two suitable locations on Guam

for mariculture development. Additionally, the OTEC plant's cold water discharge can conceivably serve some of the air-conditioning and refrigeration needs at Commercial Port.

Environmental impact and economic feasibility studies of OTEC on Guam are currently being prepared and the delineation of the suitable site in this plan, is an additional step toward the acquisition of further federal funding for more specific planning and design.

3. Aquaculture Potential

As a component of fisheries development, aquaculture is the propagation and rearing of aquatic species of commercial importance. When this technique of food production is applied in marine waters, it is called mariculture. Aquaculture has proven to be a viable industry for economic growth on other Pacific islands which are less environmentally suitable for production of species such as prawns, shrimps, milkfish, oysters and tuna baitfish. Guam's year-round tropical climate is particularly conducive to this form of aquacultural production.

A major constraint to aquaculture development, insufficient supply of larval stock, will be alleviated with construction of a prawn hatchery with multiple-use options for other

species. The feasibility for such a facility has been the subject of studies by the Department of Commerce. It has subsequently been determined that the optimal site for the hatchery would be on the Dry Dock Island peninsula, on land which is currently vacant, but federally-owned. There is no Government of Guam land which meets all the requirements of the hatchery. The federal property represents an ideal site due to physical and locational characteristics which include:

- a. Construction and operation of the facility will not create significant adverse environmental impacts on the adjacent wetlands and coral reef ecosystems.
- b. The adjacent cove is one of only two suitable locations for mariculture (i.e., raft culture of oysters) on Guam. Mariculture requires a shallow depth of saltwater in a location protected from wind and wave assault. The only other location for mariculture is the Piti Channel tidal flats.
- c. The adjacent land area has suitable topography for associated on-land aquaculture ponds.
- d. The proposed hatchery is in a suitable shoreline location for drilling a saltwater well which is required for purified saltwater.

e. The site is separated from sources of water pollution.

The hatchery's water supply must not be subject to toxic substances.

f. The proposed hatchery site and associated aquaculture sites are in proximity to a required access road, freshwater distribution system and power infrastructure.

g. The hatchery site and associated suitable aquacultural sites are in close proximity to fishing boat operations which would minimize transport of live bait (i.e., mollies) if produced to support a fishing fleet.

Hatchery operations are compact and efficient in terms of land area requirements. A self-contained hatchery capable of stocking up to 500 acres of grow-out facilities could easily be accommodated on two acres of land, assuming that the site was roughly square in plan view and 100 percent usable. Such a site will be able to accommodate all hatchery equipment, utilities, installations, equipment storage, a workshop, office space, laboratory facilities, and residential quarters for a hatchery manager.

The hatchery will function as the supplier of post-larval and juvenile stages of cultured species in Guam's developing aquaculture industry. It will also serve as a training

facility for farmers and prospective farmers in the practices of aquaculture and serve as a collecting and dissemination base of new data and information pertinent to the practices of aquaculture. Extension work from hatchery based personnel will also be made available to on-site training and advisement of pond culture management.

RECREATIONAL ACTIVITY

Apra Harbor has been a popular recreation site for many years. Fishing, swimming, sailing, water skiing and scuba diving in outer Apra Harbor are enjoyed daily by numerous individuals. The harbor is designated for general use by the Government of Guam in its 1975 Water Quality Standards.

Small boats are commonly found in the outer harbor. Marianas Yacht Club members maintain approximately 21 keel boats in deep water moorings to the west of Cabras Industrial Park. Club facilities on land controlled by Mobil Oil fully utilize the site's development capacity.

The upper Piti Channel is frequently utilized as a refuge during stormy weather. The Army Corps of Engineers recently granted a permit authorizing the construction of a boat ramp in the channel on land adjacent to the Guam Power Authority's Cabras Island Power Plant.

Small boat accommodations on Guam are insufficient to meet the expected increase in pleasure boats. The Agana Marina which is far from com-

pletion is the only alternative to Apra Harbor. The development of the proposed Agat Small Boat Harbor is complicated by the establishment of a War in the Pacific Park. A marina and a small boat harbor of refuge must be developed in Outer Apra Harbor in order to satisfy the island's water-oriented recreational demands.

SOCIAL & ENVIRONMENTAL
CONSIDERATIONS

SOCIAL & ENVIRONMENTAL CONSIDERATIONS

SOCIAL & ENVIRONMENTAL CONSIDERATIONS

RELATIONSHIP TO PITI COMMUNITY DESIGN

Although development of Apra Harbor will ultimately affect the lifestyle of the entire island through provision of goods and services and overall economic growth, it will have the most immediate impacts upon community lifestyle in the village of Piti. The residents of Piti depend upon the shoreline in the scope of this plan for recreation and traditional subsistence activities. Expanding industrial and aquaculture development could further limit the public's use of the shoreline.

This plan also delineates land areas along Marine Drive for industrial development. These lands are directly within the municipality of Piti and their development may create aesthetic impacts or pollution sources which could significantly alter the image of the community as a whole. Industrial land use in the port area could stimulate encroaching intensive use of the land toward the residential village proper. Industrial development could also stimulate employees to seek residence in the Piti area and thus accelerate community population growth and place additional demands on community facilities. Land values could change in response to adjacent developments.

It is imperative that major port area developments include public involvement in their planning process such that adverse impacts upon the community of Piti can be mitigated.

ENVIRONMENTAL QUALITY

Although the land and water area within the scope of this plan has been highly developed and the natural barrier reef altered by man, there still remains a significant amount of natural habitat, marine and terrestrial wildlife, and historic sites. Some of these features are considerably unique and deserving of a conservation approach to management. They are not of such a magnitude as to preclude all the major immediate expansion needs within the harbor area or even projected developments, as there is sufficient vacant, suitable land, without unique values.

It is imperative that highly fragile and unique portions of the total island ecosystem be conserved, even in proximity to intensive land use. The technology exists to maintain industrial development without producing a high volume of pollution. The natural areas should not be viewed as a constraint to port development, but rather a part of the island's resource base and an aesthetic, scientific and recreational asset to the port area. Inasmuch as maintenance of unique natural areas is important to the tourist and fishing industries, these features also represent an economic asset. Though not highly visible, such resources as juvenile fish within mangrove wetlands, are of high economic value.

1. Lulinao Barrier Reef

Lulinao Reef is considered to be a pristine marine ecological community and a primary candidate for designation as an area of particular concern to the government's coastal zone management program. Pristine marine ecological community is defined as the most untouched or natural representative of a

a particular type of habitat. In this case, Luminao Reef is one of only two barrier reefs on Guam. Although part of the reef serves as the foundation of the Glass Breakwater, the submarine portion, as shown on Map No. 2, is still a highly diversified reef community. It is important for snorkelers, photographers and surfing enthusiasts who call the location "Magundas."

Luminao Reef has been surveyed for environmental values and candidacy for special management attention in a study (Stojkovich, 1977) entitled Survey and Species Inventory of Pristine Marine Communities on Guam. The survey found that the reef community is highly diverse, with luxuriant coral growth and a colorful array of reef fishes. It is recommended that the area be established as a marine sanctuary in which no coral harvesting, net fishing or other such activity be permitted. A series of underwater trails should be developed.

2. Western and Jade Shoals

There are several areas of shoals or isolated patch reefs within Apra Harbor (see Map No. 3). Coral reefs are highly productive biological areas and economically important as a source of fish, corals and shellfish. The diversity of species within Jade and Western Shoals and related patch reefs makes them a favorite diving location. A University of Guam Marine Lab study (1977), Technical Report No. 34, provided the U. S. Army Corps of

Philippine Sea

60 ft. contour

Zone of Millepora

Luminao Barrier Reef

Zone of extensive Porites colonies and Acropora thickets

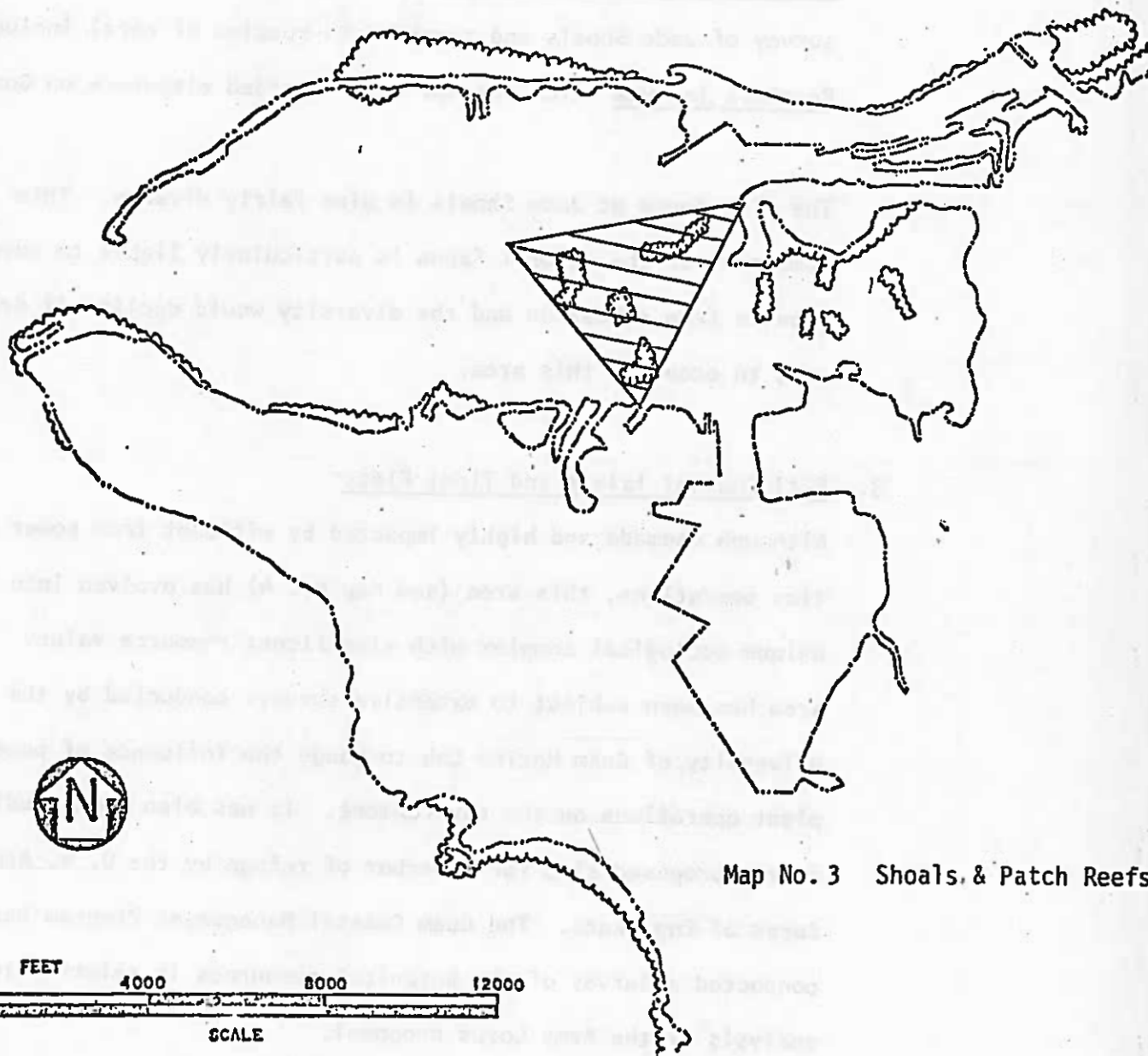
Glass Breakwater

Apra Harbor

N
1:4800

- KEY:
-  reef margin
 -  reef flat
 -  low relief coral
 -  boulders
 -  artificial reef
 -  depressed zone

Map No. 2 Luminao Reef



Engineers with the Marine Environmental Baseline Report, Commercial Port, Apra Harbor, Guam. This study included a site survey of Jade Shoals and recorded 94 species of coral including Pectinia lactuca which has not been recorded elsewhere on Guam.

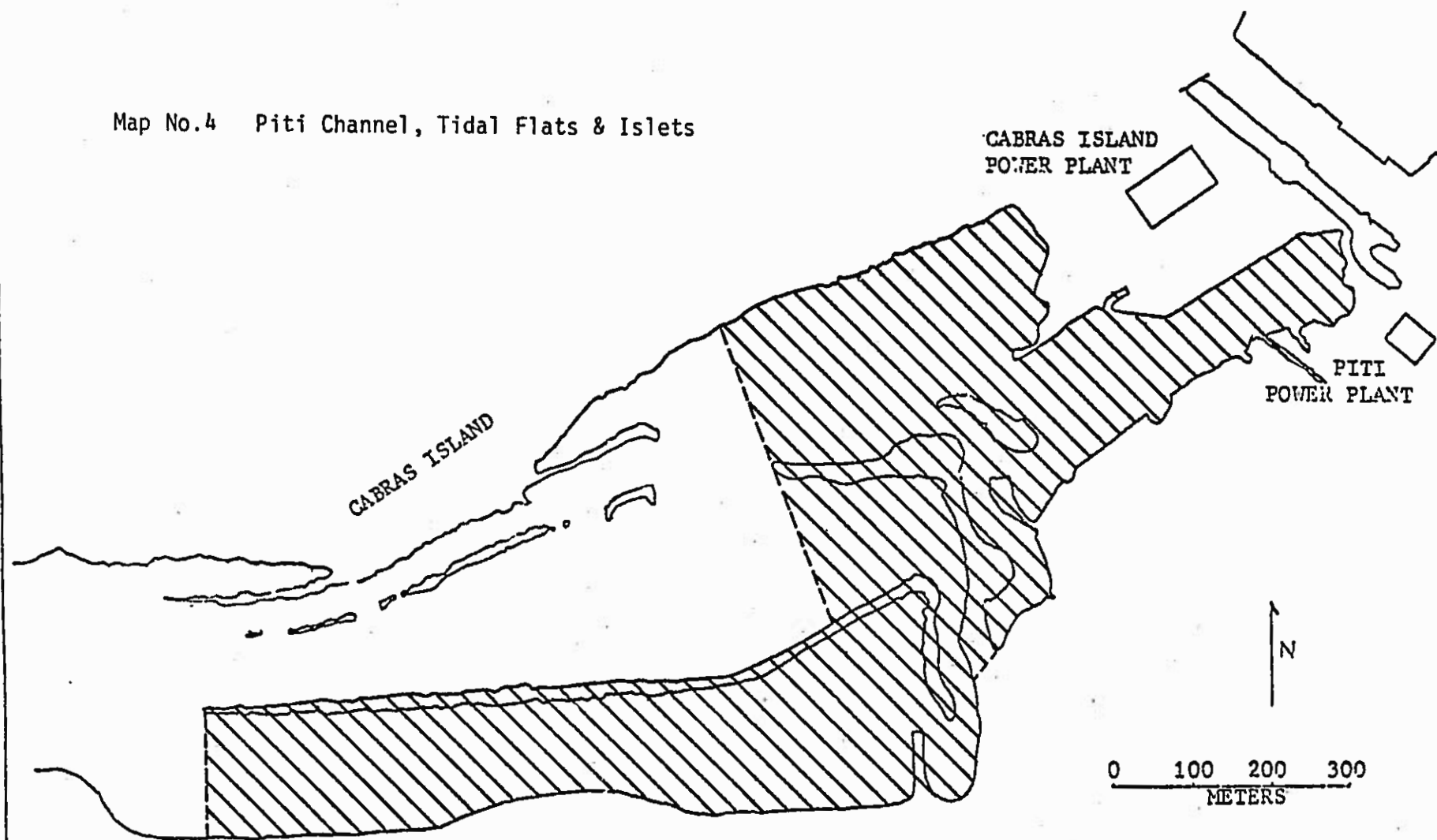
The fish fauna at Jade Shoals is also fairly diverse. This component of the natural fauna is particularly liable to adverse impacts from siltation and the diversity would decline if dredging were to occur in this area.

3. Plti Channel Islets and Tidal Flats

Although manmade and highly impacted by effluent from power generation operations, this area (see Map No. 4) has evolved into a unique ecological complex with significant resource value. This area has been subject to extensive surveys conducted by the University of Guam Marine Lab to gauge the influence of power plant operations on the environment. It has also been studied as the proposed site for a harbor of refuge by the U. S. Army Corps of Engineers. The Guam Coastal Management Program has conducted a survey of the botanical resources in relation to its analysis of the Army Corps proposal.

A University of Guam Marine Lab technical Report No. 6 (Marsh and Gordon, 1973) described some of the values and use of the area. It was found that fish of many species are conspicuous throughout the deeper channel areas and are often present in large numbers.

Map No.4 Piti Channel, Tidal Flats & Islets



Net fishermen often set their nets to trap fish. The channels are also fished by people using hook-and-line. Another conspicuous biological feature is the large number of oysters growing there. These are sometimes harvested by local residents.

The vegetation found along the shoreline and on islets is a coastal strand plant community and important component of the area's ecological structure. The Guam Coastal Management Program surveyed and found that four mangrove species are represented. These species are considered threatened or endangered on Guam and are primary candidates for inclusion on official listings:

- *Avicennia alba*
- *Lumnitzera littorea*
- *Rhizophora* sp.
- *Xylocarpus mollucensis*

There are several trees of *Xylocarpus mollucensis* on one islet. This tree known as the Cannonball Tree or locally as lalanyok is found only at Adelup Point, on the Piti Channel islet, and the Atantano River Mouth. Less than 10 trees have been located on Guam.

The unique features of this site make it highly suitable for mariculture, recreational use for a harbor of refuge, and for shellfish harvesting, fishing, crabbing and picnicking. Therefore, it should be reserved for these less intensive uses.

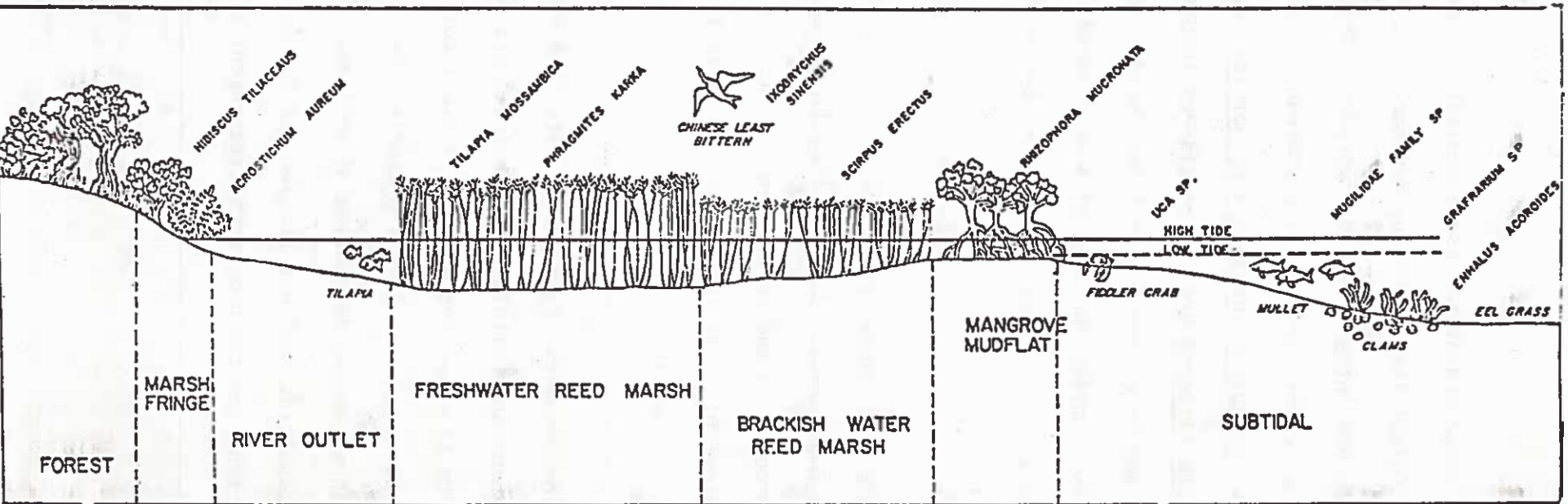
4. Sasa Bay

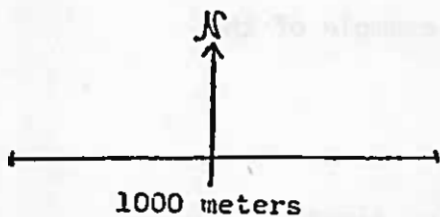
Sasa Bay is comprised of two basic ecological communities, the mangrove/tidal flat shoreline and marine coral reefs. Both segments are integrated and important. They have been the subject of major studies. The dominant species: Rhizophora mucronata, R. apiculata, Bruguiera gymnorhiza, Avicennia alba and Lumnitzera littorea are all considered threatened, due to the limited amount of mangrove habitat found on Guam. The Sasa Bay mangroves comprise one zone of a well-zoned wetland complex which includes reed marshes and the Sasa-Laguas-Aguada Rivers (see Fig. 1).

Mangroves are ideal nursery grounds for a host of marine species of economic importance. Juvenile fish find shelter in its system of prop roots and associated mudflats. A Bureau of Planning study (Stojkovich, 1977) included Sasa Bay in its survey of pristine marine communities and stated:

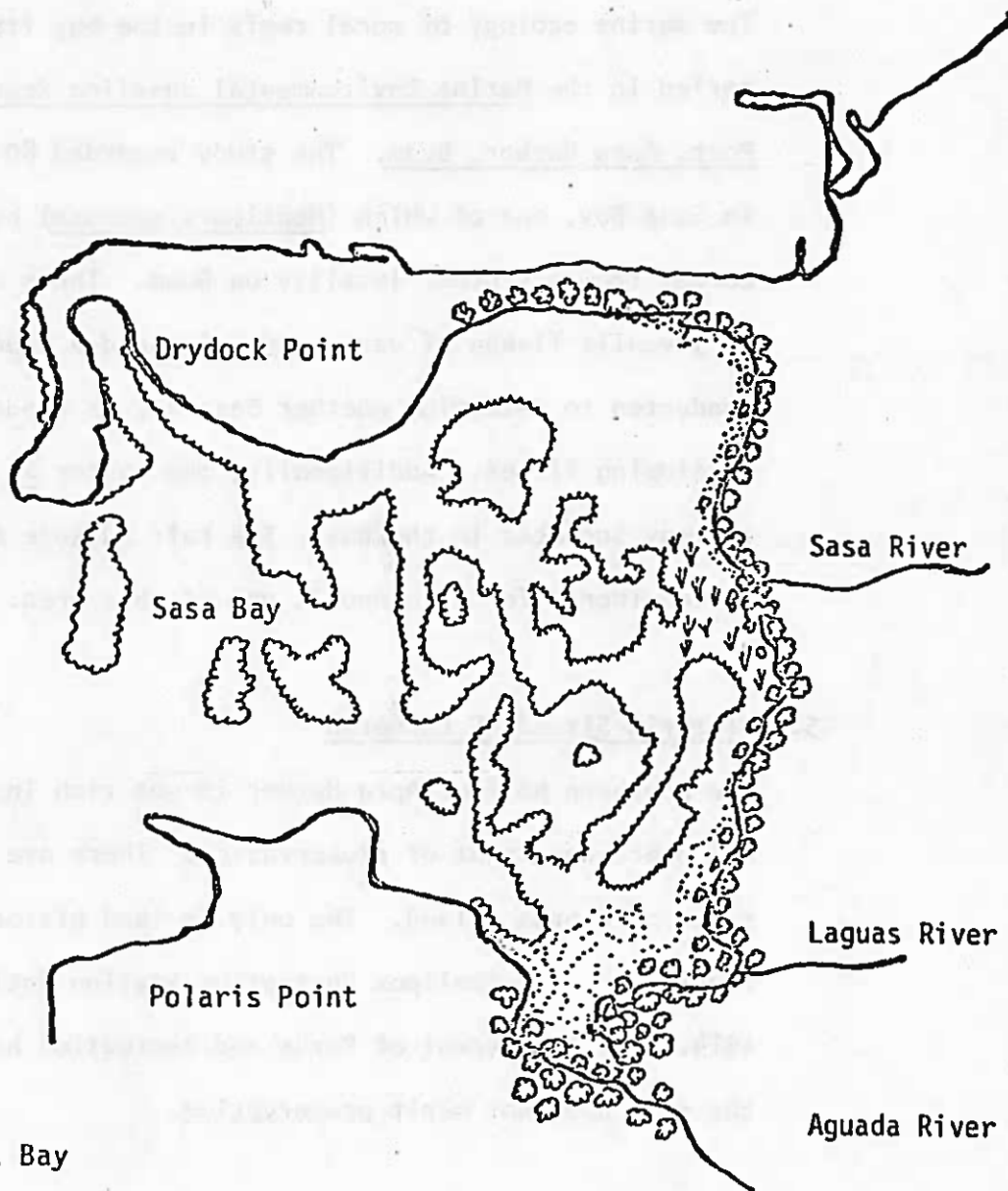
The dynamics of this community type include both land building and erosional protection. The propropoot system reduces tidal currents and traps much floating debris, resulting in extensive deposition of sediments. The resulting mudflats provide burrows for mud crabs and the propropoots, attachment sites

Fig 1
CROSS-SECTION OF THE SASA BAY WETLAND





- KEY:
-  mangroves
 -  sand and mud
 -  reef margin
 -  seagrass beds



Map No. 5 Sasa Bay

for a variety of mollusks. In addition, mangroves exhibit high primary productivity and possibly represent the best example of the detrital food chain.

The marine ecology of coral reefs in the bay itself was inventoried in the Marine Environmental Baseline Report, Commercial Port, Apra Harbor, Guam. The study recorded 80 species of corals in Sasa Bay, one of which (Montipora spumosa) has not been recorded from any other locality on Guam. There are a large number of juvenile fishes of various species and a study should be conducted to determine whether Sasa Bay is a nursery ground for developing fishes. Additionally, the oyster S. mordax are attached to many surfaces in the bay. The raft culture of oysters should be considered for an economic use of this area.

5. Historic Sites/SMS Cormoran

The northern half of Apra Harbor is not rich in historic sites which are deserving of preservation. There are no prehistoric sites on Cabras Island. The only on-land historic site is the foundation of a Smallpox Quarantine Station dating from about 1914. The Department of Parks and Recreation has determined that the site does not merit preservation.

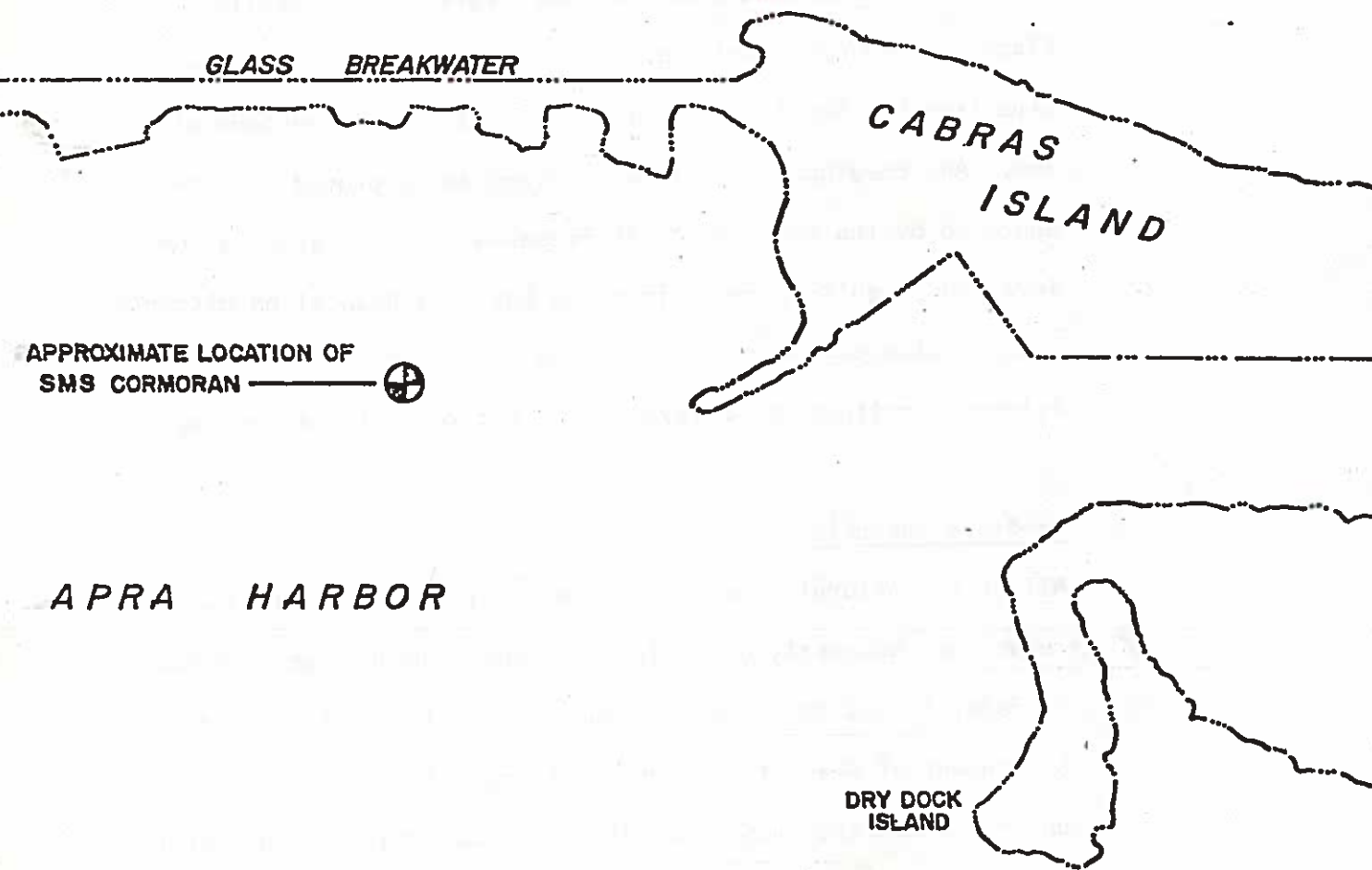
SMS Cormoran is a historic sunken ship, lying within the harbor at 13° 27' 33" N and 144° 39' 15" E. An ongoing underwater

survey may identify other historic ships, such as the Tukai Maru, a Japanese ship sunk during WWII which lies next to the SMS Cormoran. However, at this time, the SMS Cormoran is the only site listed on the Guam Register of Historic Place and National Register of Historic Places. Thus, the site (see Map No. 6) is protected by both local and federal law. Any development must be reviewed and approved or disapproved by the State Historic Preservation Officer on a local level and require comment from the Advisory Council on Historic Preservation on federal level. The site is important to the island's heritage and offers a site for recreational diving.

6. Land-Use Controls

All of the natural areas and historic site outlined in this report are presently under federal land ownership and subject to federal laws for resource management. If acquired by the Government of Guam, these lands/submerged lands would come under a broad spectrum of applicable local controls in addition to continued adherence to federal law.

The following matrix (see Fig 2) depicts the applicable federal and local controls on development of the previously described areas.



MAP NO. 6 LOCATION OF SMS CORMORAN

Fig. 2

MATRIX OF CONTROLS
APPLICABLE TO ENVIRONMENTALLY
SENSITIVE AREAS AND HISTORIC
SITES IF MANAGED BY GOVGUAM

AREAS	LUMINAO REEF	PITI CHANNEL, TIDAL FLATS AND ISLETS	SHOALS AND PATCH REEFS	SASA BAY MANGROVES	SASA BAY CORAL REEF	SMS CORMORAN
LAND-USE CONTROLS						
WATER POLLUTION CONTROL ACT, SEC. 404: COE	X	X	X	X	X	X
NATIONAL HISTORIC PRESERVATION ACT: HCRS						X
ENDANGERED SPECIES ACT: USFWS	X	X	X		X	
LAND-USE POLICIES: ALL AGENCIES	X	X	X	X	X	X
LAND-USE DISTRICTS: TPC		X		X		
SUBMERGED LANDS PERMIT: DLM		X		X		
GUAM WATER QUALITY STANDARDS: GEPA		X		X		
ZONING LAW: TPC		X		X		
TERRITORIAL SEASHORE PROTECTION ACT: TSPC		X		X		
WETLANDS RULES AND REGULATIONS: TPC		X		X		
FLOOD HAZARD AREAS RULES AND REGULATIONS: DPW		X		X		
BLASTING PERMIT: GEPA	X	X	X	X	X	X
GRADING & CLEARING PERMIT: GEPA/DPW		X		X		
GAME AND FISH LAWS: DAg	X	X	X	X	X	
CORAL HARVESTING LAWS: DAg	X	X	X	X	X	
ENDANGERED AND THREATENED SPECIES: DAg	X	X	X	X	X	
HISTORIC OBJECTS AND SITES: DPR						X

OPTIMAL LAND-USE PLAN

OPTIMAL LAND-USE PLAN

This chapter is comprised of the mapping and classification of lands in the port area for specific types of uses. The classifications, as delineated, project the optimal pattern of land use given the projected needs in the port area and the suitability of particular lands to accommodate those needs. This plan avoids constraining growth within suitable areas through the projection of site-specific facilities as has been done with past plans, and retains a degree of flexibility through a broader classification of optimal uses.

Both lands suitable for intensive development and those suitable for conservation-oriented use are delineated. Past plans have ignored the value of certain natural areas, within the port vicinity. Such a balanced approach is required for compatible land-use within the port area.

The Optimal Land-Use Plan, as the focal point of the Government of Guam's official plan for the civilian use of lands in Apra Harbor, is intended to serve as a guide to decision-making in the allocation of land for various competing interests. As the official guide to the direction of growth, it provides a base for site specific analysis of future proposals and the relocation of some existing uses to more suitable areas. As an interim plan, it also provides a base for more detailed planning toward a more refined long-range plan for the port area.

LAND-USE CLASSIFICATION

As previously mentioned, the use classifications projected on the Optimal Land-Use Plan have a degree of flexibility because some land areas are suitable for a number of different uses and the status of projected port developments is too tentative to allow for specific siting of actual facilities. The classification system for use of lands in the port area is adapted to the unique physical conditions and needs of the area. Definition of those uses follows:

1. Commercial Port Facilities

These lands are suitable and required for existing and projected facilities and functions of the Port Authority of Guam. Specific uses are, for example, container handling, administration offices, docking space, warehousing and infrastructure.

2. Water-Dependent Port-Related Industry

This land area is suitable for private sector industries which require land area which is immediately adjacent to deepwater for ship dockage. Such industries may be for ship repair, net repair, fish processing or other industries where direct on-loading and off-loading of ships is required. Within this area, an aquaculture hatchery, dependent upon a saltwater well, and associated mariculture of species such as oysters or baitfish is also suitable as a water-dependent and port-related industry.

3. Port-Related Light Industry

This property on Cabras Island is suitable for industry such as warehousing, which not requiring deep water dockage, would directly support or benefit from commercial port operations through adjacent proximity, reduced transportation or integration with the infrastructure of the Port Authority of Guam.

4. Light-Heavy Port-Associated Industry

This is land area which is suitable for relocation for non-port dependent industry, such as fuel storage, from lands needed for expansion of the Port Authority of Guam, and also suitable for development of other uses such as warehousing or manufacturing which would benefit from location near the port itself.

5. Power Production Facilities

These lands are those reserved for existing use and project expansion of conventional power production operations and the proposed location of an OTEC power plant.

6. Recreation

These are areas suitable for recreational facilities, such as the marina or reserved as open space for recreational use, such as public beaches and picnic areas. (NOTE: The open space of the northeast point of Cabras Island, primarily serves as stormwave protection for the adjacent

power plant operations; however, it could be suitable for development of a facility which did not detract from this function.) The underwater historic site, SMS Cormoran, is also reserved for recreational use and historic preservation under this classification.

7. Protection of Wetlands

These are mangrove strand, river estuaries (Sasa and Laguas River) and mangrove-vegetated islets which primarily support aquatic wildlife, fishery resources and protect the shoreline from stormwaves.

8. Conservation and Development of Fishery Resources

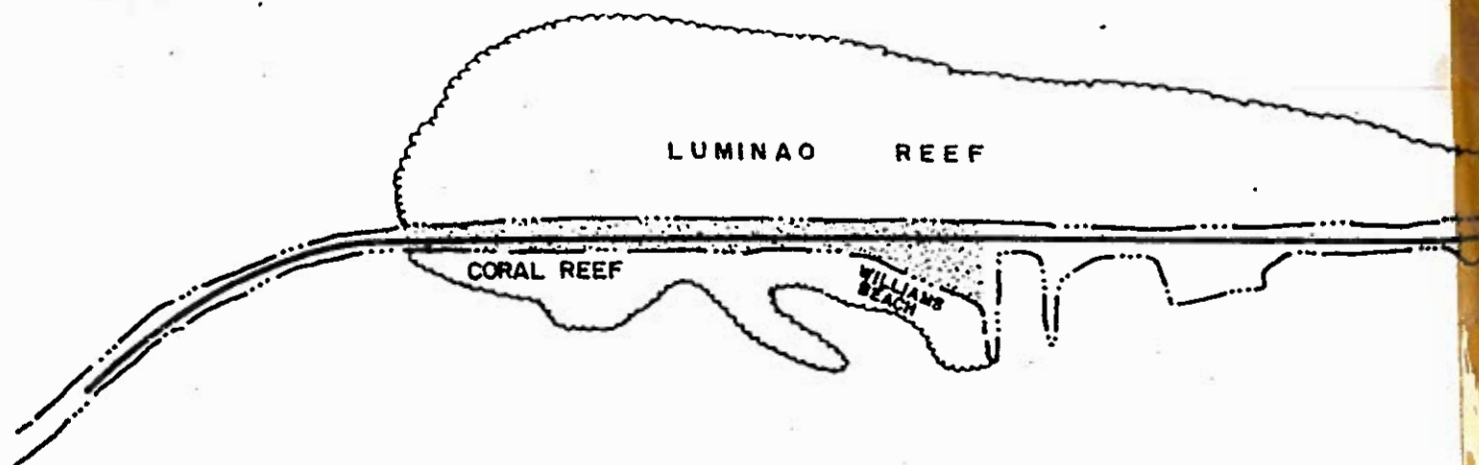
These submerged areas primarily support marine wildlife, such as coral reefs and tidal flats. These areas are mostly reserved for maintenance of wildstock fisheries and recreation, or environmentally sensitive uses such as mariculture on tidal flats.

9. Military Operations

These areas, within the scope of the plan are recognized for existing use of a fuel dock and projected development of the old seaplane ramp area which both support military missions and are dependent upon a port location.

Table 4

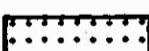
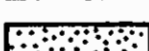
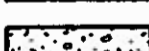
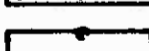
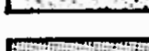
<u>Land-Use Classification</u>	<u>Location</u>	<u>Est. Land Area (acres)</u>
Commercial Port Facilities ex: container handling administration bldgs. docking space cold storage warehousing fire station	Cabras Is.	151
Water-Dependent Port-Related Industry ex: cannery ship repair net repair aquaculture hatchery & ponds	Dry Dock Pt.	47
Port-Related Light Industry ex: warehousing	Cabras Is.	79
Light-Heavy Port-Associated Industry ex: fuel storage warehousing manufacturing	Marine Drive (entrance to Dry Dock Pt.)	168
Power Production Facilities ex: Cabras Power Plant Piti Power Plant Fuel Storage OTEC site	Cabras Is. & Marine Drive (entrance to Cabras Is.)	59
Recreation ex: marina beaches picnic areas	Cabras Piti Channel & William's Beach (Glass Breakwater)	57
Protection of Wetlands ex: mangroves estuary islets	Sasa Bay Piti Channel	64
Conservation & Development of Fishery Resources ex: coral reefs tidal flats (Mariculture)	Luminao Reef Jade Shoals Western Shoals Patch Reefs Piti Channel Sasa Bay	361 (Submerged Lands)
Military Operations ex: U. S. Navy Fuel Dock U. S. Coast Guard Seaplane Ramp	Dry Dock Is. Cabras Is. (western tip)	10



OUTER APRA HARBOR

OPTIMAL LAND-USE PLAN

LEGEND

- | | |
|---|---|
|  | COMMERCIAL PORT FACILITIES |
|  | WATER-DEPENDENT PORT-RELATED INDUSTRY |
|  | PORT-RELATED LIGHT INDUSTRY |
|  | LIGHT-HEAVY PORT-ASSOCIATED INDUSTRY |
|  | POWER PRODUCTION FACILITIES |
|  | MILITARY OPERATIONS |
|  | CONSERVATION AND DEVELOPMENT OF FISHERY RESOURCES |
|  | RECREATION |
|  | CONSERVATION OF WETLANDS |
|  | PROPOSED ROAD RELOCATION |

WESTERN SHOAL

SCALE: 1" = 12,500'
SCALE: 1" = 1,042'

BUREAU OF PLANNING — JUNE 1979

SEA



U.S. COAST GUARD
SEAPLANE RAMP

CABRAS ISLAND

PORT AUTHORITY OF GUAM

U.S. NAVY
FUEL DEPOT

DRYDOCK POINT

JADE SHOALS

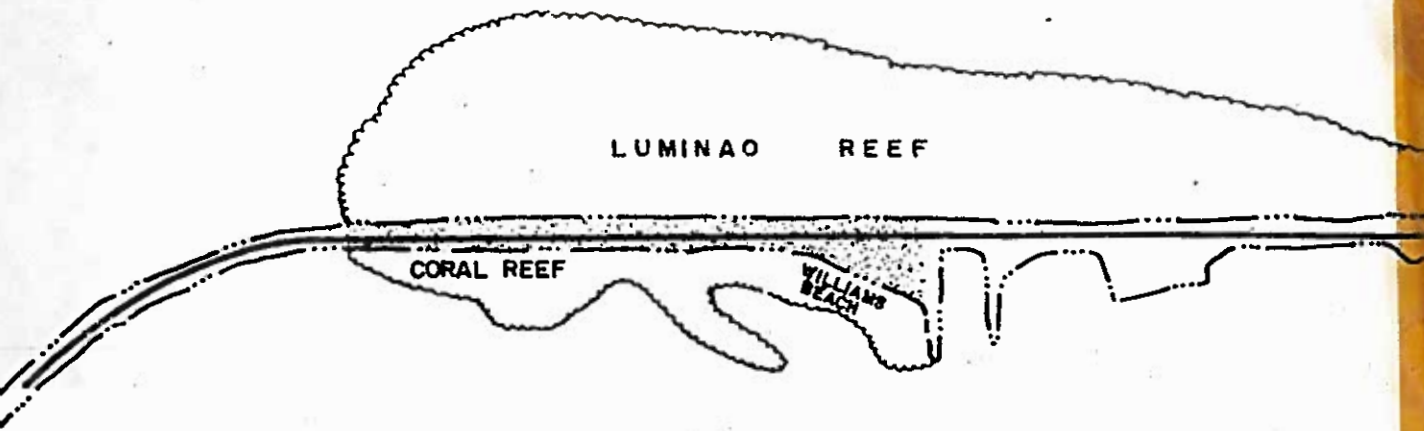
DRYDOCK
ISLAND

CORAL REEF

TIDAL

SASA BAY

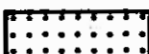
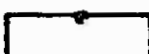
PATCH REEFS



OUTER APRA HARBOR

OPTIMAL LAND-USE PLAN

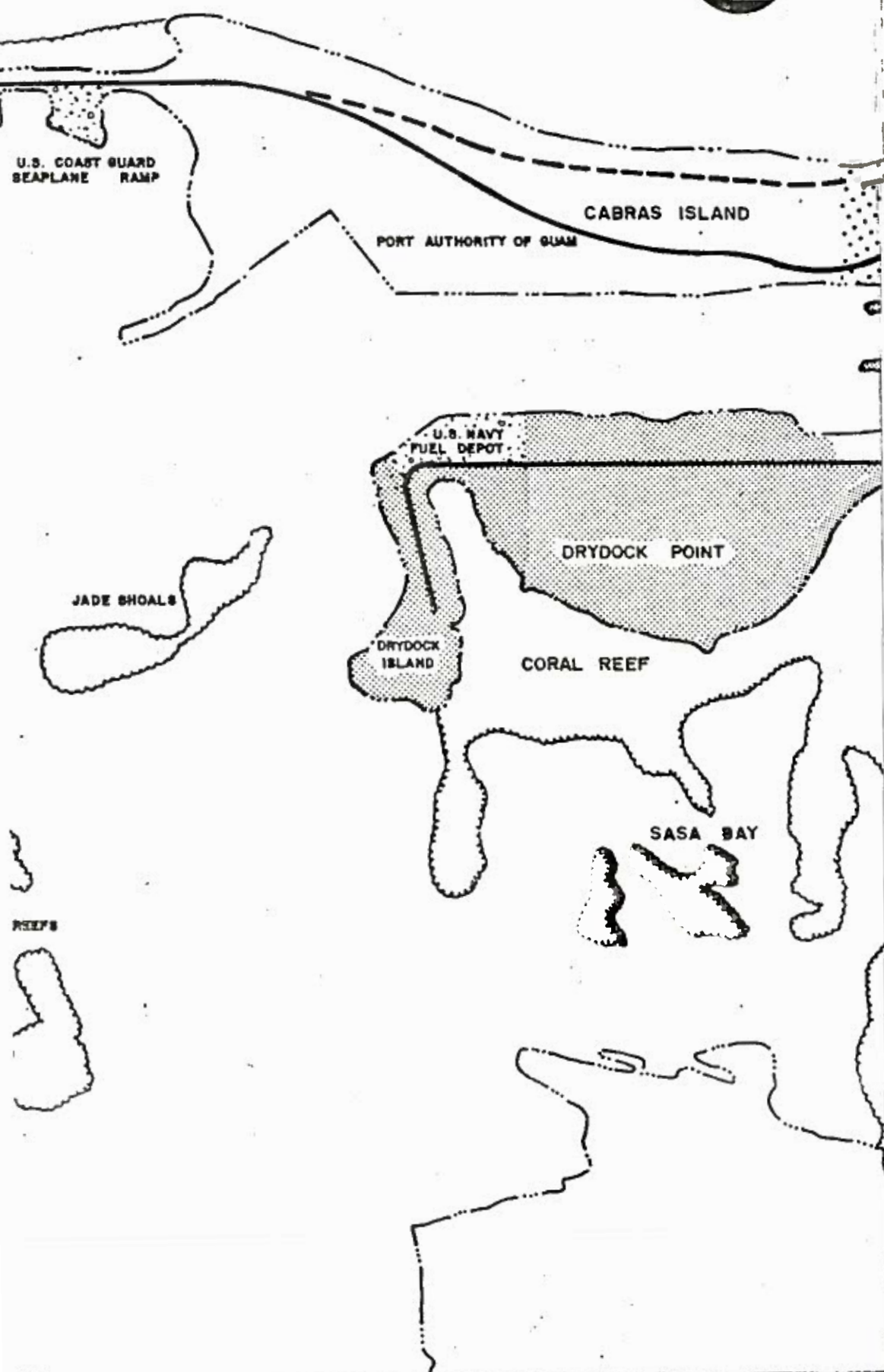
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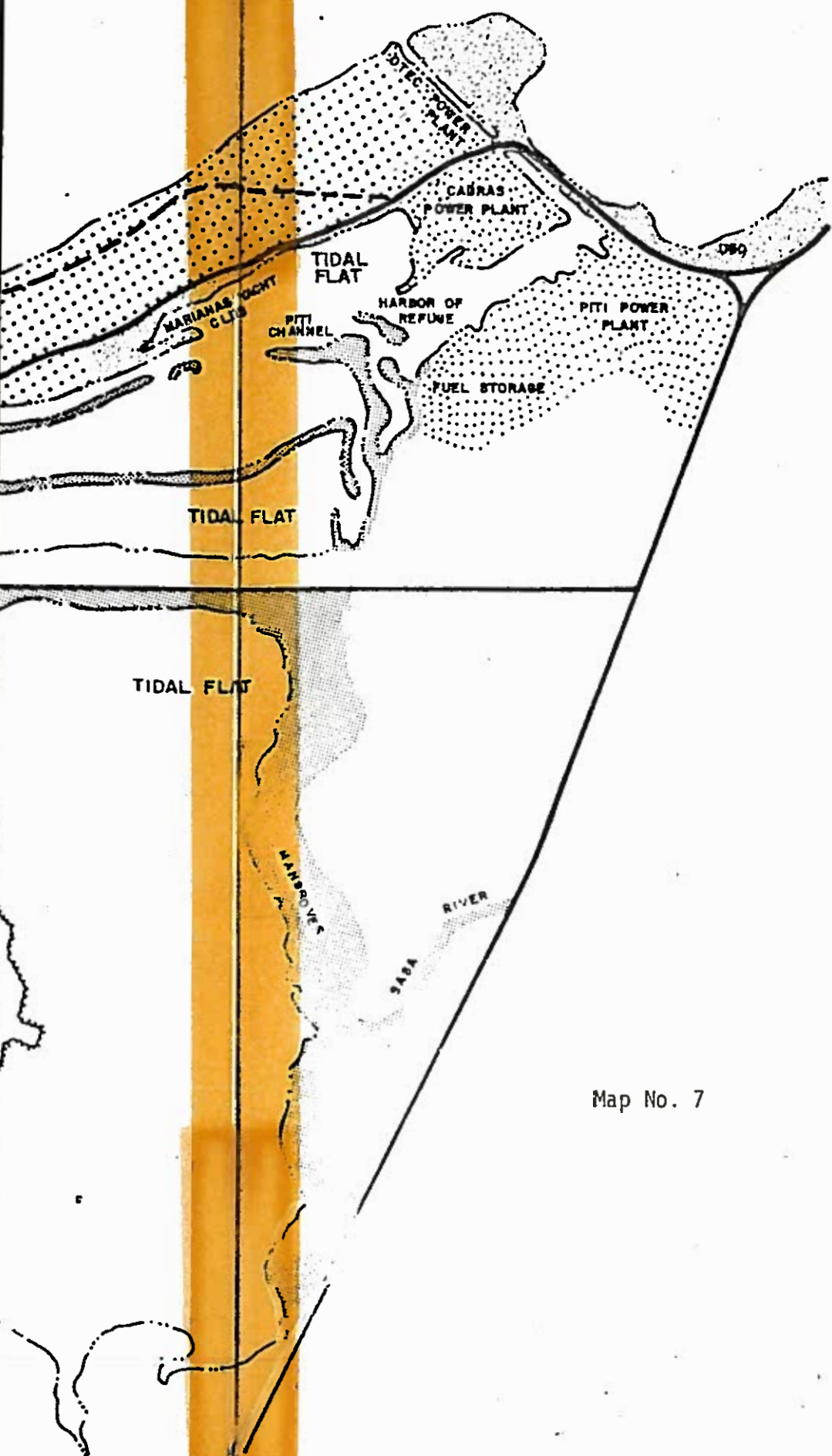
- | | |
|---|---|
|  | COMMERCIAL PORT FACILITIES |
|  | WATER-DEPENDENT PORT-RELATED INDUSTRY |
|  | PORT-RELATED LIGHT INDUSTRY |
|  | LIGHT-HEAVY PORT-ASSOCIATED INDUSTRY |
|  | POWER PRODUCTION FACILITIES |
|  | MILITARY OPERATIONS |
|  | CONSERVATION AND DEVELOPMENT OF FISHERY RESOURCES |
|  | RECREATION |
|  | CONSERVATION OF WETLANDS |
| --- | PROPOSED ROAD RELOCATION |

WESTERN SHOAL



SCALE • 1 : 12,500
SCALE • 1" = 1,042'





Map No. 7

APPENDICES

APPENDIX A

LIST OF ABBREVIATIONS

COE	United States Army Corps of Engineers
DAG	Department of Agriculture, Government of Guam
DLM	Department of Land Management, Government of Guam
DPR	Department of Parks & Recreation, Government of Guam
DPW	Department of Public Works, Government of Guam
ESQD	Explosive Safety Quantity Distance
GEDA	Guam Economic Development Authority, Government of Guam
GEPA	Guam Environmental Protection Agency, Government of Guam
GORCO	Guam Oil and Refining Company
HCRS	Heritage Conservation and Recreation Service, United States Department of Interior
NEW	Net Explosive Weight
NSD	Naval Supply Depot, United States Navy
OTEC	Ocean Thermal Energy Conversion
PUAG	Public Utilities Agency of Guam, Government of Guam
POL	Petroleum, Oil and Lubricants
TPC	Territorial Planning Commission, Government of Guam
TSPC	Territorial Seashore Protection Commission, Government of Guam
USFWS	United States Fish and Wildlife Service, U. S. Department of Interior

MEMBERS OF THE
CABRAS ISLAND TASK FORCE

PORT AUTHORITY OF GUAM

Gregorio C. Sanchez, General Manager
Bruce E. Pecon, Assistant General Manager, Administration & Finance
Michael J. Duenas, Port Market & Research Specialist
Helen F. Ada, Program Officer
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Joseph McDonald, Deputy Director
Richard Bowen, Economist

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Joseph Cepeda, Deputy Administrator

THE GUAM GROWTH COUNCIL

Michael McClure

MATSON NAVIGATION COMPANY

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Douglas A. Tilden, Port Manager