

PHYSICAL DEVELOPMENT MASTER PLAN **for the** **COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS**



Volume IV
ROTA

Prepared for
OFFICE OF
TRANSITION STUDIES AND PLANNING

Prepared by
PACIFIC PLANNING AND DESIGN CONSULTANTS
Chalan Kanoa, Saipan Tamuning, Guam

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COASTAL SERVICES CENTER
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PHYSICAL DEVELOPMENT MASTER PLAN
FOR THE
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Volume IV

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Office of Transition Studies and Planning
Government of the Northern Mariana Islands

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FOREWORD

The following summary highlights the Physical Development Master Plan for Rota and places the full text in a readily identifiable perspective. The format, in the sequence of the text, should assist the reader in quickly locating plan elements or particular areas of interest.

- POPULATION:** The present 1978 estimated population of Rota is 2100-2600 1300 and is expected to increase to at least 1700 by 1985. By 1990 the population is expected to be between 2160 and 2570 persons.
- SONGSONG VILLAGE** Songsong Village will remain the major urban center, but growing pressure for a new village at Sinapalo, adjacent to the airport, may create serious development problems.
- LOCAL ECONOMY** Agriculture and tourism - the predominant economic activities on Rota - both influence, and are influenced by, the local lifestyle. Most residents are engaged in the practice of subsistence farming, and 25 to 30 persons are presently involved in commercial operations. Tourism is expected to increase dramatically with the recent opening of the new hotel in Songsong. The plan reinforces these activities and promotes their further development.
- LAND USE PLAN** The land use plan is sensitive to environmental constraints, the scarcity of land resources, and to the prevailing lifestyle. The following land use zones are proposed for Rota.

- Conservation** Many of the open space areas outside of Songsong Village are utilized by local residents for subsistence food gathering, and these areas must be protected to preserve the lifestyle. Lands in the Conservation Zone include shoreline and beaches, especially lands within 150 feet of the high water mark, inland areas with pronounced topography, wilderness areas, and historic sites. Taipingot Mountain, Mount Manira, As Nieves Latte Quarry, Spanish Mission House, German Chapel, Japanese Sugar Train, and the Manira Jinja Memorial are specific sites to be found in this zone.
- Agriculture** The Agricultural Zones protect and encourage agriculture on the best available lands. The high quality soils in the Sabana region are proposed to be included in the cultivation zone.
- Residential** Residential zones apply to Songsong Village proper and to the proposed Sinapolo Village Homestead area adjacent to the airport. The existing Songsong Village area provides for continuation of the varied land use mix. Outside of the existing central village area and for Sinapalo Village, separate commercial areas are provided.
- Commercial** A small area at the southern part of Songsong has been designated for commercial activities as has an area at the Sinapalo area.
- Industrial** A six-hectare Industrial Zone has been designated near West Harbor. Included in the harbor development are several acres of filled lands to be utilized for harbor related developments.

Public Facilities Lands occupied or scheduled to site public buildings - the high school, municipal field, airport, harbor - as well as land in Sinapalo for schools, community centers, and commercial center, are in the Public Facilities Zone.

CIVIC CENTER The Civic Center will remain at its present location. Immediate construction of a fire and police station will be followed in later plan periods by a courthouse, library, auditorium, and cultural center.

HEALTH The plan recommends renovation of the hospital, and construction of an additional building for Public Health and Environmental Health.

EDUCATION A new high school will become a reality during the plan period. Construction of recreational facilities at the high school will be complemented by designation and development of numerous beach parks.

AGRICULTURE Several improvements will support development of agriculture and livestock: expansion of the slaughterhouse and reefer facilities; development of beef cattle grazing lands; and expansion of the irrigation water system.

WATER Water is, and will remain, most precious. Besides an aggressive metering and public education program, several specific improvements are recommended: replacement of transmission line from Matahanom to Songsong; construction of a reservoir; improvement and expansion of the

Songsong Village distribution system; replacement of chlorinator; improvement and expansion of the irrigation lines; and exploration and drilling of wells in the Sabana for supplying potable water for beef cattle grazing lands.

SEWERAGE

A public sewerage system will eventually be required; however, construction is not anticipated during the present planning period. Separate collection and pumping systems will be required for Songsong proper and the newly developed area which includes the resort hotel, high school, and MIHA housing project. During the plan period, individual and group septic tank or cesspool facilities are recommended.

SOLID WASTE

The present dumpsite should be retained, but must be converted into a sanitary landfill operation. Late in the plan period a new sanitary landfill site will need to be developed.

AIRPORT

Several improvements have been recommended to insure that Rota Airport meets minimum safety and security requirements. Improvements proposed include obstruction removal for approach and transitional areas, installation of perimeter safety and personnel security fencing. Construction of a new terminal and crash fire rescue building has recently been funded through the U.S. Department of Commerce, Economic Development Administration. A contract for the reconstruction and paving of the runway, apron, and taxiway was recently awarded, and the project should be completed by late 1978.

HARBOR

Improvements to West Harbor will include: the deepening and widening of the entrance channel, enclosing the ship turning basin, construction of a breakwater, and creation of approximately two acres of land for harbor oriented industry. Later in the plan period approximately 200 feet of medium depth pier will be reconstructed as well as facilities for sport fishing vessels.

ROADS

Improvements proposed during the present plan period include approximately 8.2 miles of the Songsong Village-Airport Road; village streets in Songsong; and the Water Cave Road.

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BACKGROUND

GOALS AND OBJECTIVES

NATURAL SETTING FOR PLANNING

SOCIO-DEMOGRAPHIC SETTING

LAND MANAGEMENT FACTORS

GOALS AND OBJECTIVES

The goals and objectives approved by the Office of Transition Studies and Planning are listed below. They provide the basic guidelines for the physical planning efforts.

- * Formulate a viable Physical Development Master Plan for Rota which provides an adequate framework for accommodating the social, economic, and political changes which are taking place.
- * Prepare a Capital Improvements Program for the next seven years, based upon the physical development plans for the island of Rota.
- * Provide for the orderly growth of Rota's community with special attention to the conservation of land resources.
- * Provide for coordinated urban growth and economic development by the timely provision of roads, utilities, harbor, airport, and other capital improvement projects.
- * Recognize natural environmental constraints such as topography, soils, and water resources in the location and development of new growth; and to preserve, to the maximum extent possible, the scenic and natural character of the island.

NATURAL SETTING FOR PLANNING

GEOGRAPHY

Rota is located in the Western Pacific Ocean between latitudes 14° 06' N to 14° 12' N and longitudes 145° 07' E to 145° 17' E. A member of the Mariana Islands group as shown in Plate 1, Rota is located 79 miles south-southwest of Saipan and 44 miles north-northeast of Guam. The larger continental island groups of Japan, Ryukyus, Philippines, and New Guinea are all within 1000 to 1500 miles west of Rota extending in a north-south arc.

The island is approximately 11.5 miles long and 3 miles wide. It is the third largest of the Northern Mariana Islands and its 32.9 square miles represent 18 percent of the total land area in the NMI group.

GEOLOGY

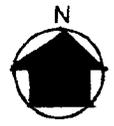
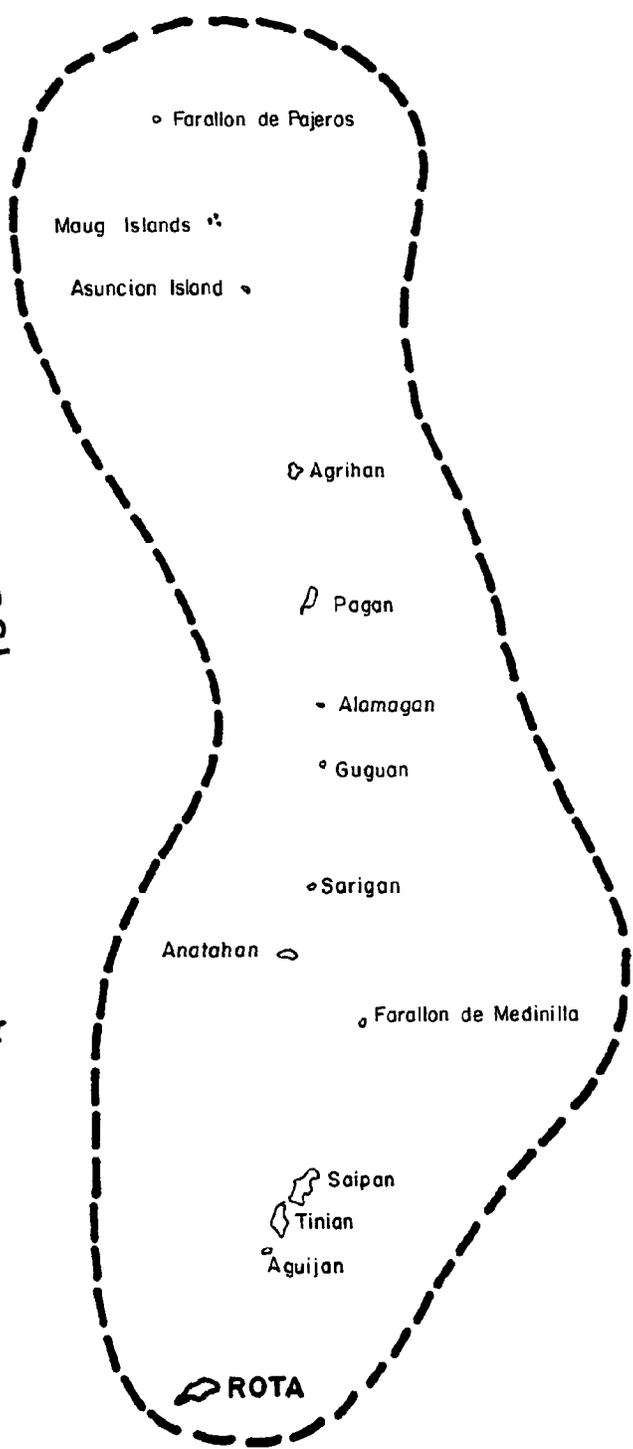
Rota has a volcanic base overlain with coral. During the periods of submergence, coralline deposits were formed which, with subsequent uplifting, gave rise to pronounced terraces of various heights. The present topography is dominated by plateaus and steep cliffs.

The most widely distributed soil on Rota is of coralline type, occurring on raised limestone terraces. There are two areas where volcanic outcrops can be found on the islands.

One area is the small dome-shaped Mount Manira, the highest elevation of the island (1625 ft). The other area is located in the southern central part of the island.

Other soil types found on the island occur in the forms of mixed, fine-textured volcanic and coralline materials and loose, medium to coarse, coral sand along the beaches.

MARIANA ISLANDS



ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN
NORTHERN MARIANA ISLANDS
vicinity

1

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TOPOGRAPHY

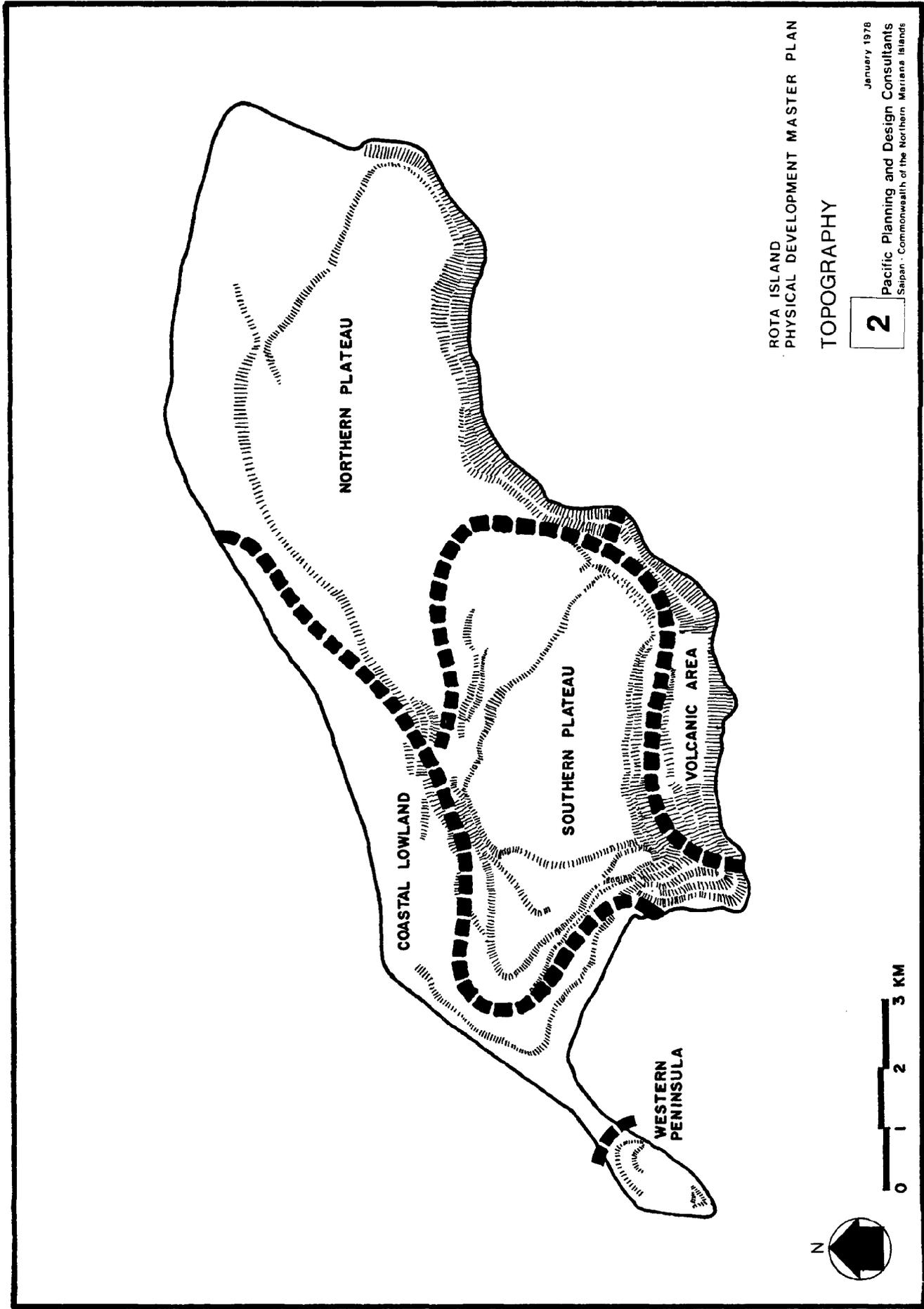
Rota's topography is divided into five principal subdivisions: a Northern Plateau; a Southern Plateau (the Sabana); a Volcanic Area; a Coastal Lowlands Area; and the Western Peninsula. Plate 2 depicts these areas as they relate to each other.

The Northern Plateau, at a general elevation of 450 feet, roughly comprises the eastern part of the island. The southern and eastern sides of the plateau terminate in pronounced cliffs which lead to a rocky shoreline. In the north, the plateau slopes gradually towards the sea, grading into the largest beach on Rota, Mochon Beach.

The Southern Plateau, known as the Sabana, is at an elevation generally exceeding 1400 feet. On its western side, a succession of sharply marked cliffs form smaller plateaus at varying lower levels. On the northern and eastern boundaries less pronounced cliffs and slopes lead gradually into the Northern Plateau. To the north, the Sabana terminates abruptly in dramatically shaped and precipitous cliffs. In the northern part of the Sabana, Mt. Manira, a gently sloped hill rising smoothly above the surface, forms the highest elevation of Rota (1625 ft).

The volcanic area is totally different in topographic appearance from the rest of the island. Streams, originating at the contact between the old volcanic surface and the limestone cliffs, have eroded this area into deeply etched ridges and valleys predominantly covered by sword grass. The weathered volcanic surface slopes gently to the southern coastline.

On the island's north shore, an area of Coastal Lowlands dominates the landscape and is bordered to seaward by a



ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN
TOPOGRAPHY

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narrow reef margin. Sandy soils with coconut palms dominate the inland areas, while strand vegetation dominates the coastal margin.

The Western Peninsula is a narrow isthmus connecting Mt. Taipingot with the remainder of the island. Mt. Taipingot rises in regularly formed terraces to a height of 460 feet. Steep precipitous cliffs practically defy access to this area.

CLIMATE

The climate of Rota is tropical, reflecting its proximity to the equator and the influence of warm surrounding waters. Humidity, temperature, and pressure vary only slightly throughout the year. However, rainfall and wind conditions vary markedly, and it is these variations that subdivide the year into the wet and dry seasons.

Annual rainfall on Rota averages between 97 and 121 inches with the higher elevations experiencing the greater amount of rainfall. The period of heaviest rainfall occurs during July through October. The period extending from February through May marks the dry season. The rainfall ratio between the driest and wettest months of the year is roughly 1:5. Relative humidity ranges from 75 to 100 percent.

Precise temperature data are not available for Rota although, as noted, only slight variations are experienced throughout the year. However, the Sabana area experiences somewhat cooler temperatures because of its altitude.

Trade winds blowing from the northeast are persistent during the period from January through May. Wind directions are far more variable during the months of July through October.

Major tropical disturbances with cyclonic winds of 33 to 65 knots are most frequent during the rainy season, although they are by no means restricted to this part of the year. The frequency of these storms is evidenced by the fact that during the 24-year period from 1945-1969, 40 typhoons (with wind speeds of 65 knots or greater) and 30 tropical storms passed within the vicinity of Rota. These storms are an integral aspect of the island's tropical climate.

WATER RESOURCES

Originating as rainfall on the Sabana, water gushes forth from a large cavern dramatically located at the base of a limestone cliff 1100 feet above the sea. This water cave is the sole source of the domestic needs of Rota's community at Songsong village.

The main cave spring emerges at the approximate contact of the island's highest limestone terrace with the volcanic subsurface. This spring is called "Matanhanom," literally translated to mean "the water's eye." At the far end of the cave, sizeable rivulets cascade several feet from the limestone into a pool about 30 feet in diameter. The top of the limestone terrace lies about 400 feet above the cave.

Like all limestone caves, Matanhanom subsides sharply during the dry season when rainfall recharge is small. It has, however, proven to supply adequate quantities of water for the village even during unusual droughts. Having a single source of domestic water supply presents cause for extreme care of this resource. Although domestic needs are currently met adequately, the increasing of irrigation demands may eventually deplete available supplies and cause a shortage for domestic needs. This trade-off will remain a crucial planning factor.

FLORA AND FAUNA

Relatively few species of both flora and fauna are unique to the Mariana Islands in general and to Rota in particular. The basic flora of Rota was probably introduced by overwater means or possibly by airborne transport during major cyclonic disturbances that periodically ravage the islands. Other likely modes of introduction include "hitch-hiking" on birds, bats, and insects or on floating logs and debris that drifted to the islands. In addition, the aboriginal settlers most probably introduced various plants that now form the basic flora of the island.

The vegetation of the island is believed to have been rather simple. On the limestone parts, a mixed forest existed varying from generally dry-season deciduous plants on the lower terraces, to a wet forest on the highest terraces. Vegetation now existing on the island is characteristically associated with its local environment. Strand vegetation, savannah or grassland growth, and marshland vegetation are typically of these flora.

Terrestrial fauna is limited on Rota. The only native mammals are two species of bats, one of which is a local delicacy. The fruit bat or "fanihi" is in danger of being eliminated principally because of unrestricted hunting and reduction of its habitat. The other bat species is an insectivorous cave dweller found throughout the islands.

The Spaniards most probably introduced goats, cattle, pigs, and chickens. Other mammals which have been introduced and now flourish in varying degrees include the Marianas Deer, rats, mice, and feral dogs and cats.

Reptilian species include the monitor lizard (iguana), considered a pest for its raids on farmsteads in search of eggs

and young chickens; the blue-tailed skink; the golden-brown skink; the New World chameleon; geckos; a non-poisonous burrowing snake; and the West Indian or Marine toad.

Bird life on Rota is classified into seabirds, migratory shorebirds, and land or freshwater birds. Of interest are the avian fauna influenced by the Japanese-Marianan flyway. From their breeding grounds in Asia, the Aleutians, and Alaska, certain migratory birds follow the Asiatic coast or adjacent island chains to the Japanese Archipelago. From Japan, some birds fly on through to the Marianas.

A total of 206 birds are represented in Micronesia, too numerous to be listed herein. It is of interest, however, to note that the Marianas Mallard, an endangered species, is endemic to this island chain. They exist nowhere else but in the Mariana Islands.

SOCIO-DEMOGRAPHIC SETTING

HISTORY

Magellan is generally credited with the discovery of the Mariana Islands in March of 1521. The impact of this discovery was minimal until the end of the 17th century when the Spanish authorities decided to transport the entire population of Rota to Saipan and eventually to Guam. This reduced the estimated population of 8000 to approximately 200, as a few families managed to escape and hide either in caves or in densely vegetated areas of the island.

Thus, Rota is the only island in the Northern Marianas which has had a history of continuous Chamorro occupancy. Today, this fact is reflected in the spoken language of the inhabitants; it is inflected differently and is verbally richer than Chamorro spoken on the other islands.

In 1898, after the Spanish-American War, Guam came under the control of the United States whereas the remaining Northern Islands of the Marianas became a colony of Imperial Germany. This division of political administration for the Mariana Islands was to have far reaching consequences upon their economic development.

The Marianas were too distant and her resources were too limited to arouse much interest in Germany. But, the Germans did not neglect the islands totally, imposing health measures, establishing public schools, extending the road network, and organizing an agricultural program, based chiefly on copra. However, the German period of occupancy was too short to leave much imprint on either the people or the landscape.

Japan dominated trade in the Northern Marianas even during the German tenure. By the end of the German period Japanese

trading incursions had resulted in their comprising the largest component of the foreign population on the islands.

With the advent of World War I the islands were taken by the Japanese without a struggle, and for the first time since their discovery, they became easily accessible to a ruling power. Being situated along the routes of Japanese economic expansion, the Marianas were soon brought to their greatest commercial development.

Japanese colonization brought about a complete change of the islands' landscapes. During the Japanese occupancy, sugar plantations dominated Rota's geographic scene. In 1936 a mining operation of phosphate deposits on the Sabana was initiated and, for a six-year period between 1938 and 1943, a yearly average of 37,000 tons was exported to Japan. Small, predominantly Japanese villages developed adjacent to plantations and mines. By 1937, total population (including defense personnel) was 7600. Few of the natives were caught up wholly into the socio-economic system established by the Japanese. Most of them preferred to sell their labor and to rent their land, retaining only enough food for home use.

Although Rota was never subjected to a direct landing attack in World War II, effective bombing destroyed facilities and made all the villages uninhabitable by the spring of 1944. The island was occupied by American forces on September 4, 1945 and the Japanese nationals were removed in January and February of 1946. War transformed Rota from a productive community to an island with a dislocated population and a broken economy, from which recovery has been slow and incomplete.

POPULATION

The 1973 Trust Territory Census showed a total resident population in Rota of 1,104. Trust Territory citizens numbered

995; the remaining 109 were temporary alien laborers and expatriate U.S. citizens holding contract assignments with the Trust Territory Government.

In the same census, a total of 1,183 persons listed Rota as their "home area." This suggests that at the time of the census 188 people from Rota were residing or working on other islands in the Northern Marianas or in the Trust Territory. Since the census was taken on September 18th and 19th, 1973, those pursuing an education or residing on Guam, Hawaii, or the U.S. Mainland were not included in the census.

The probable 1985 population range was projected from the 1973 population by applying a low 3% annual growth rate and a high 6% rate to the Trust Territory population of 995 and the 1,183 persons who listed Rota as their "home area." These projections are shown in Figure 1.

The average growth of each of these base figures establishes a population range which for the year 1990 indicates a low population of 2160 with a high number of 2570. These figures represent Commonwealth citizens only. It is assumed that a modest amount of alien labor force immigration will be accommodated within this established growth range. However, the growth projections do not consider any large scale importation of alien agricultural laborers.

AGRICULTURE

During the Japanese period, the Japan-based South Seas Development Company established extensive sugar cane plantations over vast natural forest areas. By mid 1930s, approximately 28 percent of Rota's total land area was in sugar cane production. Most of this land was located on the northern plateau in the northeastern part of the island. Smaller producing areas were

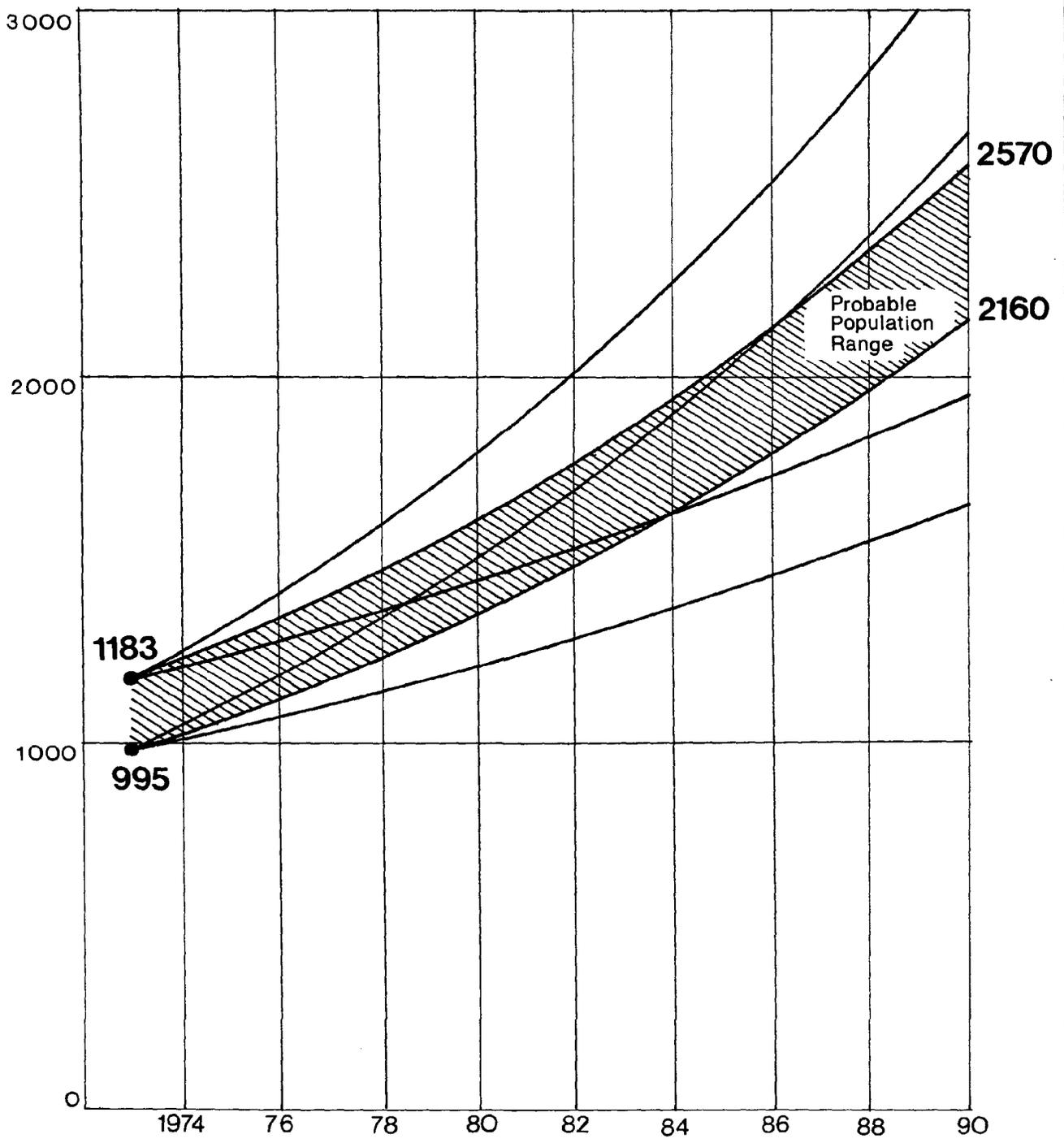


FIGURE 1 · MOST PROBABLE RANGE OF POPULATION GROWTH ON ROTA

located on the Sabana and on the volcanic soils in the south of the island. On the plateaus too steep or rocky for agriculture, limited areas of natural forest were left practically intact except for minor logging operations. On the lower terraces, a narrow, almost circumferential band of native upper strand vegetation was left intact. The plants inhabiting this coastal zone are tolerant to salt spray and rocky limestone soils.

World War II aerial bombing destroyed the villages, transportation, mining, and production facilities and denuded extensive tracts of agricultural lands. Sugar cane fields were idled and rapidly overgrown by weeds and thickets. Today, except for some homestead areas, most of the land remains idle or marginally utilized for grazing.

Subsistence farming is today the dominant expression of local agricultural activity. Twenty-five to thirty of Rota's approximately 80 farmers are engaged in full-time commercial production, the others are farming for subsistence only. Of these eighty, fewer than ten (10) are less than thirty years old, and 25 to 30 are full-time government workers who farm part-time.

Relatively low commercial agricultural productivity has resulted from a complex set of circumstances only partially understood today. Some of the more significant factors include:

- * The highly developed pre-war marketing and transportation systems were destroyed by aerial bombing;
- * Unlike Tinian and Saipan, Rota was never occupied by U.S. military forces and therefore did not benefit from the development of infrastructures which occurred on Saipan and Tinian during the final stages of the war;
- * The repatriation of the Oriental labor force left but a small population of persons interested and skilled in commercial farming; and

- * Emphasis on employment within the government bureaucracy was reinforced by American values placing low desirability on the hard physical labor associated with farm work.

The return of traditional subsistence farming, physical deterioration of valuable acreage, high cost of land-clearing, the hot climate, and constant risk of typhoon damage further aggravated the downward spiral caused by lack of an effective marketing system.

To date a detailed soils classification program for Rota is not available. Such information would serve as a base to establish priorities and recommendations for different types of agricultural uses and initiate further studies such as crop selection by climatic requirements, production costs, and long-range market characteristics. However, the location of existing farms in the year 1948 (Bowers, 1950) and the Rota land capability report prepared by the Trust Territory Government give reasonably reliable information on areas generally suited for truck farming.

Of the 113 farms existing in 1948, sixty or 53% were concentrated on the northwestern lowlands along an extensive network of narrow Japanese roads, forty-four or 30% were located in the southern volcanic area and the adjacent hills toward Songsong, seven or 6% were situated on the southwestern lowlands, and two farms were located in other areas of the island.

LAND MANAGEMENT FACTORS

LAND TENURE

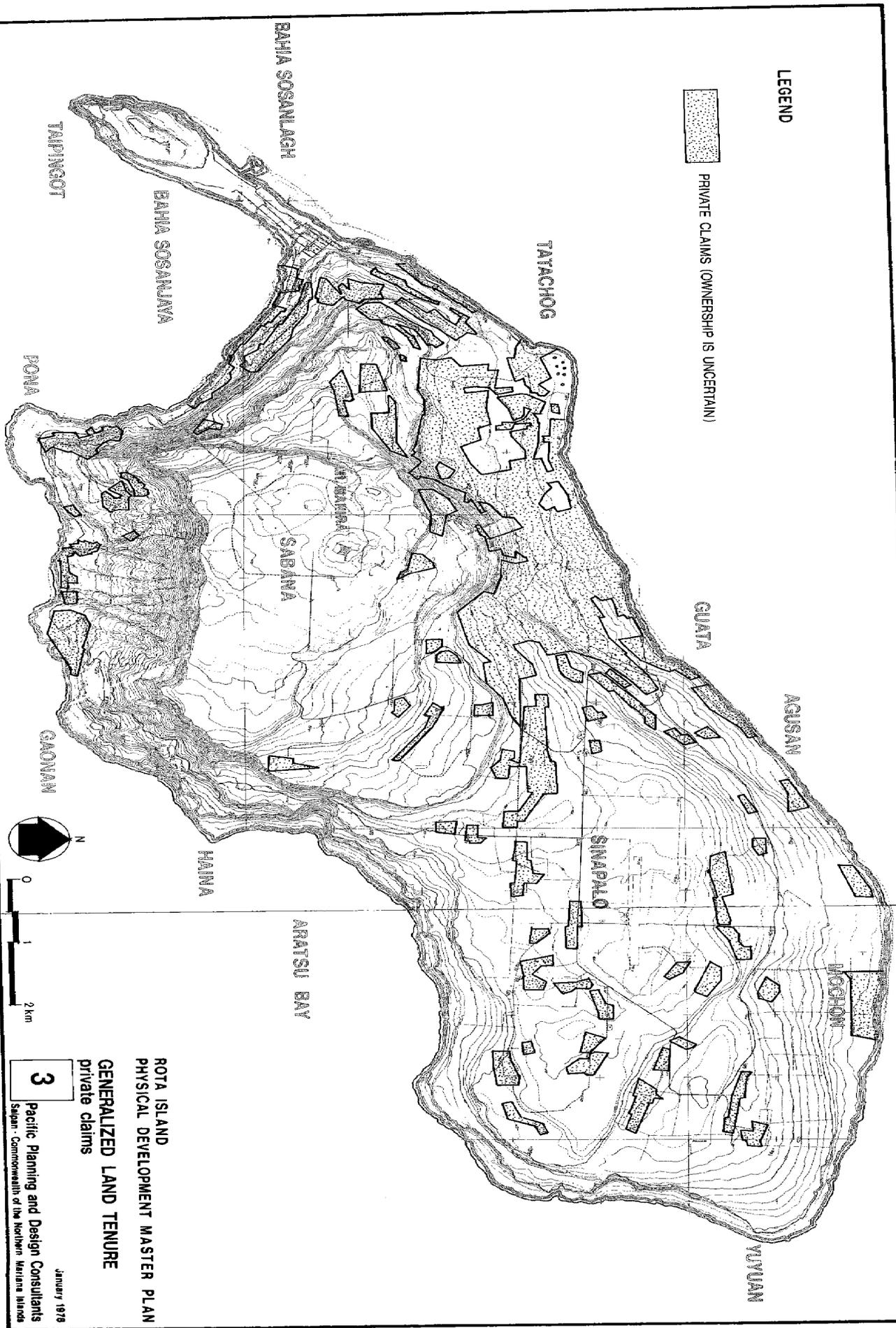
Today, more than 30 years subsequent to the end of World War II, questions regarding land ownership on Rota remain unresolved. The complicated ownership pattern which resulted from Spanish, German, and Japanese administrations was further aggravated by the initiation of village and agricultural homestead programs by the United States prior to the resolution of pre-war claims. Events and actions that have led to changes from the pre-war ownership pattern are described herein to present a general historical overview as well as to provide an understanding of the existing conditions at this time. Plate 3 depicts the claimed pre-war private lands on Rota. Approximately 20% of the island's land area falls within this sector.

VILLAGE HOMESTEADS

After World War II, the entire peninsula area including Songsong Village was in public ownership. In the early 1950s, a program was initiated under the Navy Administration which allocated lots in Songsong in exchange for lots in the old village of Tatachog. A substantial portion of Songsong was subdivided into 325 residential lots in a pattern generally following the pre-war Japanese village layout.

Initial land exchanges were made on an equal area basis and since the parcels in Tatachog were larger than those in Songsong, each applicant was to receive more than one lot in Songsong. To further complicate the ownership pattern, these lots were randomly distributed within the village as selected by the applicant rather than being allocated in subsequent order.

Recognizing the need for additional village homestead areas, the Land Management Office subdivided the Teteto area adding an



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GENERALIZED LAND TENURE
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additional 46 lots. This subdivision was completed in 1975.

As of October 1977, 212 lots (57%) of the 371 subdivided parcels in Songsong Village had been exchanged for residential parcels at Tatachog. An additional 147 lots (40%) have been allocated through the Rota Village Homestead Program. Twelve lots (3%) still remain in public ownership or are reserved for uses other than residential. Deeds have been issued for 106 lots in the exchange program and 96 lots in the Village Homestead Program. Plate 4 illustrates this condition.

Since 1957 a total of 373 village homestead applications have been filed. Presently, some 226 applicants are still awaiting the availability of village homestead lots. Although 97% of the subdivided lots in Songsong are privately allocated, approximately 120 lots or 37% remain vacant.

In 1977 thirty (30) additional lots were subdivided as part of a Mariana Island Housing Authority Section 8 housing program.

To meet present and future demands for village homesteads, there has been pressure to subdivide lands in the Sinapalo area. This village site was identified in the 1972 Master Plan and recently the Northern Mariana Islands, Land Management Office, has initiated a subdivision plat. This project is discussed later in the text.

AGRICULTURAL HOMESTEADS

Under the same homesteading program, 361 applications for agricultural homesteads have been filed since 1957. A total of 108 permits have been issued, of which 76 have received deeds of conveyance. Two hundred fifty-three applications are yet to be approved, pending the availability of additional lots for agricultural homesteads.

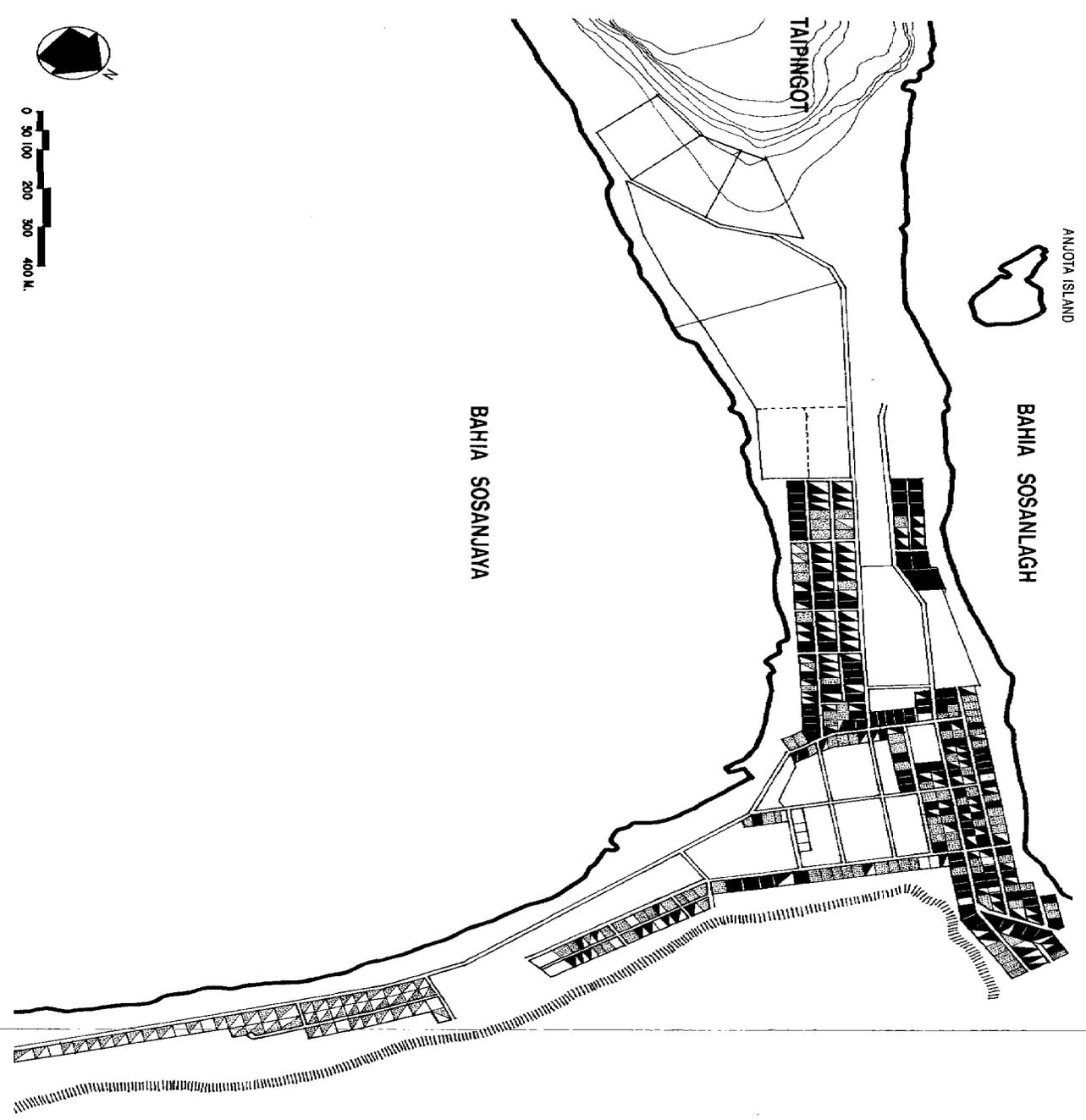
The total land area of agricultural homesteads allocated since 1957 is 581 hectares or 6.8% of the island. The average size of agricultural homesteads is four (4) hectares.

The total land area for which grazing leases have been issued is 912 hectares, or 11% of the island. The size of the grazing leases varies from five (5) to 120 hectares, with an average size of 28 hectares.

Plate 5 shows the extent of land areas which have been allocated under the Agricultural Homestead Program. Plate 5 also indicates the status of land tenure issues that affect these parcels.

Recognizing the need to provide eligible persons with land, a special provision of the constitution was enacted to assist those persons in obtaining homestead lands who had either resided upon, used commercially, or farmed lands that had been designated for homesteading but who for some reason or another have never received freehold interest in the property. This is a one-time exception designed primarily for the benefit of the people on Rota and the islands north of Saipan.

The amount of land which any one person would receive is limited to one agriculture and one village homestead, the size of which is to be determined by the legislature. Upon the completion of the property surveys scheduled for early 1978, it will then become the responsibility of the Public Land Corporation to make final determination as to those persons who qualify under the special provision.



LEGEND

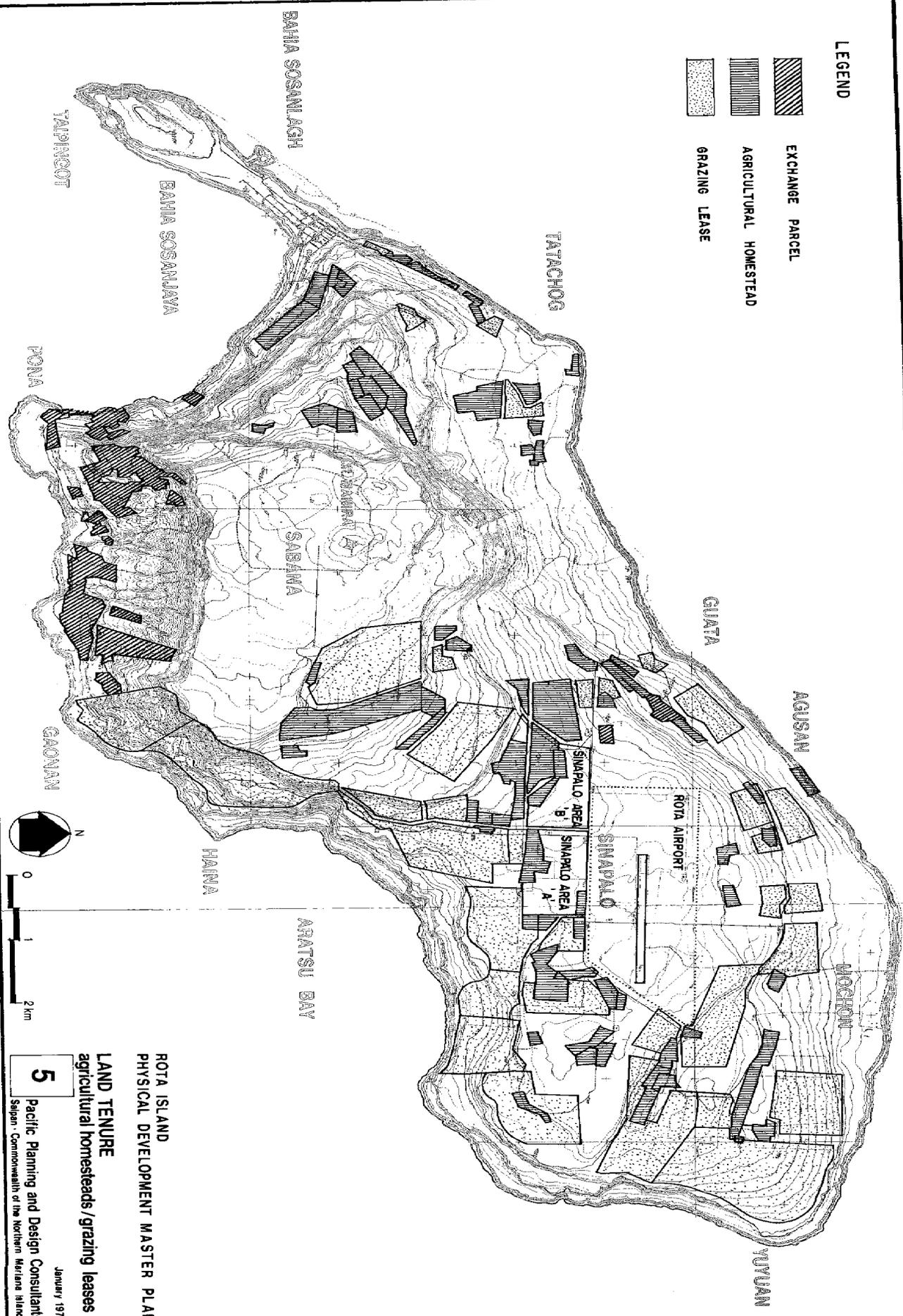
	EXCHANGE, TITLE ISSUED
	EXCHANGE, TITLE NOT YET ISSUED
	HOMESTEAD, TITLE ISSUED
	HOMESTEAD, TITLE NOT YET ISSUED

ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
SONGSONG VILLAGE
 lot status

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LEGEND

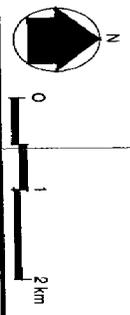
-  EXCHANGE PARCEL
-  AGRICULTURAL HOMESTEAD
-  GRAZING LEASE

**ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN**

LAND TENURE
agricultural homesteads / grazing leases

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LAND USE

PURPOSE AND OBJECTIVES

PROPOSED LAND USE ZONES

PURPOSE AND OBJECTIVES

The land use plan should provide a framework for the management of change and future growth sensitive to environmental constraints and existing resources, the availability of public services, and future capital improvements. The plan respects the right of the local citizens to own property, to have decent housing, and to actively shape (through individual choice of style and expression of preferences) the future of Rota life. Objectives of the land use plan include:

- * To recognize and respect the value system of traditional local life style.
- * To recognize and respect the wishes of the local population regarding future land use allocations.
- * To promote and provide for increasing economic independence for the island.
- * To recognize natural environmental constraints (water, topography, soils, etc.) in the dimensioning and location of future growth.
- * To provide adequate space for existing and future housing needs.
- * To preserve to the maximum extent possible the intrinsic scenic and natural resources of the island.
- * To coordinate urban growth with the availability and growth of public services including water, power, transportation, and sewer.
- * To encourage development patterns which enhance living conditions by clustering compatible land uses and separating conflicting ones.

In order to realize these goals, the designation of seven major zones are proposed for land usage on Rota. These include Conservation, Agricultural, Residential, Commercial, Industrial, Hotel Resort, and Public Facilities. Agricultural and residential zones are further subdivided. The zones and the lands on Rota so designated are discussed in the following section. Plate 6 illustrates the proposed Land Use Plan for Rota (See Plate in Pocket).

PROPOSED LAND USE ZONES

CONSERVATION

The conservation zone provides for the preservation and protection of natural resources such as watersheds, unique animal and plant habitats, historic and cultural resources, scenic resources including prominent topographic forms and features, and outstanding views and attractive wilderness areas. The Conservation Zone also establishes a mechanism to preserve these unique resources for present and future generations. The zone includes areas of unique geologic or vegetative sites; steep slopes and ridges; inland and coastal wetlands; shorelines, offshore reefs, and lagoons; beaches; beach parks; and general parks.

Geographic Areas

Except for Songsong Village on the isthmus of Taipingot peninsula, Rota is a vast open space including many scenic areas and vistas. Protection of these areas requires more than preserving their scenic beauty. Many of these areas are used by the local populace, so protection of natural resources is synonymous with preservation of an integral part of the local life style and protection of food sources.

Areas designated for inclusion in the Conservation Zone include: shoreline areas around the island, including beaches; and low limestone terraces with remnants of the original vegetation cover. Also included are inland areas with pronounced topography, such as cliffs and steep slopes, which form the characteristic transition zones between horizontal terraces at various elevations. Finally, lands classified as wilderness areas are also included for conservation. The most extensive lands in this category include the dramatic cliffs south of the Sabana.

Sites and specific features in the Conservation Zone include: Taipingot Mountain; Mount Manira, the highest point on the island formed as a knoll of volcanic material protruding through the limestone terrace; historic and archaeological sites; and public lands within 150 feet of the high water mark.

The Conservation Zone follows the entire shoreline of Rota to a minimum inland distance of 150 feet. In some instances, in order to incorporate natural features, follow pronounced topography, or coincide with a road along the shoreline, the zone extends further inland.

Historic Sites

Rota abounds in coastal latte sites, especially along the north coast in the Mochon area. These latte sites are but one class of historically significant sites which have survived largely because Rota escaped much of the destruction of World War II battles.

In 1974 an inventory of historic sites was conducted by the Marianas Historic Preservation Committee under the technical direction of the Marianas Planning Officer. The following sites have been inventoried and documented:

Pre-Contact Period:	As Nieves Latte Quarry (See Figure 2)
Spanish Period:	Spanish Mission House
German Period:	German Chapel
Japanese Period:	Sugar Train Aerial Tramway Towers Hospital Mansions Coastal Gun Emplacement Shindo Temple Cave
American Period:	Manira Jinja Memorial

In August 1977, the Municipal Council of Rota passed an ordinance establishing the Mayor's Commission on Relics and

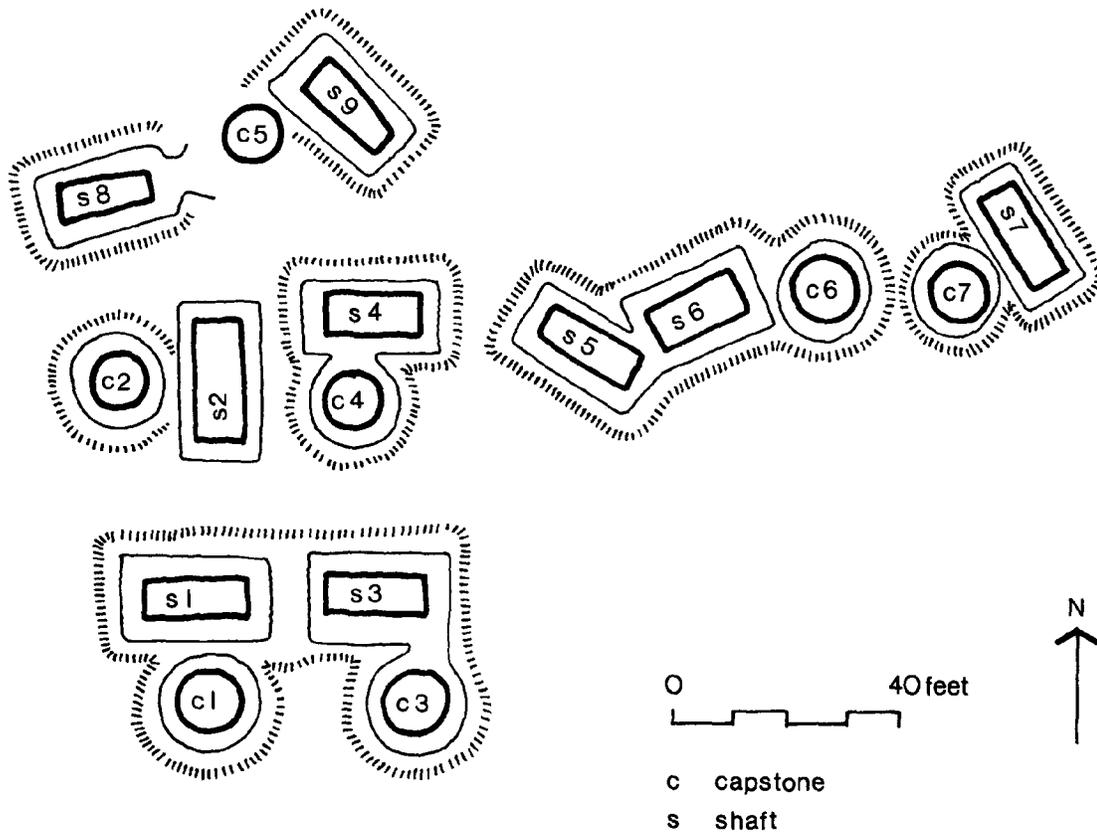


FIGURE 2. AS NIEVES LATTE QUARRY SITE

Artifacts, signed by the Resident Commissioner on September 12, 1977. The Mayor's Commission is charged with designating categories of historic artifacts through the promulgation of regulations controlling removal of relics from Rota, and the establishment of guidelines for compensating residents having valid ownership claims to such items.

Historic site preservation provides for greater understanding of local pre-contact culture and of major historical influences on today's culture. The As Nieves latte stone quarry site, for example, yielded clues in 1925 to anthropologists as to the manner of quarrying and raising of latte stones. Preservation of these sites will enrich the educational and cultural environment.

An intensive inventory of all historic sites on Rota should be conducted. Presently, only the As Nieves latte quarry is included in the National Register of Historic Places. Other sites such as the Latte village site in Mochon also merit inclusion on this list. Negotiations for an island-wide inventory program of all historic sites are under way, and hopefully will begin soon.

High priority should be placed on the survey and documentation of relics from the Japanese period. These relics are especially threatened because of physical deterioration and removal by collectors and tourists. The remains of the Japanese Phosphate Mill at the site of the former village of Terunon, and the ruins of the sugar mill next to West Harbor, are particularly valuable.

AGRICULTURE

Two agricultural zones are designated in the Master Plan. Agricultural Zone 1 includes those lands to be used for intensive cultivation of field crops, orchards, and forage. Lands included in this category contain the most productive soils which in many instances overlay valuable ground water resources. The purpose of this designation is to insure control of fertilizers and pesticides in order to avoid ground-water pollution.

Agricultural Zone 2 provides land for grazing activity, subsistence croplands, and uses related to animal husbandry, including the raising of cattle, swine, and poultry.

Agriculture-Cultivation Zone (A-1)

Approximately 330 hectares of high quality soils in the Sabana area have been included in this zone. The area is traditionally considered by local farmers as very desirable for agricultural production because of its high elevation, which leaves the moisture content of the air unaffected by the dry season. This area also coincides with the Matanhanom spring watershed, Rota's primary water supply source.

The main purpose of this zone is to protect this area from nonagricultural uses and potential threats to the watershed. A number of criteria must be followed which have been explicitly outlined in the proposed Zoning Ordinance, the implementation tool for this plan. Generally, the criteria restrict land use to intensive cultivation. Single family residential and grazing uses are permitted in this zone. Lot size for residential use must be at least one hectare per dwelling unit. The requirements of the Conservation Zone, prohibiting the construction of private wells and the use of certain fertilizers and pesticides, shall be applied.

The rotation of grazing and cultivation activities could probably eliminate the need for chemical fertilizers. Considering the water percolation depth of 135 meters and the different solubility characteristics of organic and chemical fertilizers, total elimination of pollution using natural fertilizers is practically assured, whereas the complete breakdown and elimination of chemical pollutants is not.

Agriculture-Grazing Zone (A-2)

This zone identifies the areas best suited for grazing and agriculture and accommodates these as principal uses. Single family residential uses on minimum lot size of one (1) hectare per residential unit are also permitted.

Conditional uses can be accommodated in this zone, subject to performance standards covering impacts upon social and natural environments and public facilities. The designation of areas as grazing lands implies that the ideal land use in these areas should be for large-plot cattle grazing. Grazing uses shall conform to sound agricultural practices and avoid overgrazing, a condition invariably leading to erosion.

Agriculture homesteads are permitted, provided that lot clearing will not induce erosion and cause damage to grazing, cultivation, or adjacent conservation areas.

RESIDENTIAL

The Master Plan delineates only the One-and-Two-Family Residential Zone in Rota. The purpose of this zone is to provide for low density family living, with privacy, a reasonable amount of open space, and protection from noise, congestion, and hazards that may result from incompatible land uses such as commercial or industrial. Uses include one and two family

dwelling units, incidental and subordinate commercial or personal services such as "Mom and Pop" stores, home occupations, schools, parks, playgrounds, and recreational areas.

Residential zones apply to Songsong Village proper and to the proposed Sinapalo Village located near the airport.

Songsong Village

A dominant factor in the zoning of this area as low density one-and-two-family residential is the size of existing lots. They are too small to allow rural-residential development which requires at least one-half acre per unit; they are also too small to allow multi-family development which requires at least a 20,000 square foot lot. Although multi-family lots would not be inappropriate for this area if undersize lots were consolidated, it is not anticipated that multi-family units are necessary or required within the plan period.

Plate 7 on page 35 illustrates the proposed land use for Songsong Village. Of the 42.4 hectares comprising the village, 10.6 hectares have been designated "residential/commercial" a variant of the standard zone. Previous development trends and the existing urban pattern require special provision for the unusually high proportion of "Mom and Pop" stores, service stations, and other commercial uses.

This district is restricted to the existing central village area wherein such commercial ventures are already established. Business establishments of this nature will be contained within the already existing central district and will not be allowed in the other residential zones nor in the Sinapalo subdivision.

The remaining 31.8 hectares zoned residential includes all the lands already subdivided for residential lots, the privately owned subdividable areas between Songsong and Teteto, and

some subdividable land close to the high school at the northwestern end of the village. Properly plotted, these areas would provide about 75 additional lots. Finally, this zone also includes the MIHA housing site, presently planned for 30 units.

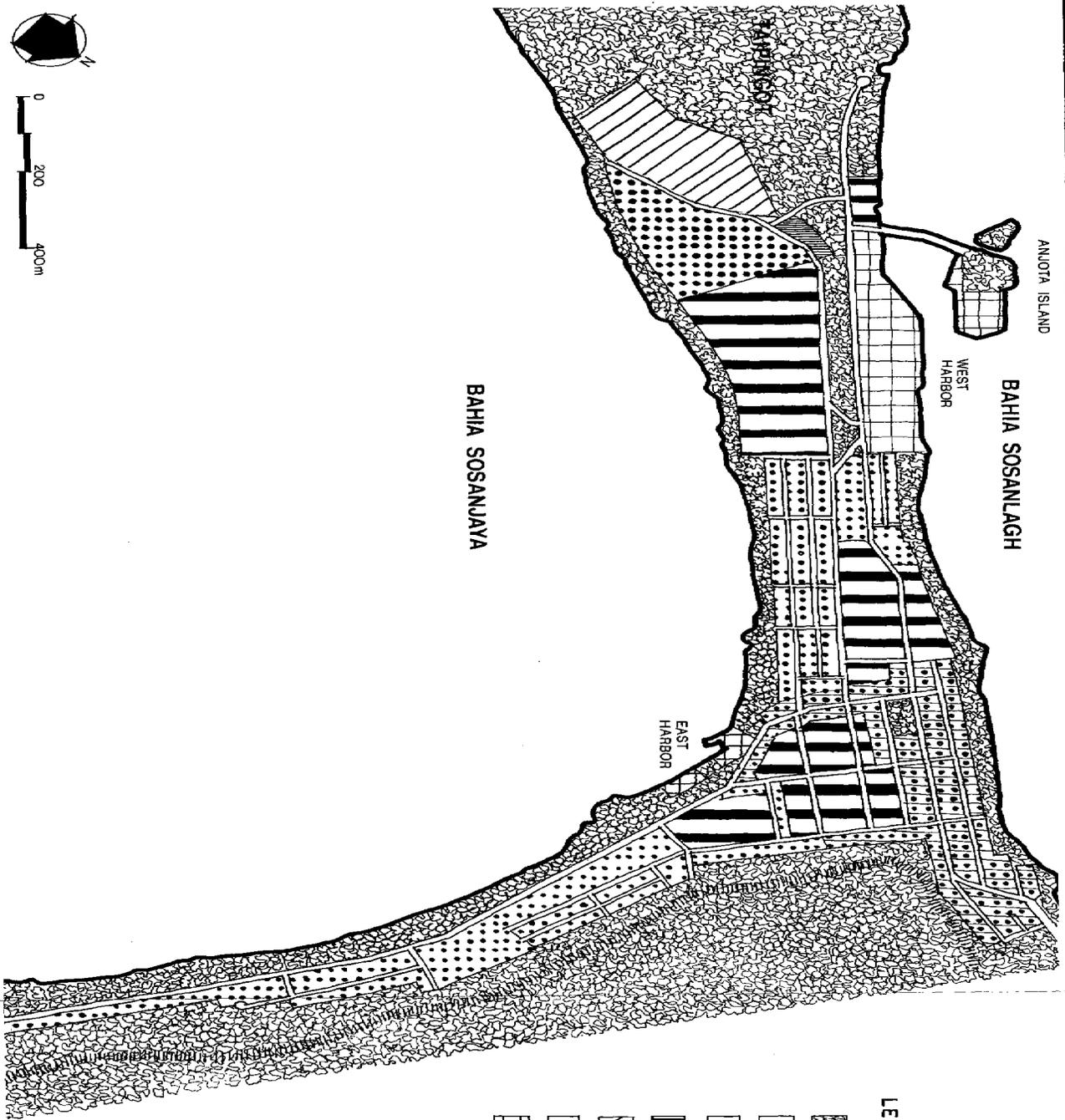
Sinapalo Village

Village homestead applications awaiting the availability of lots increased from 151 to 226 during the year ending October 1977. In response to this pressure the Rota Municipal Council requested the opening of Public lands in the Sinapalo area for the purpose of developing a new village homestead site.

The proposed area is located south of Rota airport, adjacent to the airport road. The 150 hectares area is further divided by the road leading to the southern part of the island into an eastern section of approximately 84 hectares and a western section of roughly 66 hectares. Plate 8 illustrates a conceptual design for the eastern portion of the Sinapalo subdivision.

Postponement of significant improvements to Sinapalo Village beyond the present planning horizon is recommended in order to avoid excessive strain of the government's ability to provide essential services. Construction within the plan period is inconsistent with the need to upgrade the infrastructure in Songsong. Concentration of Rota's inhabitants in Songsong results in high cost-effectiveness of CIP monies. Establishment of another village at this time will place a tremendous strain on the financial resources available for island capital improvement projects. Although the waiting list for village homestead applications would be reduced, a great number of more serious problems will be created.

Sinapalo Village would require duplication of such facilities as the elementary school, health services, power generation,



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BAHIA SOSANLAGH

ANIOTA ISLAND

WEST HARBOR

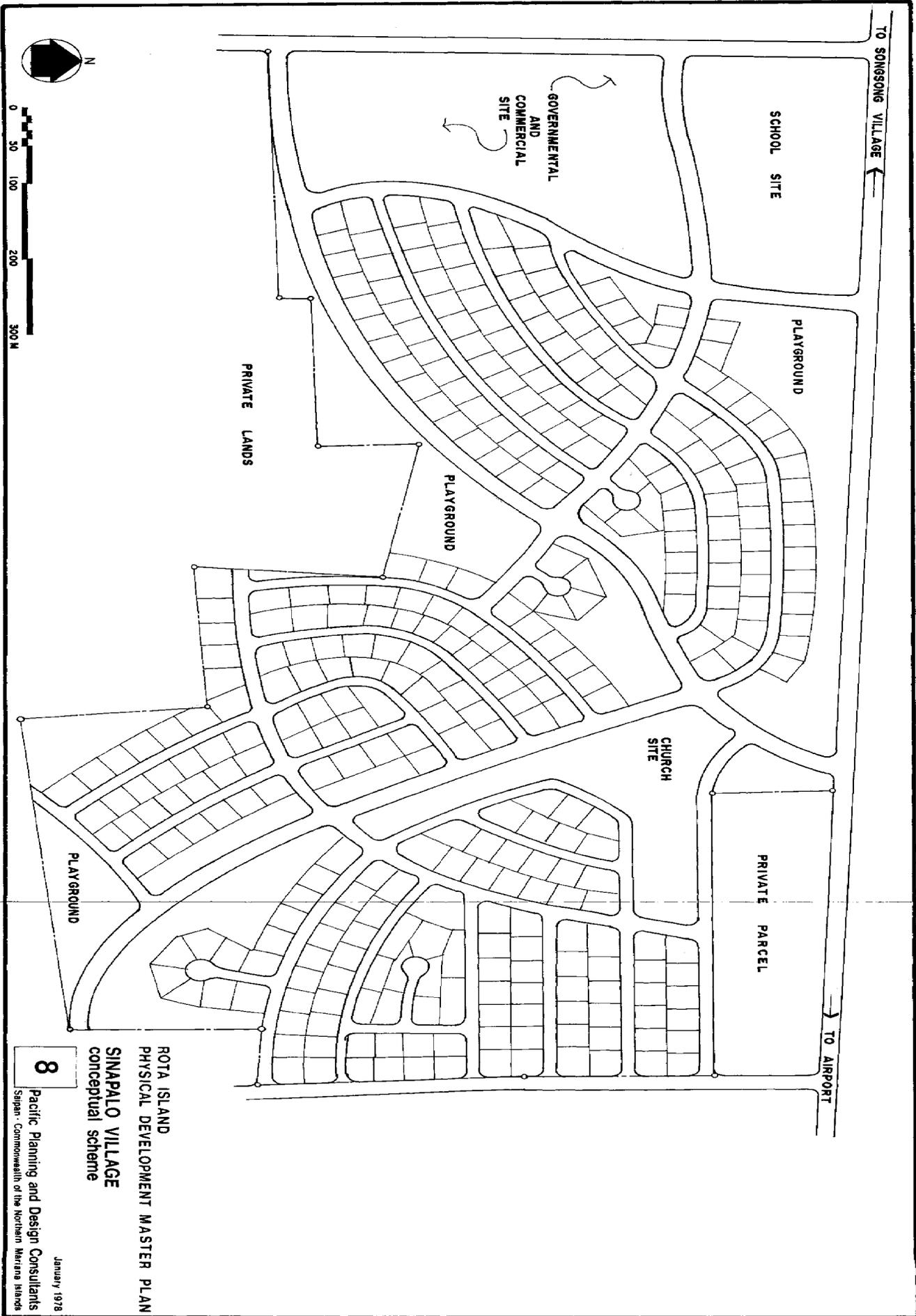
EAST HARBOR

LEGEND

-  CONSERVATION
-  RESIDENTIAL
-  RESIDENTIAL COMMERCIAL
-  COMMERCIAL
-  RESORT
-  PUBLIC FACILITY
-  INDUSTRIAL

ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
SONGSONG VILLAGE
 land use

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ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
SINAPALO VILLAGE
 conceptual scheme

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and water supply system. It would require daily busing of high school students. None of these facilities have been anticipated for scheduling CIP monies over the next seven years. Costs for infrastructure improvements for Sinapalo would be diverted from allocations earmarked for planned improvements in Songsong. Instead of developing into true urban areas with orderly and proximate government facilities, Songsong and Sinapalo would both remain underused, under-equipped, and underserved village areas competing for public financial assistance.

COMMERCIAL

The commercial zone provides for the concentration of personal service-related commercial uses more extensive than those found in the commercial/residential district. They may be in close proximity with, and easily accessible to, nearby residential zones. They provide for compact, one-stop shopping areas, office buildings, public and quasi-public facilities, and centers which are architecturally and functionally related.

A small 1¼ acre area towards the southern part of Songsong has been designated as a commercial zone. A one-stop shopping center with small offices is envisioned for this site.

INDUSTRIAL

A six hectare Industrial Zone has been designated near West Harbor. This zone will accommodate the harbor activities, operations of the Department of Public Works, the power plant, and the existing slaughterhouse and reefer plant. An area must also be set aside for the eventual construction of a sewage treatment plant/pump station, and the site must

accommodate shore activities related to the development of West Harbor. An industrial area of approximately two and a half acres, which includes the Mobil bulk fuel facilities, is also designated in the vicinity of East Harbor.

PUBLIC FACILITIES

The land occupied by the dispensary/sub-hospital, administration building, post office, and the elementary school have been designated as a Public Facilities Zone. Total area in this existing zone is 85,000 square meters. Five government-owned single family residential units are also located within this zone.

The nine hectare site of the proposed high school and the present 4,446 square meter site of the Municipal Field have been zoned as Public Facilities, as have the lands on which airport and harbor facilities are located. The Sinapalo subdivision also includes land for schools, community centers, and commercial areas, all of which will also be included within the public facilities zone.

PUBLIC FACILITIES

INTRODUCTION

CIVIC CENTER

HEALTH FACILITIES

EDUCATIONAL FACILITIES

POLICE AND FIRE FACILITIES

PARKS AND RECREATION

HOUSING PROGRAM

AGRICULTURAL IMPROVEMENTS

INTRODUCTION

The Government of the Northern Mariana Islands has found it necessary to provide facilities and services which in larger communities would normally be handled by private enterprise. Education, parks and recreation, and administration facilities are commonly provided by most governments. However, the Northern Marianas Government, by precedent and conscious choice, is also involved in providing other functions such as health care, agricultural facilities, and housing.

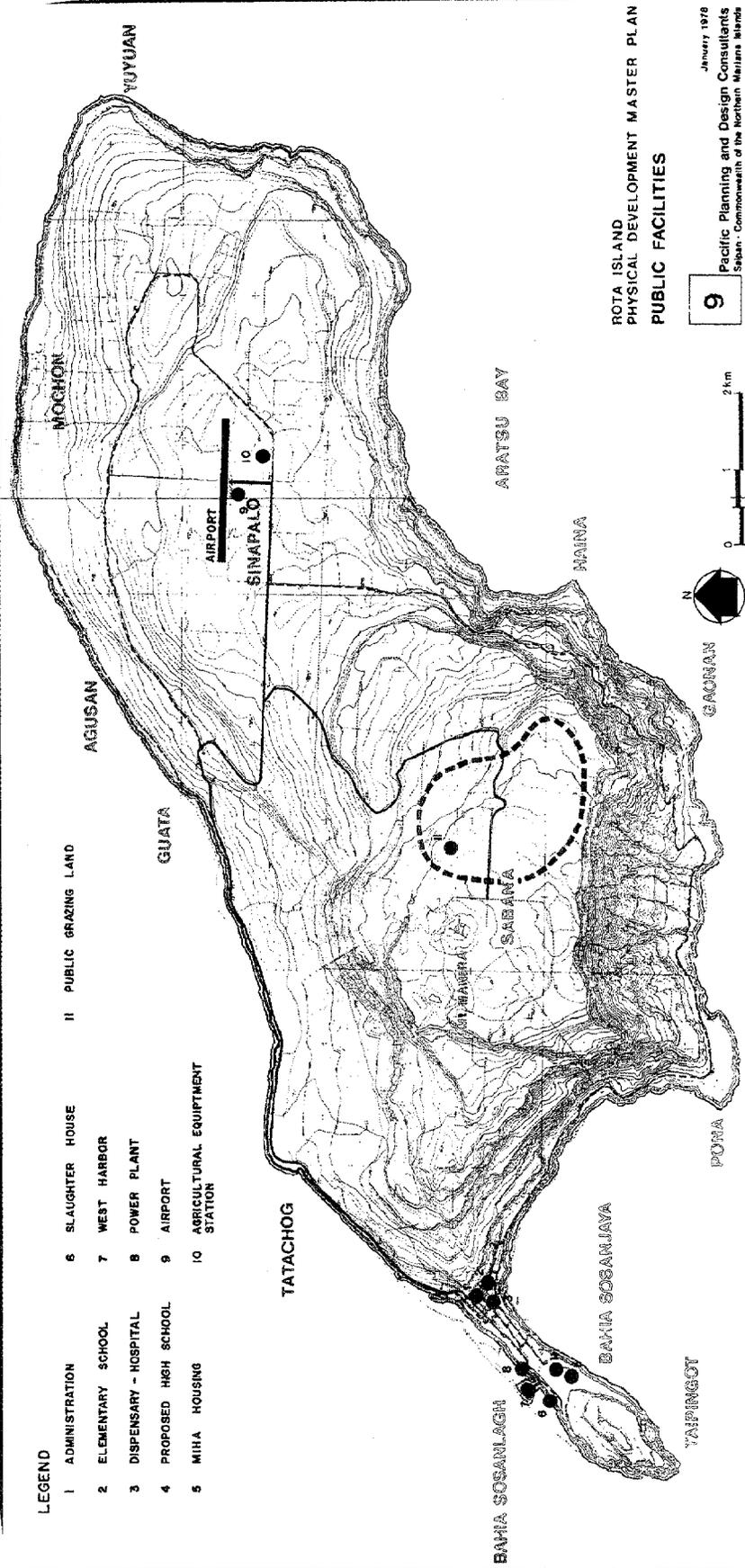
The following sections present details on the major public facility projects recommended during the plan period. Refer to Plate 9 for specific locations.

- * The plan suggests that the Civic Center will remain at its present location. It recommends the construction of a fire and police station during the initial short-range plan. Subsequent improvements to the civic center include the addition of a court house, library, auditorium, and cultural center.
- * The plan recommends the renovation of the existing hospital, and the construction of an additional building for Public Health, Environmental Health, and a morgue.
- * A new high school is proposed to be constructed during the plan period.
- * Recreational improvements include the renovation of the basketball courts and baseball field, construction of additional courts and fields as part of the high school complex, designation and development of numerous beach parks and general purpose parks, and finally the future development of sport fishing facilities.

* Agricultural improvements include the expansion of the slaughterhouse and reefer facilities, improvements of public grazing lands, and improvement and expansion of the irrigation water system.

LEGEND

- 1 ADMINISTRATION
- 2 ELEMENTARY SCHOOL
- 3 DISPENSARY - HOSPITAL
- 4 PROPOSED HIGH SCHOOL
- 5 MIHA HOUSING
- 6 SLAUGHTER HOUSE
- 7 WEST HARBOR
- 8 POWER PLANT
- 9 AIRPORT
- 10 AGRICULTURAL EQUIPMENT STATION
- 11 PUBLIC GRAZING LAND



ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
 PUBLIC FACILITIES

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CIVIC CENTER

Although the 1972 Master Plan recommended that the civic center be located near the high school site, recent land use decisions concerning the provision of low-cost housing and relocation of the proposed high school site dictate retaining the administration complex in its present location. The site lies directly across from and northeast of the present hospital.

In Plate 10 a schematic layout of the Civic Center complex is shown. Perimeter parking and a site layout open to the air as much as possible are the major features of the site plan. A garden-like effect is thus provided.

Within the first phase of construction, a single-stall fire station and an adjacent police station, with four detention cells and administrative offices, should be built. The fire station will be designed to enable the fire engine to drive through the station.

The court house will be situated immediately northeast of the fire station and will be constructed in Phase II. The library will be located on the northeast side facing the prevailing breeze as this is the portion of the site subject to least noise.

The existing buildings in the southern corner of the site will be retained for administrative use until the construction of the town hall and administrative complex.

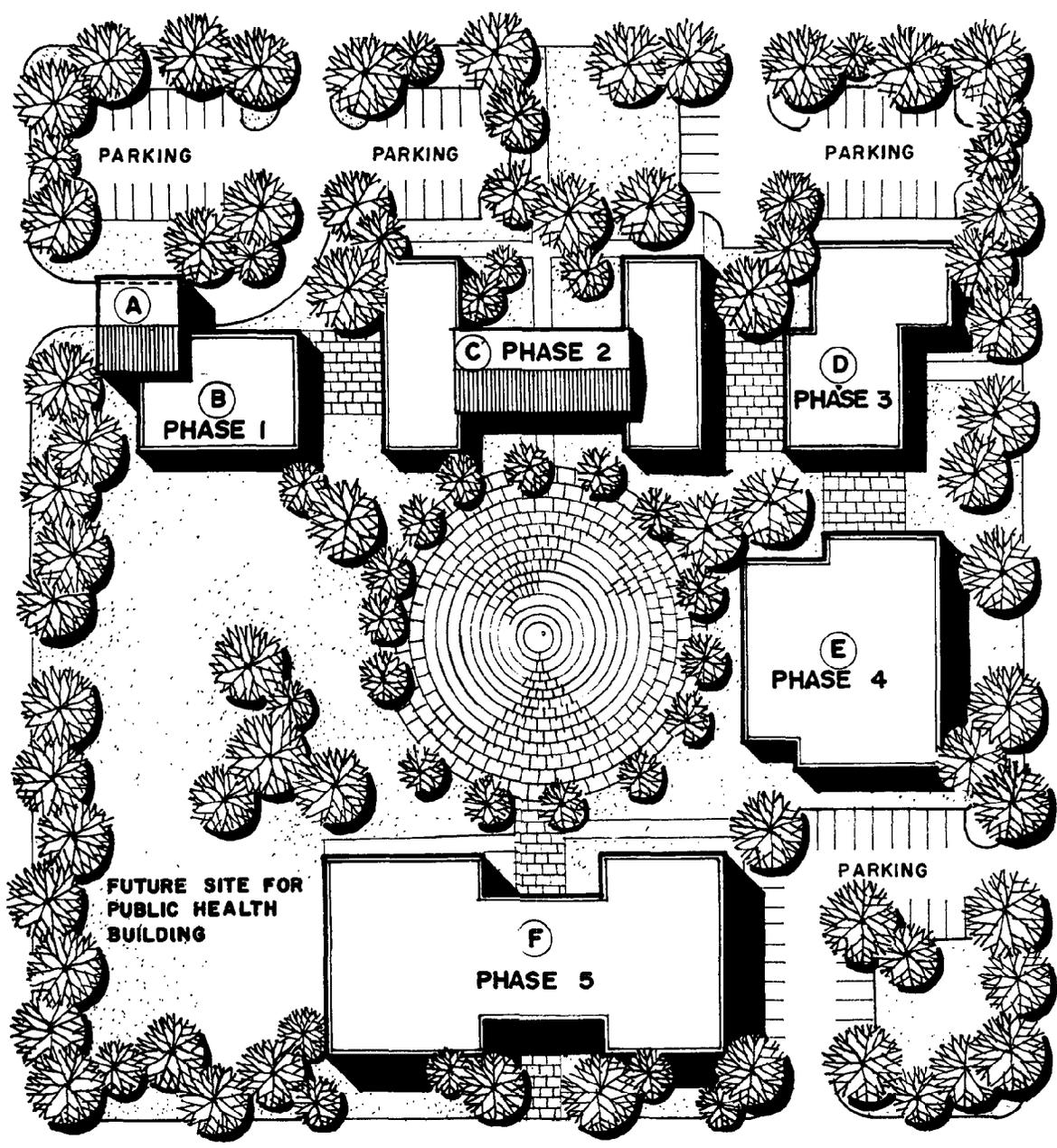
A multipurpose auditorium and cultural center is proposed to the southeast of the site. This layout will provide a central mall which would be very desirable for those functions which can be held outdoors and are normally associated with a civic center.

In addition, the surrounding planted and landscaped area would provide a pleasant setting for the buildings as well as outdoor leisure areas where people utilizing these facilities can relax and enjoy lunch or outdoor leisure hours.

The area occupied by the existing administrative buildings should be used later as the site for additional public health facilities.

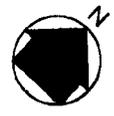
The proposed layout makes possible incremental construction with easy expansion to any of the buildings. While parking may not be an immediate requirement, it would be unrealistic to plan an administrative complex and neglect provisions for parking, an important aspect always associated with a developing community.

Construction of the administration complex is to be phased, made necessary by funding limitations. It is anticipated that only the fire and the police stations will be constructed during the plan period. The Fiscal Year 1980 budget allocates \$175,000 for the design and construction of administrative buildings.



LEGEND:

- (A) FIRE STATION
- (B) POLICE STATION
- (C) COURT HOUSE
- (D) LIBRARY
- (E) FUTURE TOWN HALL
- (F) AUDITORIUM (multi purpose)
CULTURAL CENTER



ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN
CIVIC CENTER
schematic plan

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HEALTH CARE

The existing hospital is housed in a prefabricated building constructed in the early 1970's. Presently, the facility can accommodate twelve beds; however, administrative space and nursing stations are considered inadequate.

Although a new hospital had been identified in previous planning studies, resolution of the need, location, and size of a new hospital should be deferred pending extended observation of population growth and housing development trends. Although this issue should be examined during the short range planning horizon, construction of a new facility should be deferred until trends are re-evaluated.

Fifty thousand dollars has been programmed for renovations to the existing hospital. These improvements should serve adequately during this planning horizon. To house Public Health, Environmental Health, and a morgue, construction of an addition to the hospital is proposed in FY 1979. A total of \$75,000 has been allocated for this new addition.

EDUCATION

ROTA HIGH SCHOOL

Construction of a high school facility is proposed within the plan period. Rota High School will not only provide secondary level education but also form an important center for community activities, adult education, and fulfill the cultural and recreational needs of the people.

The high school site proposed in the 1972 Master Plan has been redesignated for housing in order to accommodate a MIHA project. The new school site, northeast of the previously proposed site, will now encompass the land area formerly set aside for a new administration complex (the civic center complex will remain at its present location).

The high school buildings are to be oriented toward the prevailing winds as much as possible to take advantage of the breezes for comfort. Inadequate funds will prohibit air-conditioning of all the facilities; however, the library, audio visual rooms, and other special purpose rooms will be air conditioned.

Plate 10 provides a schematic plan for the overall high school design. Most assuredly the plan will be altered during final site design and after the completion of a much more detailed topographic survey. However, the present plan shows the overall plant layout and the facilities which are to be provided.

The direction of the prevailing breeze makes it desirable to locate the classrooms at the northern end of the site with the gymnasium and cafeteria towards the center and the recreational fields at the southern end. This concept is consistent with good school planning.

The site contains two existing residential type buildings which were constructed by the Japanese and which are scheduled

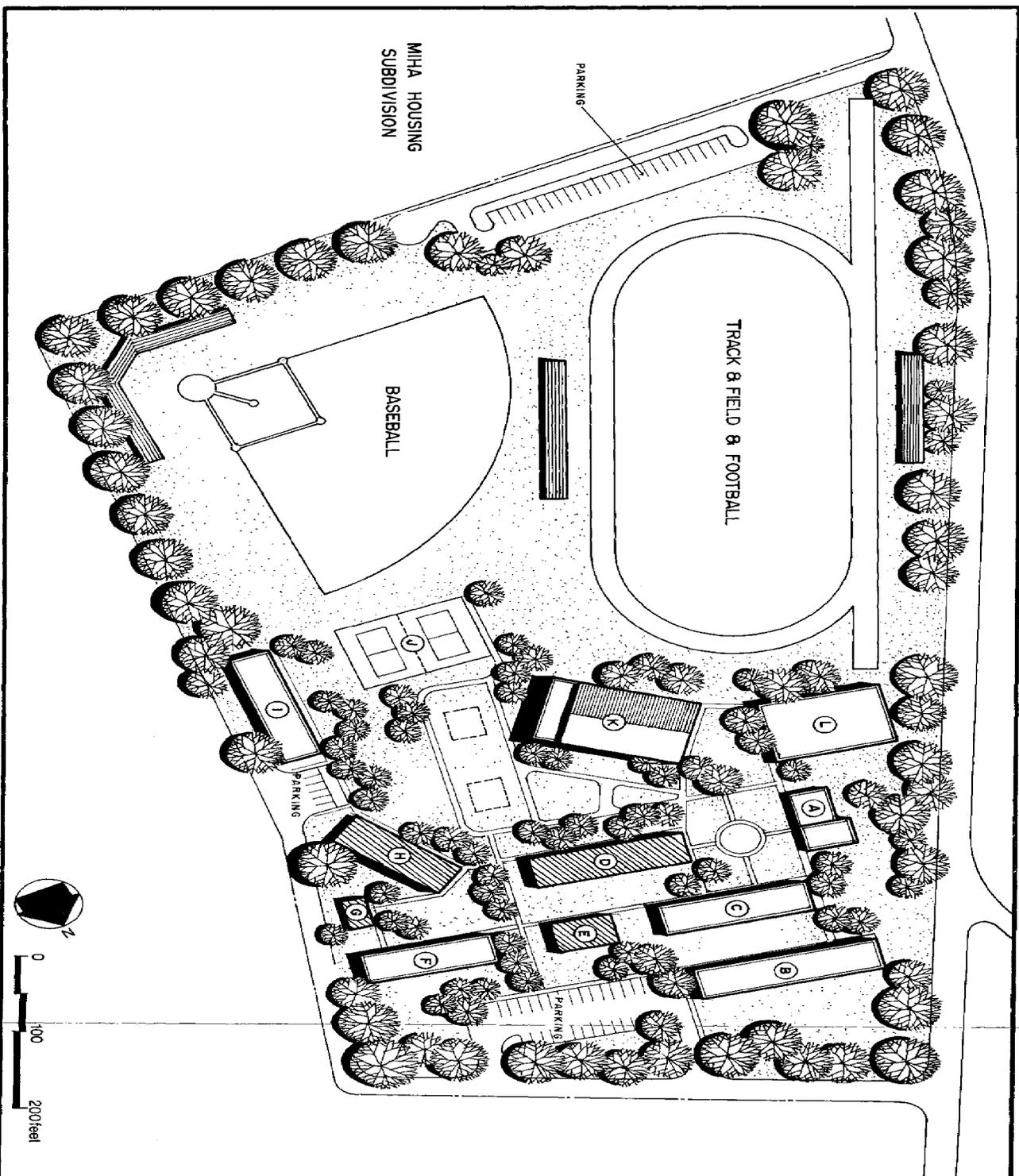
for inclusion in the register of historic buildings; accordingly, the area surrounding these structures has been preserved as an open green area to give the buildings an attractive setting.

It is suggested that after being renovated these buildings be utilized as the school learning center and that they contain the library and a museum to house the Rota artifacts. Due to the size of the island and the anticipated population growth, vehicle parking will not present a major problem, although for safety the access to the parking lot has been taken off the main street and the lot is visible from the administration building for control.

The agricultural and vocational trades building together with the animal husbandry building are located on the side of the site most remote from the main road.

At the extreme southern end of the site, a provision has been made for additional parking which is easily expandable should the need arise. This will provide sufficient parking for residents from all parts of Rota that may come to the area for recreational purposes. With the open planning of the southern half of the site, the grounds will be suitable for use for large fiestas, county fairs, inter-island sports competitions, and similar activities.

It is anticipated that extensive use will also be made of the gymnasium and cafeteria for social and community functions and their relationship to the open recreational areas and their proximity to the main street are considered to be desirable characteristics which will meet the requirements of social and community functions. The basketball, volleyball, and tennis court area will sustain the most use and is conveniently situated adjacent to the gymnasium and in reasonably



LEGEND

- A ACADEMICS
- B ACADEMIC CLASSROOM
- C ACADEMIC CLASSROOM
- D ACADEMIC CLASSROOM
- E ADMINISTRATION
- F VOCATIONAL CLASSROOM
- G TOILET
- H AGRICULTURE
- I ANIMAL HUSBANDRY
- J BASKETBALL & TENNIS COURTS
- K GYM & SHOWERS
- L CAFETERIA
- ZZ PHASE I

**ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN
ROTA HIGH SCHOOL
schematic plan**

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PARKS AND RECREATION

Rota's park system should be organized mainly around beach areas and historic sites. These parks would offer various recreational activities within a setting of natural, scenic, and historic features. The park plan must also consider the need for active recreational facilities necessary to satisfy local demands.

A park system should provide for recreational patterns that complement and supplement existing local outdoor activities. Areas presently utilized by the local population for traditional outdoor recreation and food gathering activities should be reserved to permit continuation of the present lifestyle.

The park system should also provide for the recreational needs of visitors. However, it has been observed in other Pacific areas significantly dependent on tourism that greater amounts of public money and the majority of scenic resources were allocated to the visitor industry in order to promote tourism. This has often resulted in the unintentional alienation of the local population from their traditional pattern and locations of outdoor recreation, causing resentment towards tourists. It is essential to avoid such a conflict on Rota which has a small population segment easily overpowered by a large number of tourists. On the other hand, efforts should be made to educate the residents that financial benefits from tourism cannot be realized without the sharing of recreational facilities and scenic resources. The following recommendations are made cognizant of the need to strike this delicate balance.

RECOMMENDATIONS

Parks and recreation needs will be met through development/improvement of courts and fields, identification and

close proximity to the school building, but is sufficiently removed to eliminate noise problems.

To control noise and to provide site beautification, extensive perimeter tree planting is recommended.

With the funds initially available, it is recommended that one 4-room academic classroom building, a 2-room administration building, and the vocational and agricultural science building be constructed with appropriate toilet facilities adjacent thereto.

The Rota High School will be designed in FY 1978, and \$45,000 is allocated for the design. Construction is planned to begin in the following year and \$380,000 has been reserved in FY 1979 for construction of the facilities and related recreational areas.

ELEMENTARY EDUCATION

The Elementary and Headstart School buildings will remain in their present locations. With the construction of Rota High School, more elementary classroom space will be available. An adequate space for elementary education will be assured during the plan period.

However, these structures are not designed to withstand typhoon winds. Should a severe storm occur during this period, substantial damage to these facilities can be expected. Replacement of these structures with typhoon-proof buildings would then be required.

development of beach parks, and provision for sport fishing. Most of these proposals are primarily intended to meet the recreational needs of the local population.

Courts and Fields

Presently, there are three public outdoor recreation facilities and a semi-public facility on Rota. Two facilities, a basketball court and a baseball field, are associated with the elementary school. There is another basketball court located across from the Mayor's office. The semi-public facility is a volleyball court associated with the Catholic Church on the island.

During this planning period, improvements to the existing facilities as well as the construction of new facilities to be linked with the new high school are anticipated. Funding for these projects will come from the \$10,000 allocated annually for community affairs and the \$30,000 allocated in FY 1979 for construction of high school recreation facilities. A baseball field, basketball court, and perhaps a dual purpose volleyball and tennis court should be constructed as part of the new high school facility. During non-school hours, these facilities should be open to public use.

Improvements to the baseball field at the elementary school and to the two basketball facilities should be funded from the annual allocations for community affairs. The basketball courts appear to require surface work as the courts are poorly drained.

Beach Parks

The coastline of Rota, as already noted, is included within the Conservation Zone. The designation considers that the constitution prohibits transfers of an interest in any public lands within 150 feet of the high water mark of any sandy

beach within the Commonwealth. It is intended that the Public Land Corporation via the Department of Natural Resources maintain the sandy beaches for use by the people of the Commonwealth. Park development would include maintaining adequate public access to the resources.

Beaches are valuable natural areas whose recreation potential require preservation and protection. The following areas should be preserved from development and protected from recreational use. They are further described in the appendix: Mochon Area General Park; Agusan Beach Park (Swimming Hole); Tatachog Beach Park; Taipingot General Park; and Teneto Beach Park. Other parks described in the appendix are: As Nieves Latte Quarry Historic Park; Manira Jinja Memorial Park; and East Coast Nature Preservation and Wilderness Area.

Plate 12 depicts the proposed park and recreation sites for Rota. Appendix 1 includes a discussion of the numerous beach parks that are recommended for improvement during the plan period.

Sport Fishing Facilities

The potential for sport fishing and possible commercial ties to boats fishing waters between Guam and Rota should not be overlooked. The improvements currently planned for Rota's harbors present an opportunity to attract sport fishermen to the island. As more tourist oriented development occurs, the market for profitable sport fishing boat charters would develop. Specific improvements for sport fishing are discussed along with the harbor improvements.

HOUSING PROGRAMS

A recently conducted inventory of housing conditions on Rota indicated that only 83 of the existing housing units are considered adequate to meet minimum housing standards; the remaining 142 units are substandard. Federally assisted housing programs available through Housing and Urban Development and the Farmers House Administration and local assistance as provided by the village homestead program will be available during the plan period to meet housing needs. A most critical factor affecting the success of the housing program is the development of an appropriate mix of federal versus local programs which will provide the most economic and cost efficient program. This problem has been addressed in extensive detail in the Housing Chapter of the Socioeconomic Development Plan.

The goals and objectives of the Housing Program as identified in the Socioeconomic Plan are:

- * To provide decent, safe, and sanitary houses for the people of Rota and the Northern Marianas;
- * To develop houses under the homestead assistance program affordable to the residents of Rota;
- * To develop house plans that incorporate conservation features, which allow for future expansion, and still meet the criteria of decent, safe, sanitary, and inexpensive houses;
- * To provide amenities and infrastructure improvements to homestead housing sites without significantly increasing costs to prospective residents.

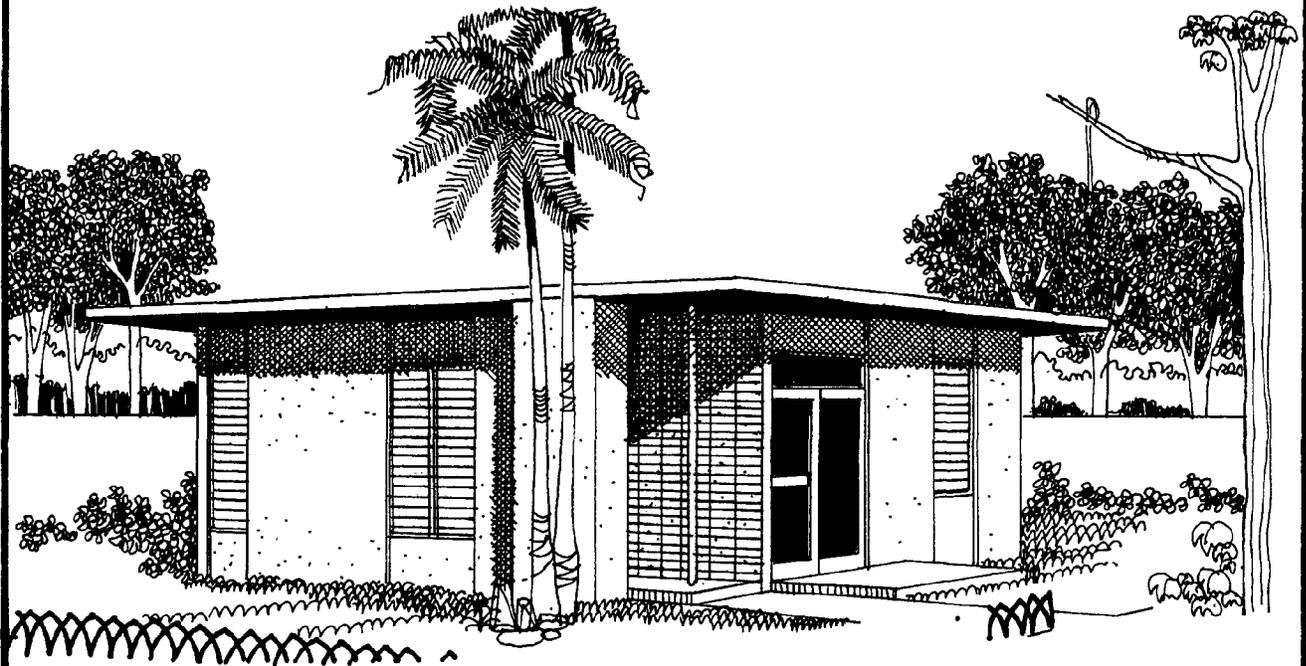
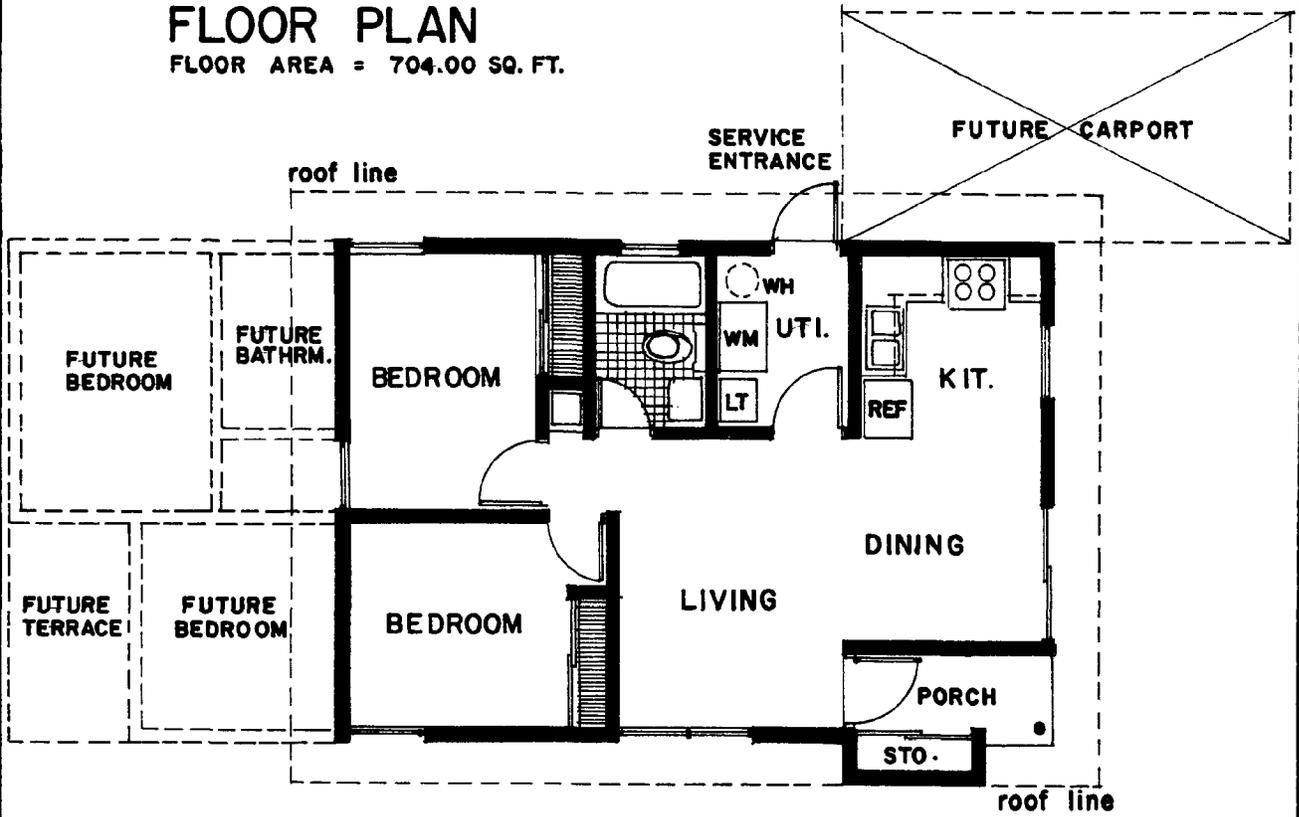
Based on the expected 1985 population, Rota will require a total housing stock of between 290 and 355 units. Eighty-three

existing units are considered to meet minimum standards. Therefore, the number of standard or additional housing units required during the seven-year plan period is projected to be between 207 and 272. It should be noted that developable lands within Songsong could provide as many as 180 additional housing units should a decision be made to accommodate future population growth within the existing village. With the addition of the Sinapalo subdivision, sufficient housing lots will be available to provide for growth well beyond the present planning horizon.

During the FY 1978-85 plan period, \$1,645,000 will be available to the Commonwealth for site design and development; a proportionate amount should be made available for Rota. In order to keep structure costs as low as possible, plans have been developed for housing which provides basic minimum living space with potential for incremental expansion as family size and income increase. Plate 13 illustrates one of two schemes developed to provide this flexibility, at an approximate cost of \$14,500. Refer to the Saipan volume - "Public Facilities" chapter - for a more extensive treatment of this scheme.

FLOOR PLAN

FLOOR AREA = 704.00 SQ. FT.



PERSPECTIVE
SCHEME 1

ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN
HOUSING
schematic

13

Pacific Planning and Design Consultants
Saipan - Commonwealth of the Northern Mariana Islands

January 1978

AGRICULTURAL FACILITIES

Throughout the seven-year plan period, allocations will be made from CIP funds to develop Rota's agricultural potential. Projects to be funded include equipment purchases, development of public grazing lands including the construction of corrals and support facilities, expansion of the slaughter house and refrigeration facilities, improvement and expansion of the irrigation system, home demonstrations of production methods, and information dissemination and advice or education in nutrition, home canning, and freezing of food. From Fiscal Year 1978 to Fiscal Year 1985, a total of \$740,000 will be expended for these projects. The funding schedule as well as the particular projects for Rota are outlined in Table 1.

Besides the \$740,000 in direct CIP funding for Rota, additional benefits will also be derived from CIP expenditures on Saipan for developing facilities serving the entire Northern Mariana Islands. The development of facilities at the Kagman Agricultural Station and the improvement of plant protection laboratories are notable among the Saipan-based projects with Marianas-wide impacts.

Expansion of Slaughterhouse and Reefer Facilities

Assuming an increase in beef and possibly swine production, improvements and renovations will be necessary for the expansion of the slaughterhouse and refrigeration facilities at West Harbor.

Public Grazing Lands

Improvements of grazing lands, corrals, and support activities for public grazing land on the Sabana are proposed for FY 1980 and 1983. It is anticipated that 600 acres can be improved into prime grazing lands. Estimated costs for this program are \$70,000. The proposed location of facilities is illustrated on Plate 9 (see page 43).

TABLE 1

SCHEDULE OF AGRICULTURAL IMPROVEMENTS

<u>YEAR</u>	<u>SCHEDULED IMPROVEMENT</u>	<u>COST</u>
FY 1978	Purchase Agricultural Machinery	\$ 40,000
	Water Resource Study	(40,000)
FY 1978	Irrigation Reservoir	(40,000)
	Exploratory Drilling and Well Development on Sabana	(135,000)
	Home Economics Program	15,000
FY 1980	Purchase Agricultural Machinery	50,000
	Improvement of Grazing Lands, Corrals, Support Activities	35,000
	Improvement and Expansion of Irrigation System	(50,000)
FY 1981	Improvement and Expansion of Irrigation System	(50,000)
FY 1982	Expansion of Refrigeration Facility	50,000
	Improvement and Expansion of Irrigation System	(50,000)
FY 1983	Purchase Agricultural Machinery	50,000
	Improvement of Grazing Lands, Corrals, Support Activities	35,000
FY 1984	Purchase Agricultural Machinery	50,000
FY 1985	Improvement and Expansion of Irrigation System	(50,000)
COST OF WATER SYSTEM IMPROVEMENTS*		(415,000)
COST OF NON-WATER AGRICULTURAL FACILITIES		<u>\$325,000</u>
TOTAL AGRICULTURAL FACILITIES		\$740,000

* Figures in parentheses are budgeted and described in water section of Public Utilities.

Irrigation Improvements

Improvements to the irrigation water system are scheduled for the seven-year plan period. These include a study of the Matanhanom resource, grading and lining of the quarry site near the airport for an irrigation water ponding basin, and improvements to the irrigation transmission lines. Because of the interrelationship between the irrigation and potable water systems, detailed descriptions of improvements are discussed with the proposed improvements to the domestic water system found in the water section of the public utilities chapter.

Exploratory well drilling and construction of facilities on the Sabana are necessary for the proposed implementation of the public grazing land program. Investigation and development of this resource are proposed during Fiscal Year 1979.

PUBLIC UTILITIES

WATER

POWER

SEWERAGE

SOLID WASTE

COMMUNICATIONS

WATER

EXISTING CONDITIONS

Potable Water

The Matanhanom water cave is the island's sole water source for domestic and irrigation needs. The reservoir in the cave is fed from springs emerging at the approximate contact of the highest limestone terraces with the volcanic subsurface. Only limited measurements of the spring flows have been taken, but they suggest the following flow parameters:

Mean Daily Flow	-	1.85 mgd (1280 gpm)
Absolute Maximum		5.39 mgd (3740 gpm)
Minimum Daily Flow		.50 mgd (350 gpm)

A small masonry dam at the cave mouth diverts water into a 12' x 12' x 12' concrete holding tank via two 6-inch pipes. Water for Songsong Village is transmitted five (5) miles from the tank in another 6-inch pipe. The system dates back to the period of Japanese occupation and is in remarkably good working condition.

Replacement of the distribution lines within Songsong has recently been initiated, and work is continuing to complete the system. The water mains consist of 4- and 6-inch lines following the routes of the major collectors in the street grid system. Plate 14 illustrates the extent of the existing water distribution system in Songsong Village.

Water is transported from the cave to the village along man-made trails that follow precipitous terrain. Five hydrostatic tanks are strategically located at high pressure points to function as overflow and pressure release valves. The condition in which these tanks would overflow has not occurred primarily because faucets in the village are oftentimes left

opened. Therefore, there has been no need to release pressure or excess water from the water distribution system.

Water treatment for potable water is accomplished by a single chlorinator installed at the point where the old Japanese pipe reaches Songsong Village. Water quality problems have not been encountered primarily because of the high quality of the water drawn from the spring.

At present there is no secondary reservoir facility in or near the village. Consequently, there is no water supply to serve the village in an emergency or during extremely dry periods.

Irrigation Water

Overflow from the masonry dam in the water cave is contained by a steel plate dam, forming a second pool within the cave. This pool serves as the source of irrigation water and distribution is accomplished through an eight-inch pipe.

Another spring, As Onan Spring, located east of Matanhanom, also provides irrigation water to the pipeline; however, the quantity of water is limited as records of this spring suggest an average flow of 0.10 mgd (70 gpm), a maximum daily flow of 0.21 mgd (150 gpm), and a minimum flow of 0.06 mgd (41 gpm).

The irrigation pipeline extends for nine miles to Ginalangan, the agricultural area near the airport. Some farms located adjacent to the waterline course are allowed to connect into the pipeline for their irrigation water needs. Presently twenty farmers have access to this water source, enabling them to produce during the dry season.

PLANNING FACTORS

Consumption and Demand

The residential hook-ups into the distribution system are not metered. Actual consumption data are therefore unavailable.

In the absence of actual data, estimates of the demand for water during the plan period have been made and are outlined in Table 2. The estimates are based on projected water demands for the 1985 population, adequate supply for fire protection, and the projected land uses for the seven-year plan period.

Residential water needs and an adequate reserve for fire fighting capability are the major determinants of future water demand. Fire protection requirements establish the reservoir capacities necessary to meet the needs of the immediate future.

Water Pressure

Low water pressure will generally not be a problem in Songsong Village. In fact, the high elevation of the water source with respect to the elevation of Songsong is such that water pressures will be excessive, especially in the low lying areas. This condition may require the installation of pressure reducers at strategic points in the distribution system.

The new MIC Hotel does, however, present a problem in that a booster pump is necessary to provide adequate pressures to boost water to the small tank providing water for the hotel. This connection of the booster pump on lines of insufficient diameter may reduce pressures in the village system. This point is further elaborated upon in the discussion of proposed improvements to the distribution system.

Reservoir Capacity

Reservoirs should have sufficient capacity to meet the following conditions:

TABLE 2

ESTIMATED WATER DEMAND BY 1985

<u>SECTOR</u>	<u>AVERAGE DAILY DEMAND (GAL)</u>	
Residential	242,000	(286,000)
Public Facilities	20,000	
Commercial and Industrial	20,000	
Resort Area	<u>10,000</u>	
TOTAL	292,000	(336,000)
MAXIMUM DAILY DEMAND:		
1.5 x Total Daily Average	438,000 GPD	(504,000)
Fire Protection		
2000 gpm for two hours	240,000	
<hr/>		
TOTAL WATER DEMAND	<u>678,500 GPD</u>	(744,000)

Note: Numbers in parentheses reflect total demands when provisions are made for possible expansion in Sinapalo.

- * Equalize the fluctuations in the demand rate during the day.
- * Provide for highest fire flow plus maximum day consumption rate for the duration of fire flow unless rate is available to the reservoir.
- * Provide for one day's maximum consumption.

In the case of Rota's system, these are minimum requirements. Due to the antiquated transmission line which serves the village, it is recommended that a tank be constructed that will provide a minimum of three day's water requirements.

Irrigation Requirements

The existing irrigation system in Rota presently provides water to irrigate approximately 20 acres of croplands. It is desired that an additional 100 acres of croplands be irrigated. The irrigation water is to be drawn from the same source, the Matanhanom water cave, which provides all the water for domestic use and most of the island's irrigation needs at this time.

The additional irrigation demand should not pose a problem if the Matanhanom water cave can meet the need. However, the present capacity of this sole water source for the island is not known. As Onan Spring does not have the flows necessary to meet the additional demand, thus the burden of the irrigation water needs will fall on the Matanhanom water cave. It is imperative then that a study be initiated as soon as possible to determine the actual carrying capacity of this water cave. Attempts to draw additional waters from the cave without careful examinations of the hydraulics of the system could jeopardize the water necessary for present domestic needs.

CAPITAL IMPROVEMENT RECOMMENDATIONS

Water Resources and Supplies

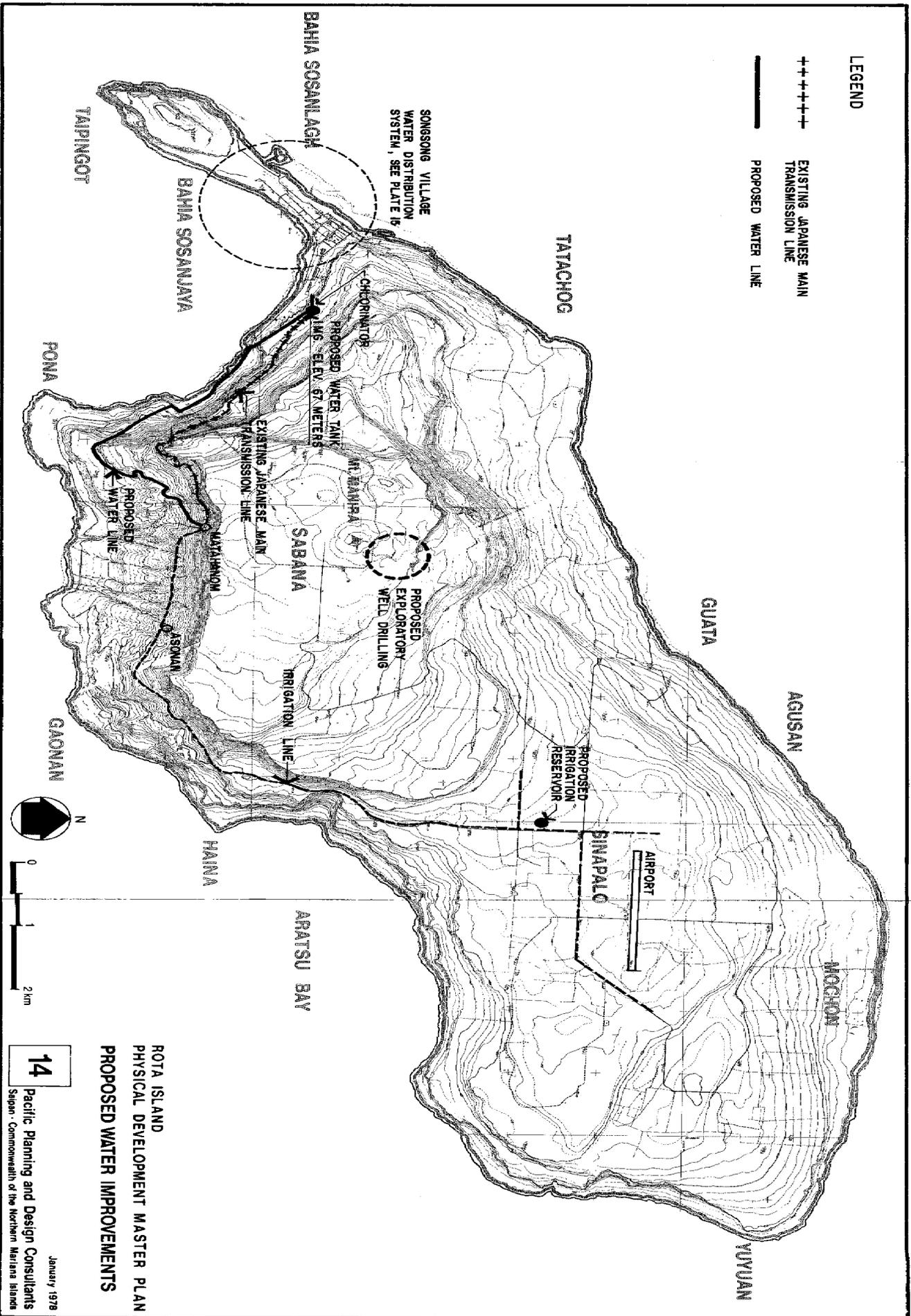
It is of utmost urgency that the study of the Matanhanom water

supply be initiated immediately. Since the study is necessitated by the desires to draw more irrigation water, the study will be funded out of Capital Improvement Funds for agricultural development. A total of \$40,000 is budgeted for the study in FY 1978. Should the study indicate an adequate supply for domestic and agricultural needs, an additional \$40,000 will be provided for the construction of an irrigation water reservoir near the airport. It is anticipated that an existing quarry site be either concrete or rubber-lined and that the irrigation line will then feed into the ponding basin.

A one-million gallon water reservoir tank is proposed to provide the village of Songsong with a supply of water for fire fighting purposes and emergency needs as well as daily needs. Ultimately, the tank would provide a supply for at least two and a half days at the demand level estimated for 1985.

The present population level indicates that at this time the tank should be capable of supplying five days of domestic consumption as well as meeting the two-hour, 2000 gpm fire fighting requirements. Estimated cost of the tank is approximately \$400,000 including costs for engineering design. It is presently scheduled for construction in FY 80; however, consideration of earlier construction should be considered if funds become available.

It is also proposed that a new distribution box be built to replace the existing holding tank at the water cave. Details of this new distribution box have not been finalized but it is anticipated that the cost will not exceed \$110,000. As the location of the distribution box will be constrained by the placement of distribution lines for domestic and irrigation needs, the construction of the box should be deferred until at least FY 1982. Plate 14 depicts the existing facilities and proposed improvements to the water system.



**ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN
PROPOSED WATER IMPROVEMENTS**

Domestic Distribution System

A new six-inch steel pipeline is proposed to replace the old concrete transmission line bringing water from the cave to the village. Cost for this line will be high--approximately \$30 per lineal foot--because of difficult rough-terrain construction conditions and the high material cost of high pressure pipelines. The line will be relocated to follow existing access roads, however, which will realize long-range maintenance savings and provide greater reliability. The five-mile line will cost approximately \$792,000.

The existing water distribution system in Songsong Village, presently undergoing improvements, will require additional expansion primarily to meet fire safety standards. The present system consists of six-inch and four-inch lines. The need for fire hydrants dictates that additional six-inch lines be installed, some to parallel the four-inch lines that are inadequate for hydrant connections. It is expected that approximately 9,200 feet of six-inch lines, various loop connectors, valves, and hydrants will be necessary. Part of the cost for new distribution lines could conceivably be funded out of MIHA and EDA funds (see Plate 15).

It is also proposed that water meters be installed at all residential, commercial, and industrial connections. The meters are necessary to reduce consumption, check against waste, and to develop a means to derive revenues to offset maintenance costs.

The need for additional treatment of the water does not seem warranted; however, the existing chlorinator should be replaced with a new one. High quality water should continue to be provided by this simple treatment procedure.

The MIC Hotel has recently installed booster pumps in order to get an adequate supply of water to meet their needs. This has

reduced the water pressures within the village primarily because of the lack of adequately sized pipelines and leakage. Improvements to the distribution system should eliminate these problems. Furthermore, the installation of the reservoir tank at the recommended elevation (67 meters) will more than adequately provide the necessary pressures. In fact, too much pressure may result, as has been noted earlier. Thus the booster pump for the hotel should not pose any further problems even with the installation of pressure reducers that may be required.

Of course a detailed study is necessary to determine the exact extent of the problem and the necessary corrective action. This study will be conducted in conjunction with the detailed engineering of the reservoir tank and the distribution system. Design is presently anticipated for FY 1978.

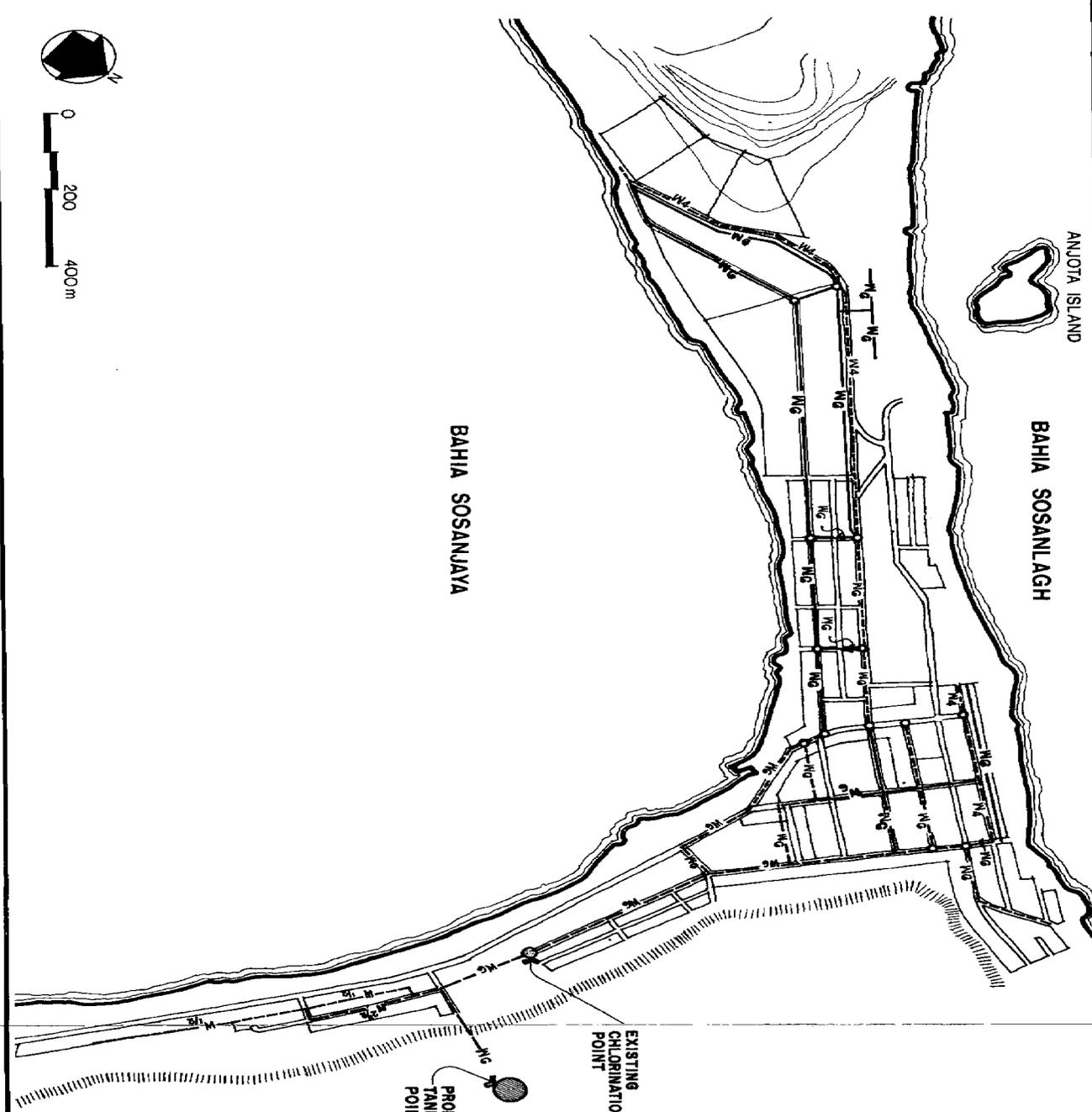
Irrigation Water

Aside from the Matanhanom water supply study and the reservoir construction in the vicinity of the airport, improvements to the existing irrigation line as well as expansion are anticipated. Approximately \$200,000 in CIP funds are budgeted for FY 1982 to FY 1985 to complete these improvements.

Additionally, \$135,000 has been allocated for exploratory drilling and well development in the Sabana region. These wells will be designed to serve the pasture lands that are to be improved for Public Grazing Lands.

Schedule of Improvements

The various improvements to the water system on Rota are phased over the seven-year plan period. Tables 3 and 4 outline the schedule of allocation to be made from CIP funds for further development of irrigation and potable water resources.



LEGEND

- EXISTING WATER LINE
- NEW WATER LINE, SUBSCRIPT INDICATES PIPE DIAMETER

ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
SONGSONG VILLAGE
 water distribution system

TABLE 3

SCHEDULE OF AGRICULTURAL WATER IMPROVEMENTS

<u>YEAR</u>	<u>SCHEDULED IMPROVEMENT</u>	<u>COST</u>	<u>TOTAL COST</u>
FY 1978	Water Cave Study	\$ 40,000	\$ 40,000
FY 1979	Agricultural Reservoir Sabana Wells	40,000 135,000	175,000
FY 1980	Irrigation Distribution Line	50,000	
FY 1981	Irrigation Distribution Line	50,000	
FY 1982	Irrigation Distribution Line	50,000	
FY 1985	Irrigation Distribution Line	50,000	200,000
FY 1978 - FY 1985 TOTAL AGRICULTURAL IMPROVEMENTS			\$415,000

TABLE 4

PROPOSED SCHEDULING OF WATER IMPROVEMENTS

<u>YEAR</u>	<u>PROPOSED IMPROVEMENT</u>	<u>COST</u>	<u>TOTAL COST</u>
1978	Water Cave Road*	\$ 50,000	\$ 50,000
1980	Million Gallon Reservoir	400,000	400,000
1981	Distribution System Design	100,000	100,000
1982	Village Distribution Improve- ments (six-inch mains, hydrants, etc.)**	100,000**	
	Transmission Line	150,000	250,000
1983	Transmission Line	350,000	350,000
1984	Transmission Line	150,000	150,000
1985	Transmission Line	242,000	
	Distribution Box	108,000	350,000
FY 1978 - 1985 TOTAL DOMESTIC IMPROVEMENTS			\$1,600,000***

* Funded out of Road Improvement Funds

** Additional funds to be derived from MIHA and EDA to complete the system

*** Excludes costs for Water Cave Road

POWER

EXISTING CONDITIONS

Generation

Power generation is presently furnished by a system consisting of two 300 KW and two 200 KW White Superior units. The system's firm capacity, defined as the capacity available when the largest unit is inoperative, is thus 700 KW. The 200 KW units have been brought on line only recently. (One of the 300 KW units is presently down for repair.)

Distribution

The existing system is a three-phase 4160 volt circuit with a minimum capacity of 720 KVA.

FUTURE CONSIDERATIONS

At present, the level of demand for power is at 320 KW. Additional loads will be felt with the completion of the Teneto Subdivision and MIC Hotel, increasing demand by 180 KW.

The airport, now under construction, will provide its own power generation facilities. In the future it is anticipated that the airport would be connected to the island system when distribution lines are extended to the airport area. The generator which will initially be installed at the airport will provide adequate power for the terminal, crash fire rescue facilities, and runway lighting and parking areas when installed. The generator is presently sized at 75 KW.

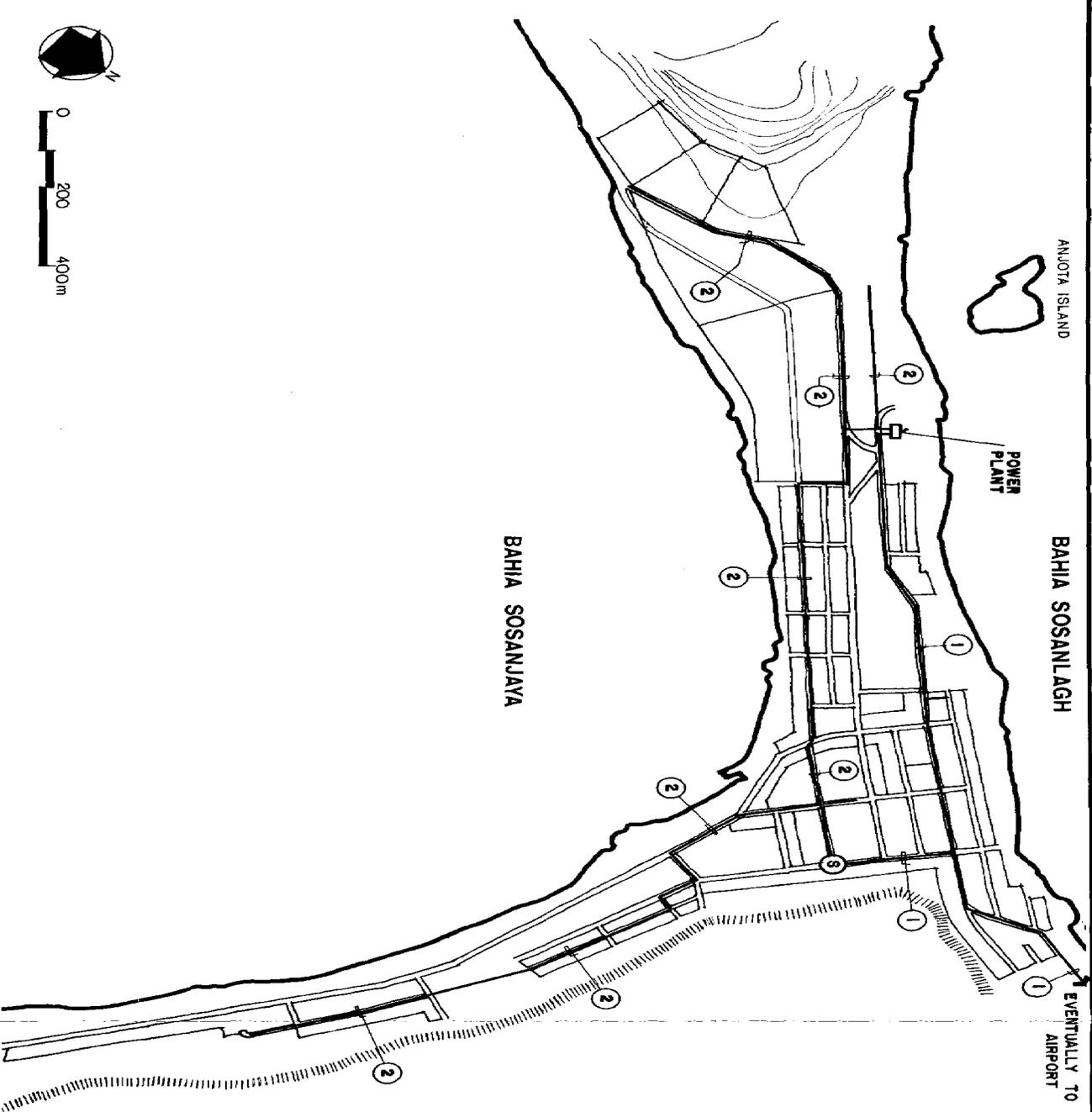
The relatively low system loads that are felt at this time imply that projections for the future will be sensitive to major changes. Any sizeable commercial or industrial construction will have a large impact on the system. Construction

activities must be monitored closely and should possibly be regulated in order to assure that load growth does not exceed power generation capability. Large power requirements for resort/hotel complexes should be assessed to determine the cost effectiveness of increasing plant size.

Given the planning, design, and construction time requirements inherent in major projects, a new power plant should be in the planning stages when the load exceeds 700 KW.

Distribution System

The proposed system shown in Plate 16 will consist of two 720 KVA circuits. There will be one circuit serving each of the areas north and south of the power plant. A tie switch between the two circuits will allow one circuit to serve the whole island, should the other circuit require maintenance or repair. A new circuit probably at 13.8 KV should be planned and built when it is anticipated that the airport is to be served by the system.



LEGEND

- ① CIRCUIT No. 1 720 KVA
- ② CIRCUIT No. 2 720 KVA
- ③ SWITCH

**ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
 SONGSONG VILLAGE
 power distribution - main circuits**

SEWERAGE

Sanitary sewerage facilities in Rota are quite limited and are predominantly located in Songsong Village. Less than 25% of the residences in the village currently have flush toilets, and they use cesspools for sewage disposal. The majority of the villagers continue to use outdoor privies for disposal of toilet wastes and surface discharge for kitchen wastes--an unsanitary practice posing a serious health menace to both residents and visitors to Rota.

PLANNING FACTORS

The 1972 Master Plan addressed Rota's sewerage system needs and recommended the construction of public sewage collection, treatment, and disposal facilities. While a part of their recommendations are still technically valid, certain planning factors and specific elements of the scheme of improvements must be reconsidered and revised as appropriate to reflect new land use and physical development requirements and constraints. It is emphasized that the detailed Northern Marianas-wide Sewer Facilities Planning effort, now in progress, will study Rota's sewerage needs and identify required improvements. This Facilities Plan is being prepared under the regulatory authority of the Federal Environmental Protection Agency and under the direct supervision of the GNMI Department of Public Works.

Sewage Flows

The population of Songsong Village is projected to increase from its present-day 1,300 people to a maximum of 2,200 by the end of the plan period. Limited commercial, industrial, and resort development on the Taipinot Peninsula is also anticipated to occur during the next five to ten years. The new Sinapalo subdivision is proposed for development adjacent to

the Airport complex. Table 5 presents the estimated ultimate average daily sewage flows projected to occur by the conclusion of the plan period and beyond.

Residential flows are computed on the basis of a generation criterion of 80 gallons per capita per day, including allowances for groundwater infiltration, while commercial, industrial, and resort development flows are based upon a realistic assessment of the nature and extent of proposed facilities. Waste flows from schools include an allowance for cafeterias, but not for gymnasiums with showers. Average daily waste flows anticipated to be reached for a 20-year design period for the village of Songsong and adjacent areas are estimated at 220,600 gallons per day (gpd), while the combined flow for the airport and the proposed new subdivision is estimated at 40,000 gpd.

These flow estimates are based on optimistic projections of the progress of development during the plan period and beyond. It must be understood, however, that the standard of living in Rota must be significantly upgraded for actual flows to approach estimated values. For this to happen, the water distribution system must be improved and adequate plumbing and flush toilets installed in every residence.

Interim Sewerage System

Before considering the planning, design, and construction of an integrated public sewerage system for Rota, the existing standard of living must be realistically evaluated and provisions established for interim sanitary facilities. It must be acknowledged that the construction of collector lines, a treatment plant, and outfall, as the 1972 Master Plan recommended, is perhaps inappropriate at this time given the fact that only a few residences are prepared to be served.

With the exception of certain isolated areas, Songsong Village is underlain by sandy soils which exhibit good to excellent

TABLE 5

ESTIMATED ULTIMATE AVERAGE DAILY SEWAGE FLOWS

Area/Land Use	Unit	Flow Generation Per Unit (GPD)	No. of Units	Average Flows (GPD)
I. Tanpingot Peninsula & Songsong Village				
A. Residential	Residents	80	2,200	176,000
B. Educational w/Cafeteria	Students	20	780	15,600
C. Medical	Beds	250	12	3,000
D. Commercial	2 Acres	Estimated	-	4,000
E. Industrial	15 Acres	Estimated	-	16,000
F. Resort/Hotel	Rooms	60	100	6,000
				<hr/> 220,600
II. New Village				
A. Residential	Residents	80	400	32,000
B. Commercial				3,000
III. Airport Facilities				
		Estimated	-	5,000
				<hr/> 40,000

percolation characteristics. It is reasonable to assume that properly designed and installed individual cesspools or septic tank and leaching fields will be able to function effectively for a minimum of five years as a sanitary means of sewage disposal for single family resident units. Cesspools would not be able to accommodate large waste flows expected from hotels as well as industrial and commercial establishments classified as heavy water users (such as schools, slaughterhouses, laundromats, etc.). Appropriately sized septic tanks and leaching fields will be required for facilities with relatively large estimated sewage flows.

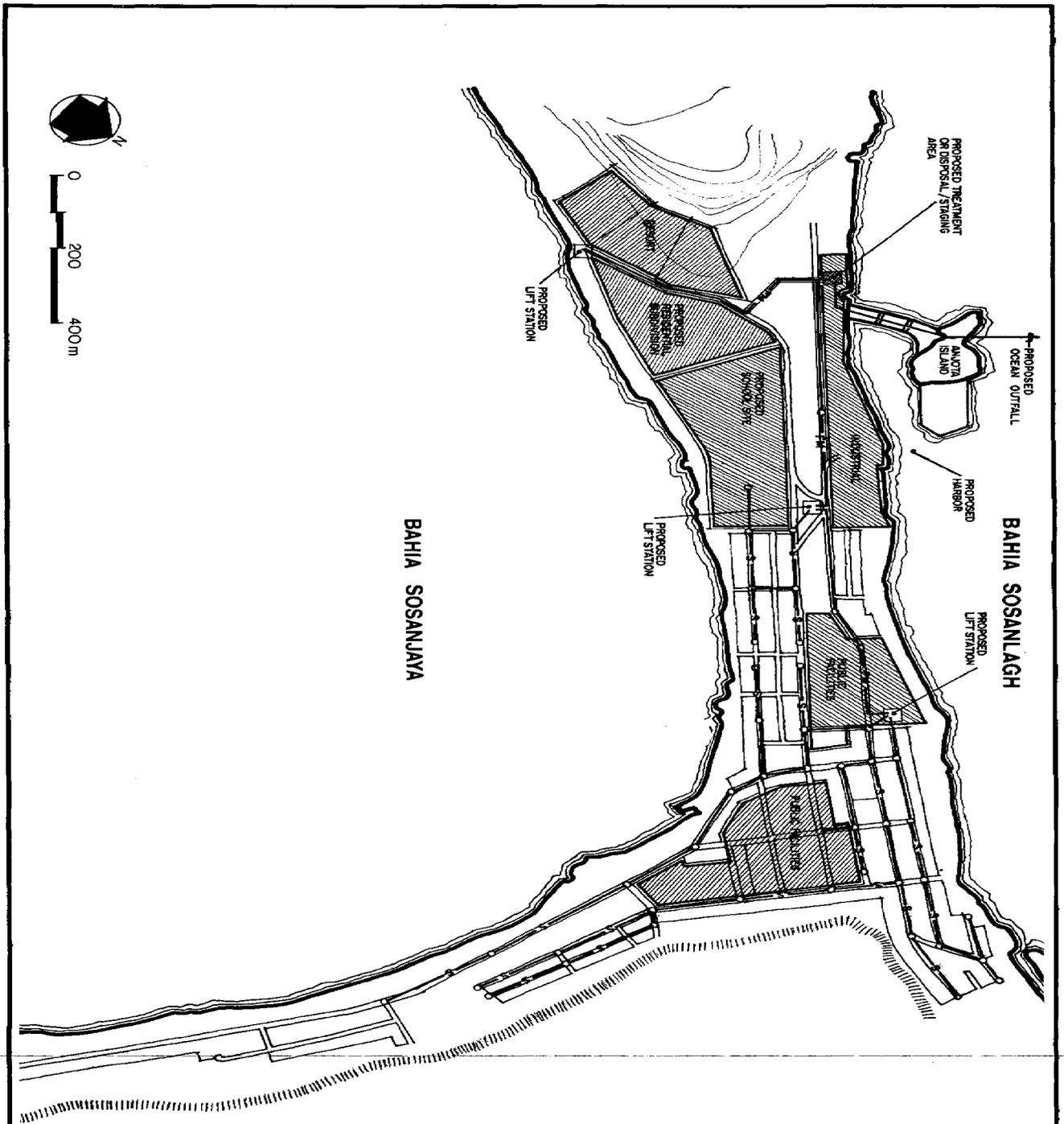
Collection System

As Rota experiences favorable economic growth and the standard of living is upgraded in the process, a public sewage collection system for the peninsula will be required. The collection system layout for the village as recommended in the previous Master Plan is technically sound and is presented with minor modifications in Plate 17. At least two pumping or ejector stations will be required to collect and convey sewage from the village to a suitable treatment or disposal staging area.

A separate system, including a lift station, will be required to collect and convey sewage from the resort and proposed residential area situated on the southern half of the peninsula, overlooking Sosanjaya Bay, to the disposal staging area.

Treatment and Disposal Alternatives

The question of the degree of treatment and manner of ultimate sewage disposal from Songsong Village (as well as other facilities existing or proposed for development on the Taipingot Peninsula) must be comparatively analyzed with respect to construction cost, operation and maintenance costs, and overall environmental impact. The Sewer Facilities Plan will presumably include a detailed evaluation of treatment and disposal alternatives.



LEGEND

-  LIFT STATION
-  COLLECTOR LINE
-  FORCE MAIN
-  SEWER MANHOLE
-  TREATMENT/DISPOSAL STAGING AREA

ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
 SONGSONG VILLAGE
 sewer collection system

Analysis and selection among system alternatives should provide for the character and scale of development anticipated for Rota and should avoid overdesign based on the application of inappropriate criteria. Previous Trust Territory experience with Federal and EPA criteria has occasionally indicated blind application of planning, design, and construction standards. Sophisticated primary and secondary treatment facilities costing millions of dollars are ineffective when turned over to ill-equipped, untrained local government personnel for operation and maintenance.

Furthermore, because of the typically low standard of living in the islands, treatment plants often become inherently inoperable because of insufficient minimum sewage flows. This situation could easily occur in Rota where the developing economy is fragile, logistics difficult, and power costs high. Treatment and disposal facilities must be thoroughly justified and be constructed so as to require minimum maintenance.

Because of the relatively small sewage flows expected from the peninsula, it is felt that sewage treatment may not be necessary and that a deep ocean discharge of raw sewage is a potentially sound disposal alternative. Limited current studies conducted in the vicinity of the mouth of West Harbor showed that current movements are away from the Island.

RECOMMENDATIONS

Emphasis on development of cesspools and individual and group septic systems is recommended during the plan period. As densities increase and sufficient sewage loads warrant additional facilities, a public collection and disposal system should be implemented. Deep ocean discharge of raw sewage may be possible and should be considered as an alternative in the Sewer Facilities Plan.

SOLID WASTE

EXISTING CONDITIONS

The present method of solid waste disposal for Rota is through open dumping at a site approximately two miles north of the village of Songsong. During field observations of the site in March and April 1977, piles of unburied refuse were evident. In most cases, the refuse had been bulldozed into piles on the periphery of the dump area. It would seem only logical that some method be implemented to keep the site from becoming a health hazard.

There is no danger in retaining the present site for solid waste disposal, although the site is not optimal in that it is generally flat land and the soil available to cover refuse is fine to coarse aeolian beach sands. These conditions can lead to water percolation through the community's waste. The relative safety of retaining the site stems from the fact that groundwater movement from the basal lens underlying the site does not feed into the island's water supply. Rather, the site's location near the ocean suggests that groundwater flows seaward.

The dumpsite would, however, provide a breeding area for mosquitoes, flies, and rodents that might carry diseases. Thus, there is a need to prohibit further practices of open disposal.

PLANNING FACTORS

Although no information was available on the amount of household refuse produced on Rota, we can assume that the amounts of refuse would be no greater than that produced on Guam, perhaps as much as 3.9 pounds per capita daily. This is felt to be a conservative estimate as it is doubtful that the people of Rota

produce as much refuse, especially since food and garden waste is most likely used as feed for poultry and swine.

These weights in turn relate to a per capita yearly rate of 1,420 lbs. Assuming a compacted volume of 1,000 lbs per cubic yard, 1.4 cubic yards per year on a per capita basis will be generated on Rota. The present population, assuming 1,300 persons, would therefore produce 1,850,550 lbs per year or require a spatial volume of approximately 1,850 cubic yards to dispose of waste generated in 1978.

Population projections for Rota indicate a range of between 2,100 and 2,600 by 1990. In the thirteen years between 1978 and 1990, approximately 32,578,700 lbs of solid waste will have accumulated as shown in Table 6. Assuming compacted refuse equals approximately 1,000 lbs/cu.yd., the island of Rota will need a refuse area capable of handling 32,578 cubic yards of material.

RECOMMENDATIONS

The small size of Rota's community and the small magnitude of the solid waste problem require adequate yet cost effective recommendations. Waste collection by private enterprise would reduce costs for the government; however, it is doubtful that such a system could be implemented unless a law mandating private collection were to be established. The feasibility of purchasing specialized equipment for solid waste collection and disposal such as a packer truck or a specially equipped bulldozer that would only be sparingly used for their intended purposes must be questioned.

Still, it must be recognized that the present condition of the dump site and the poorly maintained access road result in indiscriminate disposal within the dump site. Oftentimes, refuse is left along the road leading to the site. Although

TABLE 6

SOLID WASTE GENERATION ON ROTA
1978-1990

<u>YEAR</u>	<u>POPULATION</u>	<u>REFUSE IN THOUSANDS OF POUNDS (000's)</u>	<u>REFUSE IN CUBIC YARDS</u>
1978	1300	1,850	1,850
1979	1378	1,961	1,961
1980	1460	2,079	2,079
1981	1547	2,203	2,203
1982	1639	2,333	2,333
1983	1738	2,472	2,472
1984	1842	2,622	2,622
1985	1952	2,779	2,779
1986	2069	2,945	2,945
1987	2193	3,121	3,121
1988	2324	3,309	3,309
1989	2463	3,506	3,506
1990	2610	<u>3,715</u>	<u>3,715</u>
CUMULATIVE TOTALS 1978-1990		32,578	32,578

Note: For illustration purposes, 32,578 cubic yards equals a pile of refuse one hectare in size and 10 feet high

the development of a new sanitary landfill will be required during the plan period, several practices could and should be implemented during the interim period to improve present conditions. These practices include:

- * The commissioning of Department of Agriculture's bulldozer weekly to properly prepare, cover, and pack waste at the dump site.
- * Improving and proper maintenance to the access road into the site.
- * The implementation of once a week collection utilizing Public Works crews and a dump truck. Given the limited number of collection points in the village, it is assumed that the entire village could be collected in an 8-hour day.

For the longer range planning horizon an alternate dump site must be developed. Due to the relatively small amount of waste material that will be generated, a sanitary landfill will still be the most efficient and economical method of solid waste disposal.

The Capital Improvement Program provides \$80,000 in 1984 for the development of a sanitary landfill and the purchase of equipment. Present sanitation practices suggest that a collection system should be implemented. However, a suitable alternative could be the establishment of collection sites within the village to be periodically cleaned and maintained by Public Works. The cost of an 8-yard packer truck is presently about \$25,000. The alternative collection sites within the village could be implemented at approximately the same cost.

COMMUNICATIONS

EXISTING CONDITIONS

Telephone, inter-island radio, and mail service form the basic communications system for the Northern Mariana Islands. Presently, telephone service is restricted to Saipan. In Rota inter-island communications are furnished by short-wave and general broadcasting radio systems supplementing U.S. Mail delivery. The Pacific Daily News, a daily newspaper published on Guam, receives widespread distribution in the Northern Marianas. Two weekly papers are also published on Saipan and are distributed on Rota. Generally, communications to and from the neighboring islands are and will continue to be handled outside of the Northern Marianas' government.

Telephone Services

The telephone system, operated by GNMI through the end of FY 1976, has been leased to Micronesian Telecommunications Corporation (MTC) for a ten-year period, with options to renew the lease for two five-year periods. Overseas telephone and cable service had been provided by RCA Global Communications which leased five circuits from the Trust Territory Government's communication link with Guam. The lease was terminated in early 1977, and all franchises for telecommunication "to, from, and within the Northern Mariana Islands" are now provided by MTC.

Radio Service

The GNMI operates a single side band voice radio system for a quick and direct contact between the Office of the Resident Commissioner and his representatives on Tinian and Rota. Additional small HF transceiver radios are stationed on each of the inhabited northern islands. In all cases, island-to-island contact and clarity of reception are dependent upon skip and

propagation conditions so that radio communication is not frequently disrupted. The system is reserved for official governmental communications. Private individuals or businesses must rely upon letter or word-of-mouth communication between and among the islands of Saipan, Tinian, and Rota, although in the event of emergencies the government facilities are often utilized.

Popular radio broadcasting stations also provide a means for inter-island communications disseminating news, programs of local interest, music, and other entertainment. Guam broadcasts may also be received on Rota.

Mail Service

Mail service in the Northern Marianas is provided by the U.S. Postal Service. A main post office is located in Chalan Kanoa, with substations on Capitol Hill at the Trust Territory Headquarters, Rota, and Tinian. Mail is carried by Continental Air Micronesia. Pouch service packages and mail are often carried by the Air-Charters.

FUTURE EXPANSION

Expansion of telecommunications in the Northern Marianas will focus on telephone services. On-island telephone service as well as inter-island telephone contact are planned for Rota. As originally proposed by MTC, a fully automatic ECON PAB-X system will be provided to accommodate a minimum of 25 subscribers including two pay phones for public use. Recent surveys indicate a need for facilities to handle up to 60 subscribers.

Telephone operator consoles will be installed as the need arises. Saipan operators will be utilized in the interim for calls to Saipan. Access to the Guam GTA and RCA Global will

also be provided by Saipan operators for calls to Guam, Tinian, and for overseas calls.

Preliminary engineering analysis suggests the utilization of Microwave facilities located atop Mt. Manira which would receive direct signals from Saipan. A relay transmitter is required on the ledge overlooking the village. The receiver and transmitter station is presently proposed to be located at the Rota Hospital. Units on the Sabana will be powered by battery packs or solar cells and will require minimal maintenance and space requirements.

Plans for expansion were originally outlined as part of the MTC proposal submitted during competition for the telecommunications franchise in the Northern Marianas. Original plans proposed telephone service for Rota during 1977. However, the timetable for system implementation is being revised and service is not anticipated until late 1978.

TRANSPORTATION

AIR

WATER

HIGHWAYS

AIR TRANSPORTATION

Air transportation is the principal mode of travel to and from the island of Rota. Island residents are highly dependent upon air transportation for perishable foods, medical supplies, and many durable goods. Consequently, there is a high priority placed on safe and reliable air transportation and efficient airport facilities.

The institutional structure for air transport development in the Northern Marianas is already established. A Mariana Islands Airport Authority (MIAA) was created by the Congress of Micronesia in April 1975 and is a public corporation which bears full responsibility for the development and operation of airports in the Northern Marianas. It is self supporting, deriving revenues from enplaned passenger fees and aircraft landing fees, and from rentals of airport properties. In addition, it has the authority to issue revenue bonds for construction or repair of airports. The Authority is an independent agency, functioning completely outside the budget and administrative structure of the Government of the Northern Mariana Islands.

An Airport Systems Plan has been prepared for the Trust Territory Department of Transportation and, to a large extent, MIAA is shaping its airport development program in accordance with the plan.

Financing for the development of Rota Airport to and beyond minimum standards necessary for FAA airport certification will be made possibly by FAA automatic and discretionary grants, with local matching funds provided from MIAA revenues. It is not anticipated that regular CIP funds of the Northern Marianas will be required for program financing.

The already allocated funds of \$3-1/2 million will provide Rota with an airport meeting FAA standards by 1978.

PLANNING FACTORS

Rota airfield is located on the Sinapalo Plateau, approximately 11 miles from Songsong Village. The airfield was constructed prior to World War II by the Japanese. The existing runway is approximately 5,200 feet long and 200 feet wide. It has only a compacted coral surface and requires frequent maintenance.

Rota is served by only one scheduled commercial carrier, Continental-Air Micronesia, five times a week with cargo service being the prime interest and passenger service secondary. The carrier has indicated that it does not plan to initiate night flights to Rota in the foreseeable future.

Air passenger service is largely accomplished by small air-taxi operators such as Island Air, Aviation Services, and Foxair. Because of its relatively frequent and regular service, this type of transportation will remain a significant factor in the movement of air passengers in the future. That air-taxis may provide night flights to Rota is a further indication of the significance they will play in Rota's air transport system.

Presently, aircraft serving Rota include three Cessna aircrafts including the 8-passenger Cessna 402, the Cessna 174, and a Skymaster twin engine (push pull). A wide range of aircraft are available in today's market which can serve various types of route structures and airports. Costs can vary widely for each available cargo pound mile or available passenger mile produced. Generally, the more highly specialized and smaller the aircraft, the more expensive it is to operate on a per available passenger mile basis. To illustrate, a broad

comparison of various aircraft average passenger cost per mile is shown in Table 7.

It can be readily seen that costs per available seat mile decrease as the size and efficiency of the aircraft increase. However, these figures must be matched with demand to determine load factors conducive to economical air service. If there are no passengers to fill the aircraft, costs quickly soar.

With the wide range of aircraft available to the air-taxi industry, and the unique transportation requirements of the Marianas, the air-taxi industry will become stronger and larger, and be an important user of airport facilities.

Air Traffic Forecasts

The air traffic forecasts used in this report are those developed in the Trust Territory Airport System Plan report. Projections of air passenger traffic and cargo/mail volumes were used to derive aircraft operations needed to handle these forecasts. Aircraft operations are broken down into air carrier-passenger, air carrier-all cargo, air taxi, general aviation, and military operations. Peak hour forecasts are also included. The forecasting methodology considers historical visitor arrival statistics, the economic profile, and the political aspects of the whole of Micronesia.

Table 8 summarizes air traffic for the 1980, 1985, and 1995 planning horizons. This forecast may be subject to some dispute but remains useful as a planning tool. It is significant that the forecast indicates a need for only minimum facility construction. Once accomplished, a level of usage higher than that projected could be accommodated without significant facility addition.

PROPOSED AIRPORT IMPROVEMENTS

The immediate objective of the Mariana Islands Airport Authority is to attain and retain air carrier certification for its

TABLE 7

AIRCRAFT TYPES AND COSTS

<u>AIRCRAFT</u>	<u>COST PER AVAILABLE PASSENGER MILE</u>
Helicopter (4 passengers)	70 ¢
Seaplanes (9 passengers)	19 ¢ (1975 cost)*
Brittain Norman Islander (9 passengers)	6.93 ¢ (1975 cost)*
Norman Tri-Islander (17 passengers)	5.39 ¢ (1975 cost)*
De Havilland Twin Otter (20 passengers)	5.25 ¢ (1975 cost)*

* Based on high utilization rate

TABLE 8

SUMMARY OF AIR TRAFFIC FORECASTS, ROTA INTERNATIONAL AIRPORT
1980-1995

YEAR	AIR PASSENGER MOVEMENTS (ENP & DEP)	TOTAL ARRIVING CARGO/MAIL VOLUME (000 POUNDS)	ANNUAL AIRCRAFT OPERATIONS					TOTAL
			AIR CARRIER PASSENGER AIRCRAFT	AIR CARRIER ALL CARGO AIRCRAFT	AIR TAXI	GENERAL AVIATION	MILITARY	
1980	17,808	2,236	1,146	208	3,320	100	32	4,826
1985	28,318	3,696	1,506	208	5,510	200	52	7,476
1995	46,484	8,183	2,274	624	8,500	400	52	11,850
<u>Peak Hour Operations:</u>								
1980				2	3	1	--	6
1985				2	4	1	--	7
1995				3	6	1	--	10

existing air carrier airports in accordance with the FAA safety and operational standards, Federal Aviation Regulations, Part 139. This is planned to be accomplished by January 1978, when the Northern Mariana Islands assume commonwealth status.

The needs of the Northern Mariana Islands for airport improvements are limited to items essential to enhance the safety and operational efficiency of those critical aircraft governing the maximum requirements. Several basic improvements for Rota are immediate. These include:

- * Obstruction removal for approach and transitional surfaces; site preparation, including clearing, grubbing, and grading; laying runway pavements and blast pads, connecting taxiways and aprons, including taxiway shoulders; installing a wind-cone/segmented circle; installing perimeter safety and personnel security fencing; constructing an airport access road; and constructing a crash/fire rescue building. These requirements are included in ADAP Project No. 6-75-0003-01 funded in fiscal year 1977.

- * Construct new terminal and electric generator buildings and vehicle parking lots. These facilities have been funded by the U.S. Economic Development Administration Local Public Works Program in fiscal year 1977.

The following improvements are targeted for 1984 and beyond:

- * Install runway and taxiway lighting, including navigational aids.

Airport Development Costs

The following Table 9 shows the estimated cost of each improvement, together with the suggested funding source. Cost for the Fiscal Year 1977 improvements are exact since these projects have already been advertised and bids have been received. Other costs are not as precise and should be considered

TABLE 9

AIRPORT DEVELOPMENT COSTS, ROTA INTERNATIONAL AIRPORT
 Cost and Source (\$1,000)

<u>FISCAL YEAR</u>	<u>ACTUAL PROJECTS</u>	<u>FAA</u>	<u>MIAA</u>	<u>OTHERS³</u>	<u>TOTAL</u>
1977	Strengthen existing runway, pave runway (6000' x 150'), taxiway and apron, approach aids, access road, timing, CFR building ¹	2,348.3	260.9	-	2,609.2
1977	Terminal building, electric generator building, auto parking lot ²	-	-	582.4	582.4
	Sub Totals	2,348.3	260.9	582.4	3,491.6
	<u>Potential Projects</u>				
1984 & Beyond	Runway and taxiway lighting, nav aids	340.0	85.0	-	425.0
	Sub Totals	340.0	85.0	-	425.0
	Totals	2,688.3	345.9	582.4	3,616.6

1. Project which had been recently bid; figures indicate grant amounts
2. Project currently under design; figures indicate application amounts which have been informally approved by EDA
3. EDA Funds

accurate only in the order of magnitude. The estimates provide for engineering, administration, and contingency costs.

Fund sources include the Federal Aviation Administration (FAA), Economic Development Administration (EDA), and Mariana Islands Airport Authority (MIAA). It is assumed that MIAA will actively seek maximum federal funding of eligible projects.

WATER TRANSPORTATION

EXISTING CONDITIONS

The poorly developed harbors on Rota are a severe constraint to the economic development of the island, and the need for upgraded port facilities is a strong issue with the people of Rota. Presently, there are two harbor areas on Rota, both located on the narrow isthmus of Taipingot Peninsula; one to the northwest side of it, the other to the southeast side. West Harbor is the larger of the two and is currently used as the commercial port. East Harbor is used primarily for small craft.

West Harbor has an area of roughly 50,000 square feet. Its existing dock was originally 200 feet long, but storm action and lack of maintenance have eroded this Japanese-built facility to approximately 140 feet.

The entrance channel extends across 1,000 feet of partially exposed fringing reef. The channel has been excavated by blasting and piece-meal dredging since World War II. The harbor channel entrance has a controlling depth of 9 feet. The narrow entrance channel combined with the prevailing crosswinds and variable currents preclude navigation except for motor boats and other small craft. The turning basin diameter of 200 feet also imposes a severe limitation on the size of vessels that can enter and use the harbor.

Cargo must therefore be transferred from sea-going vessels to the dock by shallow draft lighters. When high seas prevent entry through the reef fronting this harbor, the cargo is brought around to the East Harbor.

Other than a light shining from the wharf on the southeast shore of Sosanlagho Bay when cargo is being handled at night

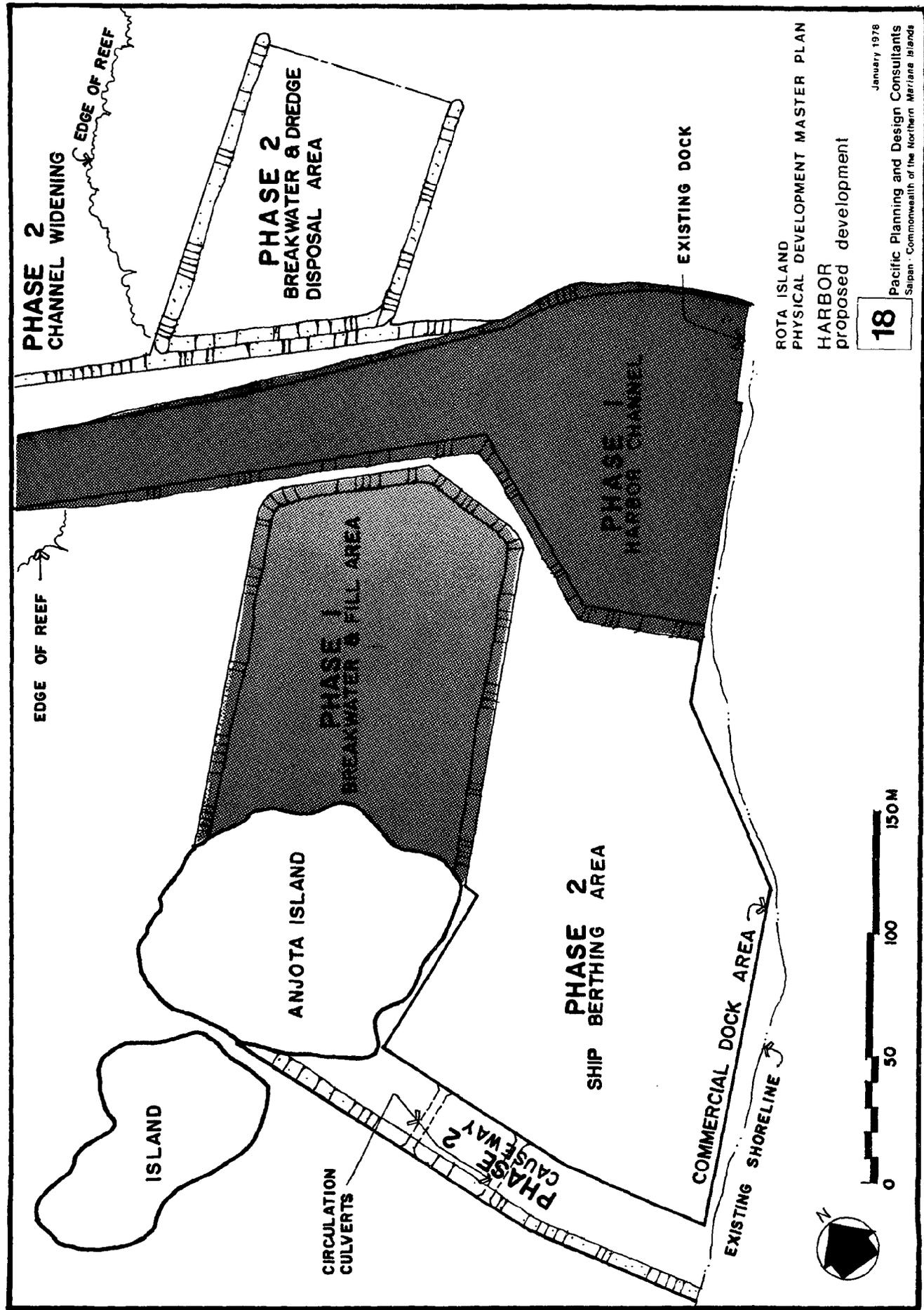
and unlighted channel markers on the edge of the reef, no other navigational aids have been provided for the harbor. These deficiencies court disaster in the movement of cargo.

During Typhoon Pamela in May 1976, East Harbor sustained certain damages which made the port eligible for compensation under the Federal Disaster Assistance Act. However, rather than request an FDAA Grant-in-Aid for East Harbor reconstruction, the GNMI has chosen to apply for a "Grant-in-Lieu" to use as the initial funding for improvements to West Harbor. It is the intention of the GNMI to develop West Harbor as Rota's major port facility and to phase out the use of East Harbor.

Table 10 lists the vessels which presently call at the port of Rota. It should be noted that these vessels are fairly small and of shallow draft. In fact, about seven vessels in addition to tugs and barges and new vessels being acquired have drafts of less than 13.0 feet. Since shipments to and from Rota are only a few hundred tons, it is assumed that the smaller vessels would continue to be used for some time. Therefore, the channel and turning basin dimensions should be selected accordingly. A 150-foot channel with a 15-foot depth appears quite adequate if not desirable.

RECOMMENDATIONS

The ultimate improvement plan for West Harbor (Plate 18) features the construction of a 150-foot wide entrance channel dredged to -20 feet; a 420' x 500' ship turning basin and dock and berthing areas on the leeward side of Anjota Island, dredged to -16.5 feet; a rip rap breakwater located west of the harbor channel enclosing an area of approximately 150,000 square feet, filled to +10 feet to provide a location for harbor support facilities as well as related recreational uses; another rip rap breakwater enclosing an area of about 80,000 square feet located northeast of the harbor entrance channel; and an



ROTA ISLAND
 PHYSICAL DEVELOPMENT MASTER PLAN
 HARBOR
 proposed development

January 1978
 Pacific Planning and Design Consultants
 Saipan - Commonwealth of the Northern Mariana Islands

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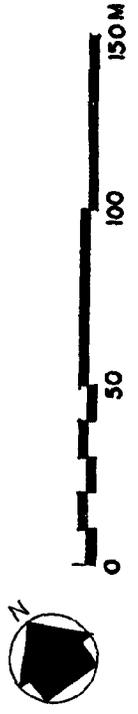


TABLE 10

VESSELS EXPECTED TO CALL AT ROTA PORT*

<u>NAME OF VESSEL</u>	<u>LENGTH (FEET)</u>	<u>BREADTH (FEET)</u>	<u>DEPTH (FEET)</u>	<u>DRAFT (FEET)</u>
Marshall Islands	185.00	33.00	11.00	<u>1/</u>
Kaselehlia	131.23	28.00	11.00	10.10
Truk Islander	111.02	22.31	9.84	8.88
Yap Islander	111.02	22.31	9.84	8.88
Tinian II	40.00	12.00	6.00	<u>1/</u>
Olwal	72.41	15.60	7.60	<u>1/</u>
Normar II	122.00	23.00	10.40	9.20
New Field Trip Vessels	185.00	33.00	15.00	11.00
Mapship/Dillingham Barge	175.00	45.00	--	4.00
Tugboat (Barge Escort)	75.00	25.00	--	13.00

1/ Information not published.

* Data revised in accordance with the American Bureau of Shipping Record Book, 1977.

80-foot wide rip rap causeway extending from shore to Anjota Island with tidal circulation culverts provided (see Plate 16).

Phase 1 improvements reflect the minimum improvements which will result in a complete and useable harbor facility. They include the construction of a 100-foot wide entrance channel dredged to -20 feet at the harbor mouth and -16.5 feet MSL elsewhere; the construction of the ship turning basin seaward of the existing dock, dredged to -16.5 feet MSL; and the construction of the West Breakwater. Phase 1 improvements rely on the continued use of the existing dock. The improvements will allow barge traffic and field trip vessels to dock and unload directly rather than via lighter cargo vessels.

The estimated total cost of the Harbor's ultimate design is \$4.6 million, of which only \$1.7 million is anticipated to be expended within the plan period. Phase 1 of the harbor improvements, to be initiated in FY 1978 and funded through the FDAA grant and local funds, will total approximately \$1.21 million. The recent bid will require reprogramming of funds for the high school and other CIP projects.

An additional \$400,000 is programmed for FY 1981 and is proposed for construction and renovation of a 200-foot medium depth docking facility. The remaining \$200,000 programmed for FY 1982 is expected to fund the construction of a one-acre container yard, small boat launching facilities, and related shore facilities. It is anticipated that these facilities geared toward the needs of smaller craft will consequently serve the needs of sport fishermen and the related tourist-oriented activities.

The total of \$1.1 million in local resources and \$544,000 in FDAA grant monies, coupled with possibly additional assistance from the U.S. Corps of Engineers, will make possible the development of an adequate harbor, dock, and shore facility for Rota by 1983.

HIGHWAYS

The existing roadway system on Rota contains approximately 65 miles of roads dating from the Japanese occupation. Most have unpaved surfaces and receive minimal maintenance. Presently on Rota there are 180 motor vehicles registered of which approximately 85 percent are private and 15 percent government-owned vehicles. The number of privately-owned vehicles has grown rapidly over the last decade. Projections to the year 1985 indicate that the number of vehicles will increase by at least 30% to 228 vehicles. If growth trends follow those of Guam, the number of vehicles could double.

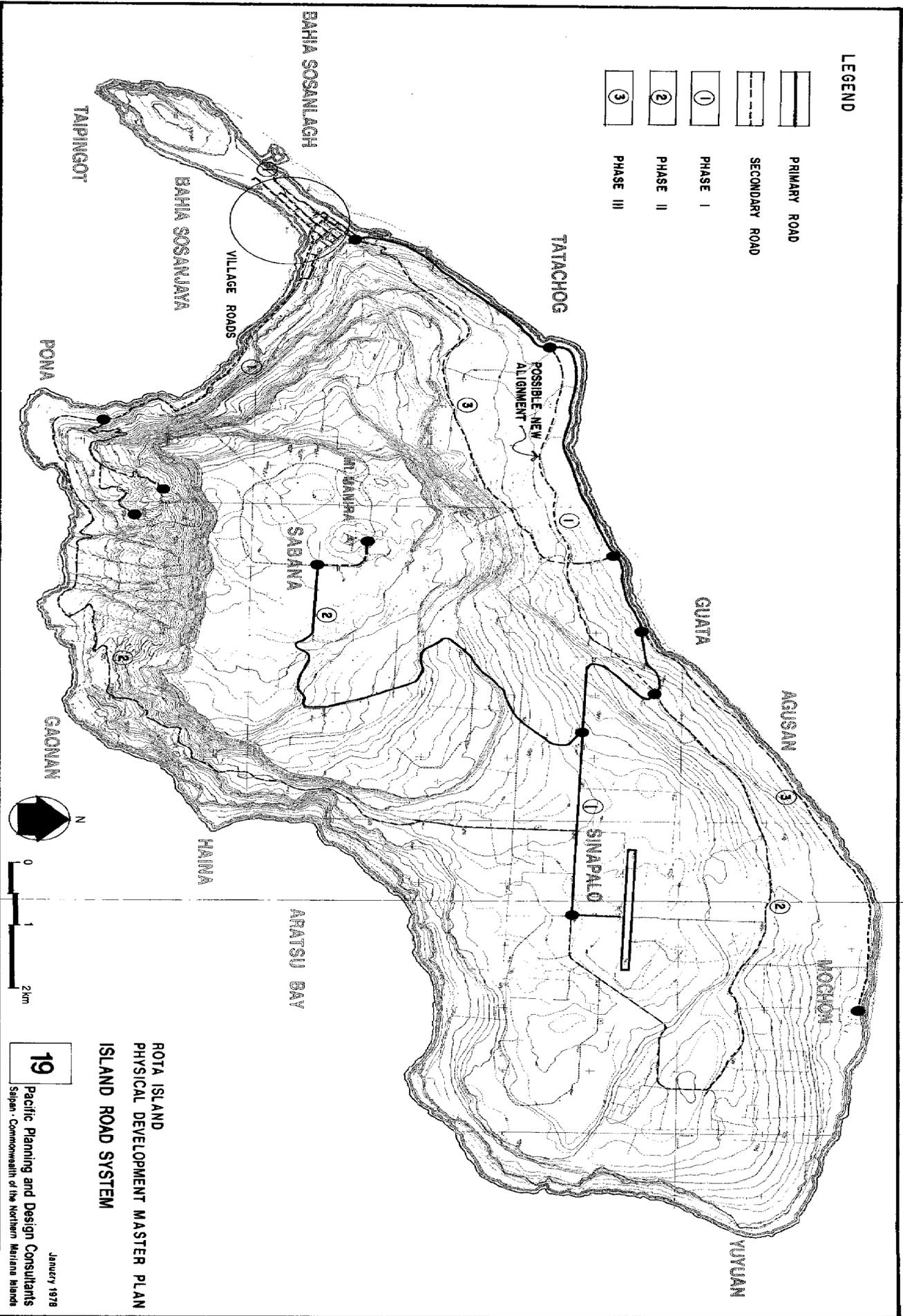
PROPOSED ROAD IMPROVEMENT PROGRAM

Between FY 1978 and FY 1985 a Road Improvement Program will be initiated. Its objective is to upgrade the road system to accommodate the expanding economic activity and evolving physical development of the island of Rota.

Road construction and reconstruction projects will be funded under the Capital Improvements Program. Whenever possible, matching funds should be obtained from the U.S. Federal Highway Act. The availability of Federal funds is limited to road improvement projects involving primary and secondary roadways. Funds are provided on a 70/30 Federal-local matching basis.

Construction and improvements of village and rural/scenic roads are ineligible for Federal Highway Act funding and must be financed from the CIP monies provided by the Covenant and the internal resources of the Northern Marianas.

The ultimate road system prepared by a consultant in 1972 appears adequate to provide access to most locations about the island. However, some of the priorities in phasing have changed (see Plate 19).



LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- PHASE I
- PHASE II
- PHASE III

**ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN
ISLAND ROAD SYSTEM**

First priority roads include:

- * Songsong Village to airport
- * Remainder of Songsong Village streets
- * Teneto subdivision to southern agricultural lands (including water cave)

Second priority roads include:

- * Access to the Sabana
- * Airport loop
- * Remainder of southern island loop

Third priority roads include

- * Guato to Mochon
- * Hillside roads along the northern shoreline

Typical Cross-Sections

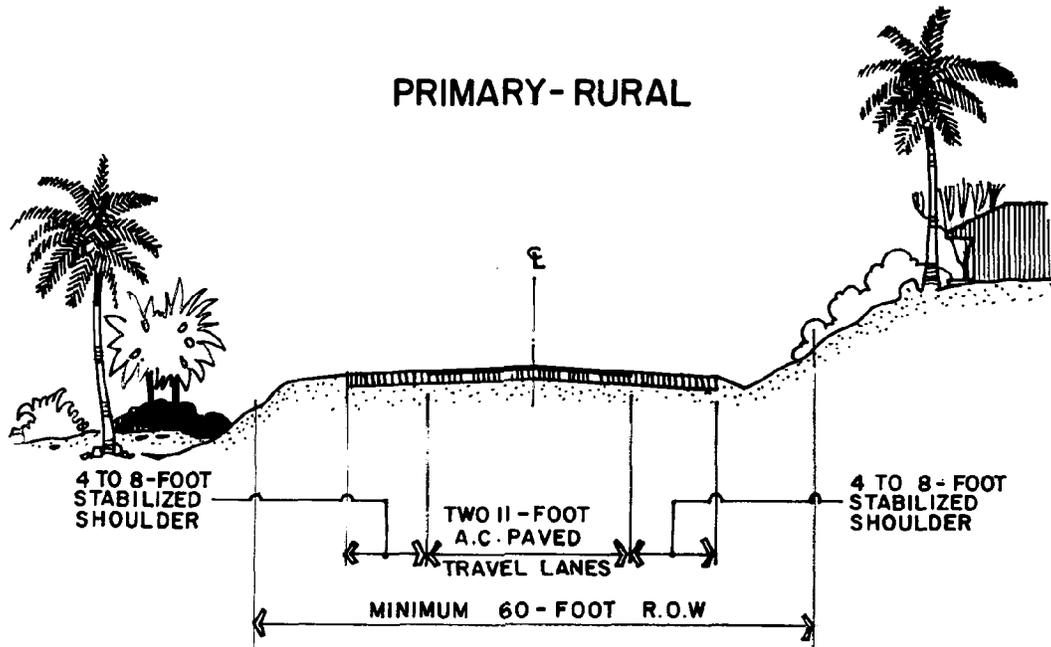
Plate 20 depicts the typical road cross-sections that are recommended for Rota. Primary rural roads will serve as the major connectors between various parts of the island. The Songsong Village to Airport Road is the prime example of this category. Village streets in Songsong will be upgraded to provide paved surfaces with improved shoulders.

There is another category of roads for which a typical cross-section is not depicted. These roads will have stabilized coral surfaces and will function as minor roads. It is anticipated that these roads will be coral surfaced as the traffic volumes do not warrant the paving. However, it should be emphasized that the stabilized surfaces will require regular maintenance which if lacking will result in quick deterioration of the surfaces.

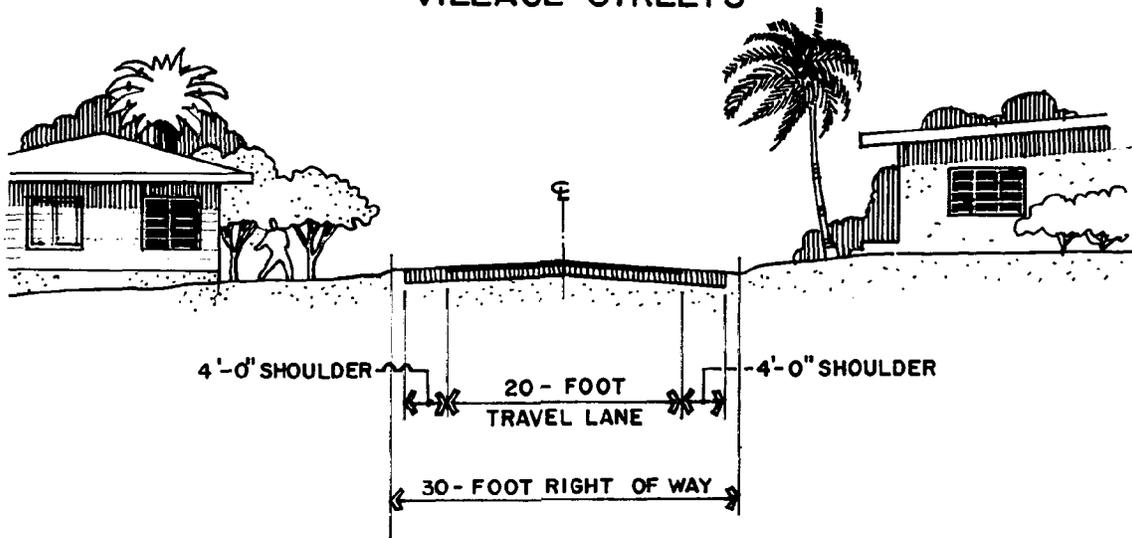
Preliminary Cost Estimates

Unit costs for construction of roads are not available for Rota. The estimates presented in Table 11 are based on costs for

PRIMARY-RURAL



VILLAGE STREETS



ROTA ISLAND
PHYSICAL DEVELOPMENT MASTER PLAN

ROADS
recommended cross-sections

20

January 1978
Pacific Planning and Design Consultants
Saipan - Commonwealth of the Northern Mariana Islands

TABLE 11

PER MILE COST ESTIMATES - ROTA ROADS

Primary - Rural

Grading and Filling, 38 feet wide	\$ 51,000
Six-Inch Base Course, 38 feet wide	70,000
Asphaltic Concrete, 2 inches thick, 22 feet wide	77,500
Average Per Mile Cost for Drainage	20,000
Signing, Pavement, Stripping, and Markers	<u>15,000</u>
Sub Total	\$233,500
A/E Design @ 10%	23,350
Total Cost/Mile	<u>\$256,850</u>

Village Streets

Grading, Filling, and Drainage, 28 feet wide	\$ 64,000
Six-Inch Base Course, 28 feet wide	51,800
Asphaltic Concrete, 2 inches thick, 20 feet wide	73,900
Signing, Stripping, and Markers	<u>15,000</u>
Sub Total	\$203,800
A/E Design @ 10%	20,380
Total Cost/Mile	<u>\$224,180</u>

Unpaved - Stabilized Surfaces

Base Course and Drainage	\$ 55,000
Oil Penetration	<u>20,000</u>
Sub Total	\$ 75,000
A/E Design @ 10%	7,500
Total Cost/Mile	<u>\$ 82,500</u>

similar activities in Saipan as well as on Guam. Presently, estimates for construction activities in Saipan indicate the following unit costs:

Grading Work -	\$.30 per sq. ft.
Preparation of Six-Inch Base Course -	\$.35 per sq. ft.
Paving with Asphaltic Concrete to a 2" Thickness -	\$6.00 per sq. yd.

Engineering design of highways is generally 10% of the construction cost. Accordingly, the per mile estimates for a completed road project include this cost.

Total Program Costs

There are approximately 65.8 miles of roads on Rota. Improvements to these roads will result in 10.5 miles of primary-rural sections (the Songsong Village to Airport Road), 5.8 miles of paved village streets, and 49.5 miles of stabilized surface roads, all built with the respective typical sections shown in Plate 18. Total costs for these three types of roads will amount to \$8.08 million. A summary of road costs by category is shown in Table 12.

The \$8.08 million total program costs are well beyond the financial resources available for the 1978-1985 plan period. Thus, a phasing of the improvements is necessary. Plate 19 indicates the phasing of the improvements over three 7-year periods. Phase 1 improvements are to be accomplished within this immediate plan period.

The improvements to be completed within the immediate planning horizon include approximately 8.2 miles of the Songsong Village to Airport Road at a cost of approximately \$2.1 million, 3.4 miles of village streets in Songsong at a cost of \$760,000,

TABLE 12

SUMMARY COSTS FOR ROTA ROAD IMPROVEMENT PROGRAM

<u>ROAD CATEGORY</u>	<u>TOTAL MILES</u>	<u>PER MILE ESTIMATE</u>	<u>TOTAL COSTS</u>
Primary - Rural	10.5	\$256,850	\$2,696,925
Village Streets	5.8	244,180	1,300,244
Stabilized Surfaces (Unpaved)	49.5	82,500	4,083,750
All Roads	65.8	-	\$8,080,919

and improvements to the Water Cave Road costing approximately \$50,000.

It is acknowledged that the entire length of the Songsong to Airport Road will not be reconstructed in the immediate plan period. Basically, it is the availability of funds that restricts the number of miles to be reconstructed. But it should be noted that portions of the road have already been improved within the past five years, and it is anticipated that these portions will not require full reconstruction work.

FUNDING SCHEMES

The only road project eligible for federal assistance is the Songsong Village to Airport Road. Of the estimated \$200,000 A&E design costs, \$75,000 will be derived from local funds in FY 1978.

The funds for construction are phased over the next several years as follows:

<u>Year</u>	<u>Local Funds</u>	<u>Federal Matching Funds</u>
FY 1979	\$135,000	\$315,000
FY 1980	150,000	350,000
FY 1981	270,000	630,000
<hr/>		
Total Construction Funds	\$555,000	\$1,295,000

Without federal matching funds, it is doubtful that the road can be designed and constructed to secondary road standards as the cost will probably exceed \$2,000,000.

A suggestion has been made to relocate the Songsong-Airport Road further inland, following the alignment of the old Japanese railroad. This would have the advantages of a smoother

alignment with fewer curves and of providing the shoreline properties with greater depths. However, approximately 60% of the lands that will be traversed by the new alignment are privately owned. Federally assisted road programs only finance highways with 100% of the right-of-way areas in public ownership. Therefore, it is of the utmost urgency to expedite the land acquisition matters of this new alignment prior to its A&E design, presently scheduled for FY 1978.

The village and rural/scenic roads program which will be exclusively funded with Northern Marianas CIP monies will allocate the following amounts:

<u>Year</u>	<u>Funds</u>
FY 1978	\$ 50,000
FY 1983	180,000
FY 1984	330,000
FY 1985	250,000

The \$50,000 allocated in FY 1978 are intended for the improvements to the Water Cave Road which will enable more convenient access to this important resource. The remaining \$760,000 will fund the Village Streets Improvements. Approximately 2.4 miles of village streets will not be improved within the plan period and should thus be included in any additional funding beyond 1985.

APPENDIX

RECOMMENDED PARKS

APPENDIX 1

RECOMMENDED PARKS

Mochon Area General Park

The most mature beach on the island with deep sands developed over beach rock, Mochon Beach 4000 feet long is particularly impressive. The proximity of an Ancient Chamorro Village enhances the scenic value of the general area around Mochon Beach, which is already attractive for the scenic area extending eastward along the dramatic shoreline, approximately 1.2 miles or 2 kilometers. Dominant uses for this park will be swimming, fishing, picnics, historic education, and nature viewing.

Agusan Beach Park (Swimming Hole)

This scenic beach park is located at the site of a small swimming hole in the reef with rugged pinnacle rocks on both sides and a small, sandy shoreline approach. Some picnicking facilities are already developed. The dominant uses of this park will be swimming and picnicking. The access leads through private lands and has to be secured.

Guata Beach Park (Mckay)

Located at the prominent junction of Airport Road and Northern Shoreline Road, this very accessible beach features pockets of sand which are separated by three-foot high pinnacle rocks. Present facilities include a wooden picnic bench. Picnics, swimming, and shelling are envisioned as the dominant uses in this park.

Teteto Beach Park

Teteto Beach is an 1800-foot long sand and gravel beach with a

very inviting recreational potential. After clarification of land ownership, a beach park should be established somewhere along this otherwise very accessible beach. The dominant uses of this park will be snorkeling, fishing, swimming, and picnicking.

Tatachog Beach Park

This discontinuous beach between Songsong Village and Sonton consists of two large parts, both under public ownership. Access at various points will have to be provided. The dominant uses of the different segments of this beach park will be picnicking, fishing, and wading. Part of this beach park includes the small islands at the entry to Songsong Village.

Taipingot General Park

This park consists of Taipingot Mountain, including its shoreline, and the slopes toward Songsong Village. It also covers the Northern Lagoon Area, including Anjota Island. The dominant uses of this highly scenic park will be hiking, hunting, picnicking, snorkeling, skin diving, nature viewing, and photography.

This park is particularly accessible to tourists since it directly abuts the resort area. Some hiking trails should be cleared for the tourists. Since access from the hotel area to the lagoon is very short, this lagoon should be an ideal location for tourist-oriented water activities such as snorkeling and skin diving.

As this area is presently used for marine foodgathering by the residents, a potential future conflict as elaborated earlier exists. Anjota Island, beyond the terminus of the causeway, will be predominantly used by residents as a picnic area.

Teneto Beach Park

Featuring a coral-pebble beach area back-dropped by a large coconut plantation, this beach park is located southeast of East Harbor and is easily accessible for tourists and residents alike. It offers extremely scenic views of Mt. Taipingot. Swimming, boating, picnics, shelling, and photography will be the dominant uses of this park.

As Nieves Latte Quarry Historic Park

This historic park incorporates the site of the latte quarry and should offer a simple sheltered rest area with some information panels. This site will be a prime tourist attraction.

Manira Jinja Memorial Park

In the northern section of the Sabana area, a park is proposed which will be centered around the historic Manira Jinja Memorial and also incorporate the scenic area of Mt. Manira, the highest elevation on the island.

East Coast Nature Preservation and Wilderness Area

The lower terraces of the eastern coastline will be a nature preserve and a wilderness area since it constitutes the only remaining area on the island where the vegetation still remains in its original state. These narrow bands of terraced land were apparently never brought under cultivation, resulting in vegetal cover that is highly mixed.

Plant communities featuring dry-season deciduous as well as wet forest components can be found generally due to the soil character which ranges from poorly developed rocky limestone to volcanic material.

The necessity of maintaining these areas as permanent preservation zones cannot be over-emphasized. They can provide an important "genetic reservoir" for reforestation projects or for medicinal plants and herbs. The latter two groups of plants have a definable cultural significance especially in these times of rapid dilution of traditional values.

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