I TANO'-TA

THE LAND USE PLAN FOR GUAM

FINAL LAND USE PLAN

May 1994

Prepared for:

THE TERRITORIAL PLANNING COUNCIL

Submitted By:

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A Joint Venture

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PURPOSE

I Tano'-ta: The Land Use Plan for Guam provides the framework to manage the growth and development of the Territory of Guam. Its purpose is to guide development in a coordinated and harmonious manner which will permit the timely provision of adequate community services, protect the delicate ecological balance between the natural and man-made environments and promote the health, safety, convenience, prosperity and general welfare of Guam's citizens and visitors.

BACKGROUND

Guam has experienced significant growth in its population since the 1960s. During the last 30 years, citizens of the Territory have witnessed changes to their quality of life, including an increase in the number and range of employment opportunities and the standard of living for many residents. However, other impacts have contributed to the lessening of some aspects of the quality of life. For example: the complex interrelationships of increased traffic congestion; the rising cost of housing, food, and other living expenses; rapid development of land, all associated with a significant loss of environmentally sensitive areas and open space, degradation of water quality, and the rapid development of the Territory's remaining beaches.

In 1990, the Twentieth Guam Legislature, in response to the impacts of rapid growth passed Public Law 20-147, a mandate for the development of a comprehensive plan. The comprehensive plan will provide long-range guidance for the physical, economic, and social development of the Territory.

In retrospect, the Territory's past planning efforts began in the 60s. The creation of the Master Plan in 1966, the development of various more specific land use plans (1977, 1978 and 1984), surveys, public workshops, and public hearings all indicated a strong desire by the residents of Guam to put into place policies for the orderly development of the island.

Unfortunately, many of the plans and recommendations completed since the 1966 Master Plan were not implemented. The economic growth in an environment without adequate planning controls brought forth unwanted impacts: traffic jams, inadequate infrastructure, increased air and water pollution, diminished recreational opportunities, rising land values and shortages of affordable housing.

The Twentieth Legislature anticipated the worsening impacts of unplanned growth in the findings of the need for Public Law 20-147, in which they have stated:

> "Many are concerned about lack of clear and decisive direction that has caused both social and economic development to occur and levels which the island may not be able to physically and infrastructurally sustain throughout the forthcoming decade.
>
> What is being indirectly conveyed to island leaders is a simple but nevertheless important sense that there must be 'appropriate limits set for social, economic and physical growth', limits that would not threaten the continued livelihood of the island and her people. How can or should this be done?
>
> The foundation for desirable growth and development stems from essential land-use decisions. Guam is forced at the present time to allow or disallow development, using a land-use plan adopted in the mid-1960s. While this plan met the needs of past development trends and characteristics, it is found to be grossly lacking for today's purposes. It is for this precise reason that the Territorial Land Use Commission has not been able to effectively address development issues and matters falling under its purview. An island-wide comprehensive development plan is needed and needed now."

I Tano'-ta: The Land Use Plan for Guam is one of sixteen elements of the Guam Comprehensive Development Plan, mandated by Public Law 20-147 in March 1990. In addition to the Land Use Plan, the Guam Comprehensive Development Plan, GCDP mandates that future plans be created to address a wide range of government services and public issues affected by growth in the Territory, including: community design, transportation, regulations, public facilities, public lands, public buildings, housing, redevelopment, conservation, recreation, safety, tourism, development policy, capital improvements, and public policy statements. All of these elements are intended to help guide Guam's future growth into the 21st century. That same law also created the Territorial Planning Council to oversee development of the GCDP. The members of the Territorial Planning Council, as designated by PL 20-147, include:

Territorial Planning Council Members

Charles P. Crisostomo, Chairman
Fred M. Castro, Vice Chairman
Mike Cruz, Acting Executive Secretary
The Honorable Edward Reyes, Senator, 22nd Guam Legislature
The Honorable Anthony Blas, 22nd Guam Legislature
The Honorable Vicente Pangelinan, 22nd Guam Legislature

The Honorable Vicente C. Bernardo, Mayor of Yona
Frank L. G. Castro, Department of Land Management
Peter R. Barcinas, Department of Commerce
Joey C. Cepeda, Guam Visitors Bureau
Chris K. Felix, Chamber of Commerce
Lourdes P. Aguon, Member-at-Large
Marcel G. Camacho, Executive Assistant

Former members of the Territorial Planning Council who participated in the development of the Land Use Plan include: Peter P. Leon Guerrero, Bureau of Planning , Senators Frank R. Santos, Gordon E. Mailloux and Martha C. Ruth of the 21st Guam Legislature.

I Tano'-ta: The Land Use Plan for Guam is the pivotal element of The Guam Comprehensive Development Plan. As Governor Joseph Ada indicated at the outset of the Plan's development: "The Plan will be our guide as to how, when and where we grow, and develop from now to the year 2015."

ORGANIZATION

Planning is a process. The development of I Tano'-ta: The Land Use Plan for Guam has been a cooperative effort between the Territorial Planning Council (TPC), its consultants, numerous government agencies, and many individuals who comprised the Community and Technical Advisory Committees. A Land Use Plan is a comprehensive, coordinated, and continuing program, the purpose of which is to help public and private decision makers arrive at decisions that promote the common good of society. The Plan includes:

(1) Identification of problems;
(2) Research and analysis to provide definitive understanding of these problems;
(3) Formulation of goals and objectives to be attained in alleviating these problems;
(4) Development and evaluation of alternative plans to attain the agreed-upon goals and objectives;
(5) Recommendation of appropriate courses of action from the alternatives; and
(6) Implementation of the approved plan and program.

Land use planning is more than merely specifying where particular uses (i.e. low-density housing, hotels, business, offices, etc.) are to be located. It entails addressing what is needed to support that development, whether it be adequate roads, public water and sewer systems, or other public services such as recreational facilities, public transit, or health care facilities.

The flow chart indicates the first phase of the planning process involves the collection and analysis of data in the areas of environmental affairs, land use, transportation, public facilities (schools, health care, public safety, etc.), public services (potable water, sanitary sewer, solid waste disposal), historical and archaeological sites, physical considerations (steep slopes, flood plains), and historical growth patterns. These efforts culminated in the development of the Land Use Plan: Technical Report I (Inventory and Analysis of Existing Conditions). This report represents an inventory of existing conditions affecting the natural and social environment in Guam. This report also served to highlight the major problems affecting the quality of life on the island.

The second major phase of the planning process involved the creation of alternative concept plans, each providing a different perspective on what Guam might look like in the year 2015, based on different development scenarios.

At key points in this process, the TPC held meetings with the public to solicit their input into the preparation of a preferred alternative concept plan. Upon completion of the data collection and analysis phase of the project, extensive public outreach village meetings were held to report the findings to the residents of the island.

Over 1,800 people attended these meetings and provided additional information, as well as their thoughts and concerns for the future of Guam. Following these village meetings, a series of alternative development concepts were prepared and, again, were presented to the public at the second set of village meetings for their consideration, input, and response. More than 800 residents attended these meetings and responded by selecting a preferred alternative, and it is from these meetings that the development of the Land Use Plan has evolved and is presented in this document.

Two groups, the Citizens Advisory Committee, CAC and the Technical Advisory Committee, TAC were formed and were active participants in the development of I Tano'-ta: The Land Use Plan for Guam and the Zoning Code. During the past two years, meetings with the Advisory groups were held enabling the TPC and their consultants to refine the concept plans with specific local knowledge of conditions and processes.

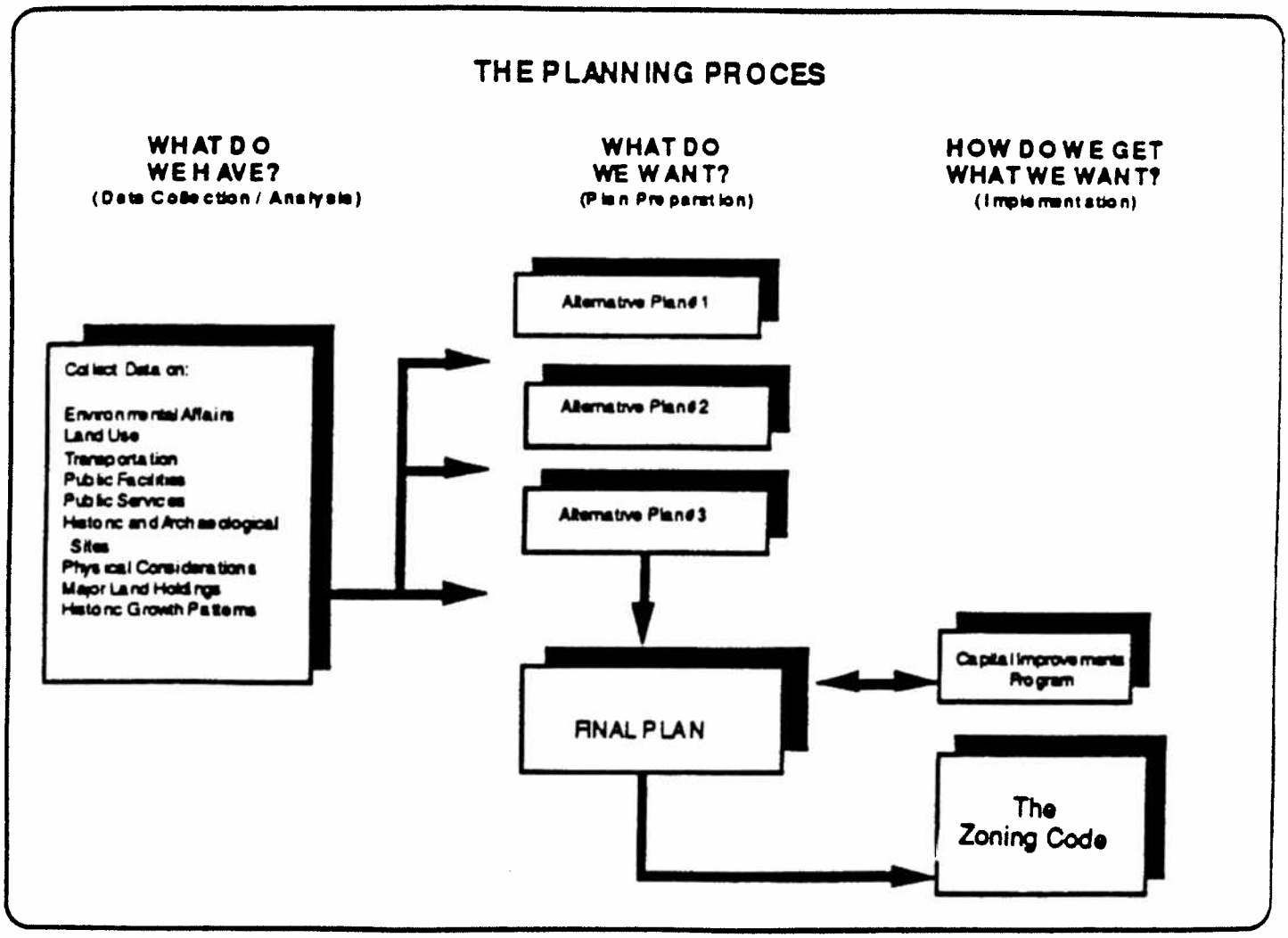
The CAC, comprised of citizens representing a broad range of community groups and private citizens provided diverse viewpoints to the planning process. The CAC formed an important link between the community, the Territorial Planning Council and the consultants. They were instrumental in generating awareness with the community, by offering public input and viewpoints to the Council. A list of the CAC group is found in Appendix A.

The Land Use Plan affects a whole range of governmental agencies and independent authorities. To insure that all who are involved in significant planning efforts and studies by these individual department and agencies of the Territory, the creation of an interagency/technical advisory committee was pertinent. The intent of TAC is to create a dialogue which will allow for the collectively pooling of knowledge of both public and private experts in order to produce a plan which is technically sound, balances diverse values and represents realistic costs and benefits. The TAC group was instrumental in identifying information, evaluating the accuracy of data, aided in establishing evaluation criteria and for a general review for scientific accuracy in various planning alternatives. A list of the TAC group is found in the Appendix A.

The third phase of the planning process resulted in the development of a Final Plan based on a third series of village meetings and extensive public comment on the Final Plan and the preparation of regulations necessary to implement the Plan. The new Zoning Code is the regulatory mechanism that will determine how development will occur within the Territory.

SUMMARY OF FINDINGS

The size of the Territory presents rigorous constraints on potential activities and limits options for development. In a small island environment such as that which exists in Guam, even isolated activities imply certain potential impacts. Resources are scarce and particularly fragile. Environmental, visual, social, and economic impacts can be felt immediately throughout the entire island.


THE PLANNING PROCES
WHAT DO WE HAVE?
(Data Collection / Analysis)
WHAT DO WE WANT?
(Plan Preparation)
HOW DO WE GET WHAT WE WANT?
(Implementation)
Collect Data on:
Environmental Affairs
Land Use
Transportation
Public Facilities
Public Services
Historic and Archaeological Sites
Physical Considerations
Major Land Holdings
Historic Growth Patterns
Alternative Plan#1
Alternative Plan#2
Alternative Plan#3
FINAL PLAN
Capital Improvements Program
The Zoning Code

Rapid unplanned growth has led to a number of social, cultural, economic and environmental problems that have served as an impetus in the preparation of the Land Use Plan. These issues include infrastructure deficiencies, lack of affordable housing and environmental degradation.

INFRASTRUCTURE CONCERNS

Rapid increases in population and economic development and a decrease in federal subsidies for capital improvement projects has affected the efforts of the Government of Guam to provide a sufficient level of public services required in the Territory.

The Government is responsible for providing basic services in two key areas: adequate and safe treatment of wastewater and provision of a public potable water supply. At the present time, both of these public services are affected by population increases and new development. They are often unable to deliver sufficient quantity and adequate quality of service.

The greatest deficiencies occur primarily in the fastest growing areas where new development may quickly exceed the capacity of existing infrastructure, and in the slower growing outlying regions of the island where the priority for capital improvements often rank behind those of the more populous regions of the island.

In an effort to help correct this imbalance, Public Law 19-47 was recently passed. This law provides for funds to be generated through the assessment of development impact fees required of developers who seek to connect into the island's water or wastewater system for the first time. This would assist the taxpayers of Guam by releasing them from the burden of the cost of new customers' demand for expanded service.

If the Government of Guam considers economic development a primary objective, it must address the corresponding needs in its existing infrastructure. It must find ways to improve the water and wastewater systems to allow for expanded and diversified economic development and to upgrade the quality of life for its people.

Rapid development and population growth are creating an overloaded condition on the wastewater treatment system. The problems are in both the capacity and location of collection lines, as well as the capacity in the treatment plants. Inadequate infrastructure has placed several development projects on hold, and has also resulted in the discharge of untreated or poorly treated effluent into streams and coastal lagoons, which poses potentially serious health problems as well. This situation is exacerbated during periods of heavy rainfall when stormwater runoff flows into sanitary sewer lines and the capacity of the collection system is quickly overloaded.

The island's predominant source of potable water is groundwater. Guam, with its aquifers in the northern and central portions of the island, is blessed with a plentiful amount of fresh water. However, there are growing concerns that rapid growth is quickly depleting the supply of groundwater and that certain land uses are endangering the quality of the groundwater.

The public water system in the Territory is plagued with problems of unaccounted usage of this precious resource. The efficiency rate (i.e., the known number of gallons consumed relative to the known number of gallons produced) hovered between 50 and 60 percent during the 1980's. This is extremely low when compared to efficiency rates of 80 to 90 percent that are the norm in other more urban communities. The main reasons for this abnormally high loss are line leakages and unmetered connections into the water distribution system. The primary distribution lines were installed more than 45 years ago, and these pipe systems may conspicuously be leaking large volumes of water, especially in the southern portion of the island. PUAG is actively seeking to rectify both problems through a leak detection program.

Traffic circulation is a mounting problem in the Territory. Traffic congestion will continue especially during peak periods (i.e., 7-9 a.m. and 4-6 p.m.) and as more and more automobiles are brought to the island. In 1991, there were more than 100,000 registered vehicles in Guam. This amounts to approximately one vehicle for every 1.3 residents, one of the highest vehicle-to-population ratio's in the world, given an island setting with limited land area. Traffic accident data from the Guam Police Department indicate that highway accidents doubled from a decade earlier (from 4,591 in 1980 to 9,181 in 1990), highway deaths increased by more than 50 percent over the same time period, and property damage almost doubled.

The mobility offered by automobiles has meant that the population may spread out further away from the traditional work places and shopping areas. Traffic flows have increased on the highways around the significant traffic generating land uses (i.e. hotels, shopping centers, offices, airport, etc.). Yet the spreading out of the population has made it difficult to achieve the critical density necessary for mass transit to significantly reduce the number of vehicles on the roadways.

The major residential, commercial, and industrial developments are located in the central and northern portions of the island along the highway. Due to traffic generated by that development, most of the very high traffic volumes occur in and around the Agana, Tamuning, and Barrigada areas. Traffic is slowed down further by the poor condition of many of the roads, inadequate pedestrian access across them, and their frequent flooding during the rainy season.

LACK OF AFFORDABLE HOUSING

The total supply of housing units generally kept pace with the growth in population from 1980 to 1990. Both indices increased by approximately 25 percent during the decade. However, this should not suggest a relatively open or "saturated" housing market. In fact, the housing tenure ratio in Guam is marked by a majority of renter-occupied dwelling units compared to owner-occupied units. This reflects a high degree of labor-related in-migration which, in turn, creates an immediate demand for more short-term (i.e., rental) accommodations and results in a longer-term "pent-up" demand for owner-occupied housing.

This type of housing tenure relationship is atypical of older, more stable communities, but is not uncommon in many small, high-growth, tourism-dependent communities with whom regional housing markets (which may act to absorb the "pent-up" demand) are not readily available. Even more obvious is the impact on housing values. As large scale tourism and commercial development bids up the price of the remaining land, housing values must follow suit. This, as anyone who has looked into housing costs in the Territory over the past 10 years can attest to, is the current situation in Guam.

Families, whose income levels do not rise as quickly as market-sensitive housing values, are unable to find reasonably-priced housing. Thus, a shortage of "affordable housing" occurs. Many residents must then find cheaper, more available rental housing or live with extended family members. The situation is further exacerbated by the fact that many of the rental units (mostly condominiums) are designed for longer-term tourist arrivals, and as such are not priced in a range affordable to many residents.
Growth in the value of residential construction (residential, apartments, and condominiums) has increased significantly during the 1980s. However, at the same time, the lack of affordable housing for many low and moderate income households has led to more direct intervention in the housing market by the Government of Guam to serve the housing needs of these households.

ENVIRONMENTAL DEGRADATION

Perhaps the most striking impact of growth and development in the Territory has been the environmental damage that has occurred to the land and marine ecosystems.

The quality of most coastal waters is still relatively excellent. Some areas, however, have received pollution impacts and include Tumon Bay, Tanguisson, Agana Bay, Apra Harbor, Agat Bay, Pago Bay and Cetti Bay. The quality of surrounding waters is affected mainly by sediment runoff, dredging and filling activities, and the discharge of thermal and sewage effluents. The degradation of water quality can have severe adverse impacts upon certain fragile near-shore ecosystems, including beaches, coral reefs, mangrove mudflats, and seagrass beds. These marine resources constitute significant foundations to not only the visual quality of life, but to the economic prosperity of the Territory as well.

Sediment Runoff - The problem of excessive sediment runoff is caused primarily by increased urbanization of previously undeveloped lands and fires in grassland on slopes. Construction activities disturb the soil by stripping vegetation and altering natural landforms. Alterations to the existing land cover, such as the construction of housing and paving, increased runoff and the flow of sediments, thereby contributing to turbidity in coastal waters. The effects of sediment runoff are particularly acute and noticeable in the bays and harbors adjacent to developed watersheds immediately following a heavy rainfall. Large plumes of silt extend from the mouths of natural drainage ways into the adjacent waters. The sedimentation effects are harmful to the marine environment, aesthetically objectionable, and increase the necessity for maintenance dredging.

Attempts to manage stormwater are relatively new. Stormwater management regulations in the continental United States have only been created in any meaningful way in the past ten years. However, most researchers agree that stormwater runoff is responsible for the following problems:

- Stormwater flushes nutrients and carries disease organisms into coastal waters at a rate comparable to effluent discharges from wastewater treatment facilities; and

- Stormwater deposits 80 to 95 percent of the heavy metals that reach the coastal waters. Lead, zinc, copper cadmium, and chromium, along with oils and greases, are flushed from highways and parking areas into the coastal waters. Heavy metals are toxic to plankton, fish, and other aquatic organisms, reducing their ability to reproduce.

Dredging and Filling Activities - Dredging of sand and other materials to create landfill, swimming areas, marina sites, improve navigation, and provide enhanced beachfronts has occurred in near-shore areas and altered these ecosystems, especially in Tumon Bay, Agana and Piti.

Near-shore dredging activities increase turbidity that disrupt natural marine ecological systems and create potential beach erosion problems. The alteration and destruction of wetlands and ponds affect fish and wildlife productivity and add to the drainage and flushing of storm and flood waters on adjacent beaches. Both sediment runoff and dredge and fill activities have resulted in increased water turbidity. Heavy sedimentation has damaged both reef and fish-life, and is also unappealing for swimming and snorkeling. Turbid or cloudy waters limit the light needed by corals and for food production by marine plants. These latter conditions, if allowed to continue, will ultimately have a detrimental effect on the tourism industry in the Territory.

- Discharge of Sewage Effluents - The discharge of raw or partially treated sewage and toxic substances from overloaded sewage treatment plants and inadequate septic tanks contributes significantly to the deterioration of water quality. In a few instances, liquid waste is disposed of in pristine waters or in waters with the least capacity to tolerate further stresses. Even minimal degradation of water quality can have severe adverse impacts upon certain fragile near-shore ecosystems.

- Loss of Natural Areas - Unfortunately, areas that are frequently attractive for the location of economic activities are ecologically fragile and extremely vulnerable to development of any kind. The loss of natural areas is frequently the result of fast paced growth. Ecologically valuable limestone forests have been destroyed and mangroves and beaches have been filled or dredged to accommodate development. In other instances, the functioning of these vital areas has been impaired by encroaching development. These losses are irrevocable and have contributed to declining marine productivity, as well as other coastal resource related problems.

- Visual Conflict - One of the most important resources of Guam is its high degree of visual quality. The island is beautiful, and its beauty satisfies residents and tourists alike. A problem which arises from the competition for shoreline space is conflict resulting from haphazard development. Piecemeal destruction of coastal resources, and the type of construction and location of facilities along the shoreline is a major aesthetic concern. Frequently, adjacent uses conflict drastically in character, as well as the quality of design, construction and maintenance between buildings. No single incongruity is so serious but cumulatively, even small projects deface the landscape.

LAND USE PLAN PROCESS

INTRODUCTION

The land available for future development in the Territory encompasses a finite amount of area. If growth were to continue in the Territory for the next 25 years in the same manner that it has for the past quarter century, a considerable amount of land would be consumed and the various infrastructural deficiencies that currently exist would be even greater. Additionally, stronger pressures would be brought to bear on environmentally sensitive lands and precious natural resources. Therefore, a balanced approach must be employed to establish guidelines for directing growth into those areas best suited for development.

The Land Use Plan process seeks to identify the major issues affecting the quality of life for Guam's residents and visitors alike. I Tano'-ta attempts to ensure that future growth takes place in a manner which reflects the need for expansion in all social and economic sectors, and, at the same time, recognizes the need for establishing guidelines for growth in areas where unplanned development would have a significant negative effect on the well-being of the people of Guam. I Tano'-ta itself is primarily concerned with the arrangement and type of land uses, their impact on the environment, and relation to community development.

Four fundamental themes have provided the framework for the development of I Tano'-ta: The Land Use Plan for Guam:

1. Directing growth and economic development activities into areas where public services, such as potable water, sanitary sewer, mass transit, and community resources, including schools and recreational areas, are adequately provided. This reduces social and personal costs by reducing energy consumption and requiring less of an expenditure of government funds to extend public services.

2. Protecting environmentally-sensitive lands. These are lands and waters that have overriding ecological, hydrological, topographical, aesthetic, or cultural importance and which cannot be developed without either seriously impairing their function or causing an irreplaceable loss of resources.

3. Allocating land use commensurate with the Territory's goal of economic diversification and expansion. This theme is more fully explored in the Overall Economic Development Program (OEDP), prepared by the Guam Economic Development Authority. The OEDP

serves to target specific services and industries appropriate to the Guam economy, while encouraging the preservation of the Territory's more traditional industries, including agriculture and fisheries.

4. Promoting the creation of more affordable housing by encouraging the development of mixed use activities and higher density residential development opportunities. On a small island, a strong tourism market and rising land values, housing values often increase at a rate which may ultimately exceed the affordability of local residents. Lacking incentives to participate in the locally-oriented housing market, housing developers are usually slow to respond to these needs without some form of government incentives or requirements.

EXISTING LAND USE CONDITIONS

From 1988 through 1992, Guam has experienced an unprecedented economic and population boom. Over the last thirty years, from 1960 and 1990, the resident population has doubled from 67,000 to over 133,000. The island has grown with continued immigration from Asia, recent immigration from Micronesia, along with approximately 20,000 U.S. military personnel and their dependents. At the same time, Japanese tourists drawn by the warm tropical waters and new resort developments have visited the island in increasing numbers. Demand for workers in the construction and service industries has quickly outpaced the local labor supply and many off-island workers have come to Guam creating even more demand for housing and commercial support services. The rapid build-up has increasingly burdened the Territory's infrastructure systems, including roads, potable water, and sanitary sewer. As the pace of development activity has increased, it has begun to spread out away from the more developed urban areas into rural areas.

Guam consists of approximately 212 square miles, most of which still remains undeveloped. The majority of the island's residents live in the northern portion of the island, in the villages of Tamuning, Dededo, and Yigo an area of the largest, most recent residential growth. About 30 percent of Guam's residents live in the central portion of the island, in and around Agana Heights, Sinajana, Barrigada, Mangilao, and Chalan-Pago. The smallest area of population is in the southern sector of Guam, where due to rough terrain, the villages remain small and relatively undeveloped. The southern villages retain a slower-paced, traditional island lifestyle and architecture, while the central and northern portions are developing a more westernized, urban flavor. Existing land use patterns on the island are shown in FIGURE 1.

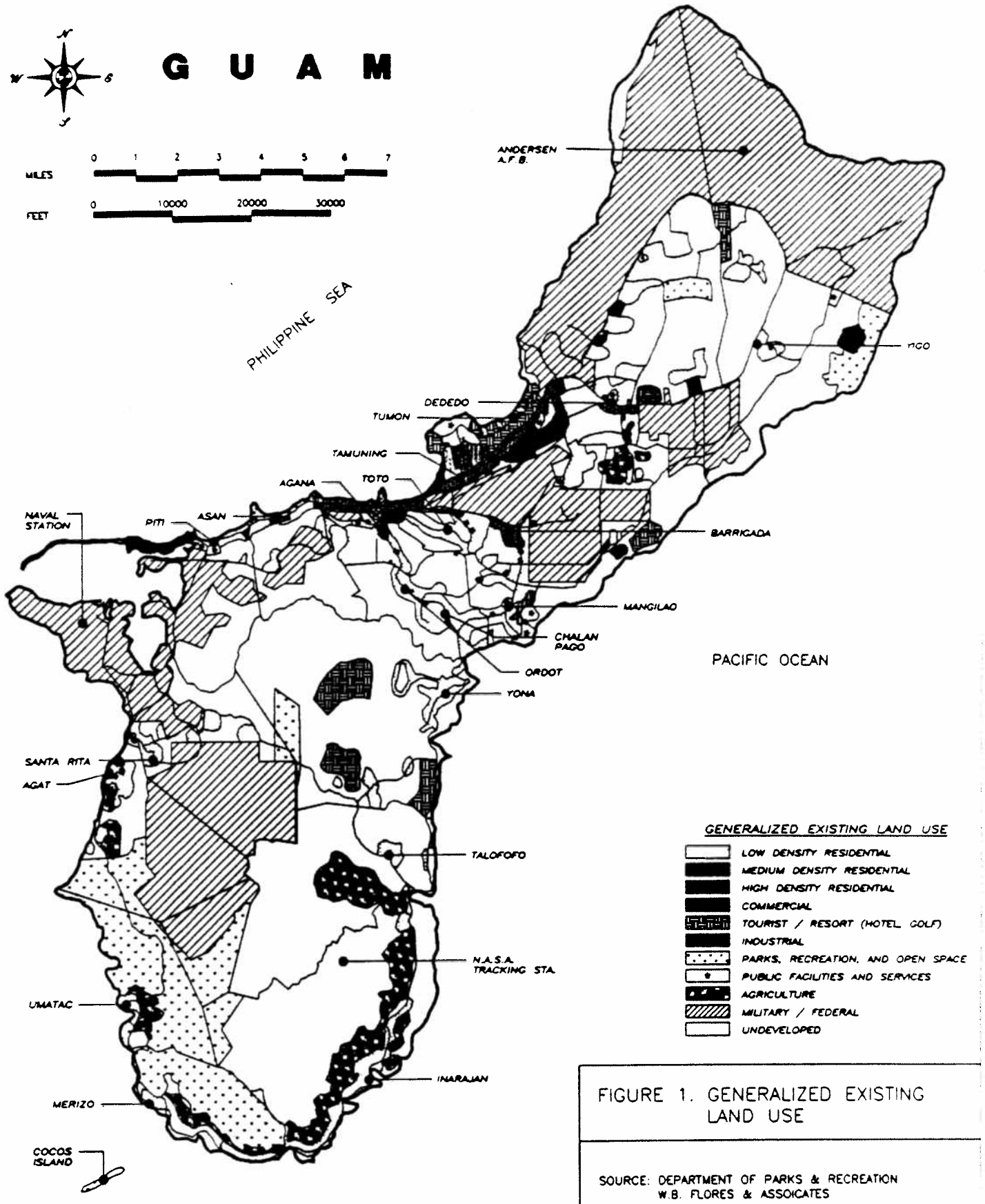


FIGURE 1. GENERALIZED EXISTING LAND USE

SOURCE: DEPARTMENT OF PARKS & RECREATION
W.B. FLORES & ASSOICATES

W.B.FLORES/STRATEGIC PLANNING GROUP JV
PREPARED BY: PATTON HARRIS RUST & ASSOCIATES

Most of the tourist-oriented development is located in the center of the island, concentrated in Tamuning and along Tumon and Agana Bays. In 1992, there were more than 5,000 hotel rooms on-island, most of them in this area. An additional 10,000 rooms have received Government approval, many of which are already under construction. In addition, almost 10,000 condominium units have been approved and another 2,000 units are pending government action. Many of these developments are proposed to be built in the rural areas of the island, outside of the existing tourist/resort development sectors.

The major military installations are located in the northern and central areas, including Andersen Air Force Base in the north and Naval Air Station in Agana, the Naval Station facility in the Apra Harbor area and Naval Magazine in Santa Rita, where the Fena Reservoir is located.

Land Ownership

Land ownership on Guam is divided into three major categories: Federal Government, Government of Guam, and private individuals and corporations. According to the Bureau of Planning, the Federal Government controls 32 percent of the island's total land area as military reservations. The Government of Guam owns approximately 20 percent, and the remainder, about 48 percent, is under private ownership.

Major Proposed Developments

As the tourist industry continues to grow on Guam, the demand for new development, particularly tourist/resort uses, including condominiums, hotels, retail, and golf courses, has increased. In Fiscal Year 1990, 2,164 construction permits were issued at a value of $486,082,000; an increase from 2,043 permits with a valuation of $362,987,000 in Fiscal Year 1989. Figure 2 shows the location of the major developments that are proposed or are currently under construction. These developments include:

- 64 hotel projects (some are additions to existing hotels);
- 66 condominium projects;
- 22 golf courses (some are expansions of existing courses); and
- 1-132-unit executive home subdivision.

As the map indicates, many of these developments are proposed for rural areas of the island outside of the existing tourist/resort development areas. A complete listing of proposed hotel and condominium development projects is shown in TABLE 1.

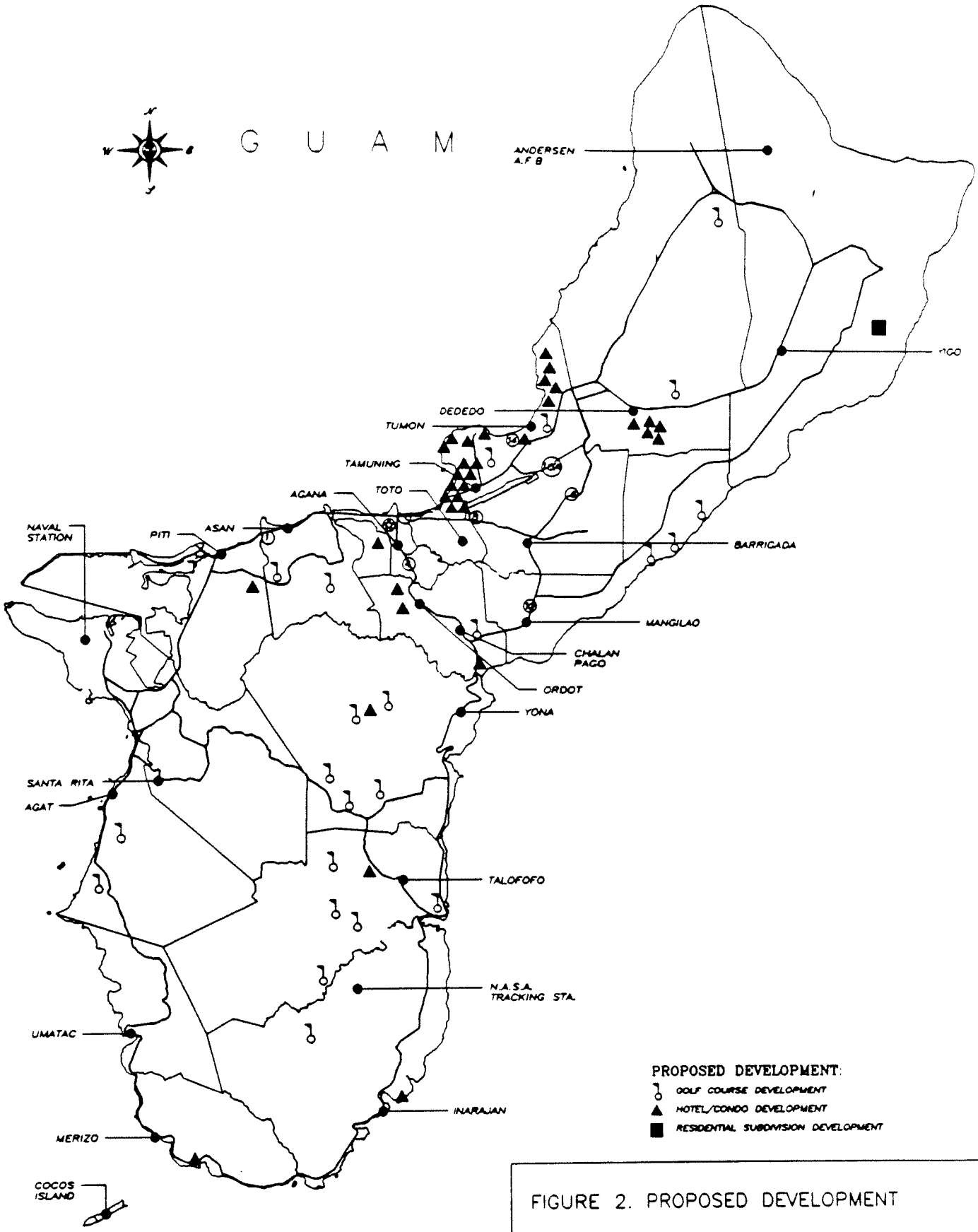


FIGURE 2. PROPOSED DEVELOPMENT

SOURCE: LAND MANAGEMENT/W.B. FLORES

W.B.FLORES/STRATEGIC PLANNING GROUP JV

TABLE 1
GUAM HOTEL AND CONDOMINIUM UNITS INVENTORY

VILLAGE/PROJECT (UNITS)	TYPE (UNITS)	EXISTING (UNITS)	APPROVED (UNITS)	PENDING	POTENTIAL
AGANA					
Agana Marina Complex	H	0	440	0	0
International Marina (Downtown)	H	48	0	0	0
International Marina Hotel	H	45	0	0	*0*
Subtotal:		***93***	***440***	***0***	
AGANA HEIGHTS					
Cliff Hotel	H	34	0	0	0
Jones & Guerrero Co., Inc.	C	0	130	0	0
Subtotal:		***34***	***130***	***0***	***0***
AGAT					
Agat Hilltop Garden Hotels	H	0	196	0	0
Fujimoto International, Inc.	H	0	224	0	0
Inn on the Bay	H	70	0	0	1,600
Jo-In International	H	0	0	0	0
Nomura Agat Resort Hotel	H	0	380	0	0
Nomura Agat Resort Condo	C	0	0	314	0
Sea View Terrace	C	0	0	264	0
Subtotal:		***70***	***800***	***578***	***1,600***
ASAN					
Lonfit New Town Hotel	H	0	0	200	
Fonte Villa Palm Condo	C	0	48	0	0
Lonfit New Town Condos	C	0	0	240	0
Okso' Taguak	C	0	0	240	0
Subtotal:		***0***	***48***	***680***	0
					0
BARRIGADA					
Cas International Dev.	H	0	78	0	
Guam International Hotel	H	0	64	0	0
Ok Soon Lee	H	0	0	33	0
Coral Sea Realty	C	0	98	0	0
Pacific Economic Dev.	C	0	518	0	0
Subtotal:		***0***	758	***33***	0
					0
CHALAN PAGO/ORDOT					
Apusento Gardens	H	120	0	0	
United Pac. Inv. & Dev., Inc.	H	0	100	0	0
Choken Corp. Guam	C	0	92	0	0
Golden Palm Condos	C	0	30	0	0
United Pac. Inv. & Dev. Co.	C	0	0	692	0
Villa Toloha	C	0	24	0	0
Subtotal:		***120***	***246***	***692***	0
					0

TABLE 1 (continued...)
GUAM HOTEL AND CONDOMINIUM UNITS INVENTORY

VILLAGE/PROJECT (UNITS)	TYPE (UNITS)	EXISTING (UNITS)	APPROVED (UNITS)	PENDING	POTENTIAL
DEDEDO					
Dededo Business Hotel	H	0	0	182	0
Grandview Hotel	H	0	450	0	0
Hatsuho International Inc.	H	0	15	0	0
Gordon Chu	C	0	0	30	0
Josephine McKeever	C	0	0	88	0
Pacific Group Dev., Inc.	C	0	48	0	0
Platinum Land Corp.	C	0	46	0	0
Villa Gloria condos/Apts.	C	0	0	42	0
Villa Rosario	C	0	141	0	0
Subtotal:		***0***	***700***	***342***	***0***
GUN BEACH					
Hasegawa-Koauten	H	0	0	0	500
Subtotal:		***0***	***0***	***0***	***500***
INARAJAN					
Dandan Estates & CC Hotel	H	0	200	0	0
Inarajan Bay Hotel	H	0	0	0	100
Inarajan Garden House	H	26	0	0	0
Taotao Resorts	H	0	0	0	2,800
Dandan Estate & CC Condo	C	0	720	0	0
Subtotal:		***26***	***920***	***0***	***2,900***
MANGILAO					
Hanil Resorts	H	0	0	0	590
Tech Chan (Oriental Kitchen)	H	0	0	26	0
Fadian Development, Inc.	C	0	1,436	0	0
Marbo Cave Resort	H	0	1,200	0	0
Marbo Cave Resort Condos	C	0	600	0	0
T & K Development Corp.	C	0	218	0	0
Subtotal:		***0***	***3,454***	***26***	***590***
MERIZO					
Cocos Island Resort	H	118	0	0	0
Subtotal:		***118***	***0***	***0***	***0***
PAGO BAY					
Guam Aida Inc.	C	0	0	60	0
Pago Bay Gardens Condo	C	0	0	198	0
Subtotal:		***0***	***0***	***258***	***0***
PITI					
Montyear Yuren/Em Chen	C	0	48	0	0
Subtotal:		***0***	***48***	***0***	***0***
TALOFOFO					
Kurason Guahan Hotel	H	0	0	150	0
Pricia Inc. Hotel	C	0	40	0	0
Subtotal:		***0***	***40***	***150***	***0***

TABLE I (continued...)
GUAM HOTEL AND CONDOMINIUM UNITS INVENTORY

VILLAGE/PROJECT (UNITS)	TYPE (UNITS)	EXISTING (UNITS)	APPROVED (UNITS)	PENDING	POTENTIAL
TAMUNING					
A & R Limited	H	0	0	0	451
AB Hotel (Seahorse) Asahi	H	0	0	0	0
AIWA Inc.	C	0	0	0	0
Big Point	H	0	0	0	16
Capital Hotel	H	32	0	0	0
Chiyoda Guam Corp.	H	0	0	0	0
City Hill Co.	C	0	67	67	0
Dai-Ichi Hotel	H	338	0	0	0
EIE Guam Corp.	H	0	0	0	448
Faifai Beach Resort Hotel	H	0	0	0	0
Frank Ko	H	0	0	0	400
Fujita Hotel	H	283	0	0	0
General Enterprises	H	0	0	0	0
Grand Hotel	H	99	0	0	0
Guam American Hotel	H	50	0	0	0
Guam AB Hotel	H	0	446	0	0
Guam Beach Hotel	H	26	0	400	0
Guam Hardwood Hotel	H	0	0	0	120
Guam International Trade Ctr.	H	33	0	0	0
Guam Plaza Hotel	H	518	0	0	0
Hakubotan Inc.	H	0	0	0	581
Hilton International	H	486	247	0	0
Horizon Hotel	H	104	0	0	0
Hotel Mai'Ana	H	77	0	0	0
Hyatt Regency	H	0	448	0	0
Hyoon Joon Const.	H	0	104	0	0
Imperial Hotel (Hale Kai)	H	0	0	244	0
Joinus Hotel/Tumon Sands	H	36	0	0	0
Leo Palace Hotel	H	0	382	0	0
Loh Chiao	H	0	85	0	0
Macau-Hong Kong Dev., Inc.	H	0	0	0	400
Marriott Hotel	H	0	0	0	500
Matsuzato Guam Resort	H	0	157	0	0
Milo Corporation	H	0	32	0	0
Nikko Hotel	H	0	500	0	0
Ocean Plaza	H	0	16	0	0
Oka Towers	H	24	0	0	0
Okura Hotel	H	224	163	0	0
Onward Agana Beach Hotel	H	0	300	0	0
Pacific Islands Club Res.	H	491	854	0	0
Pacific Star Hotel	H	436	0	0	0
Palace Hotel	H	405	0	0	0
Peter Chang	H	0	0	0	19
Pia Resort Hotel	H	55	0	0	0
Polynesian Hotel	H	35	0	0	0
Reef Hotel	H	167	0	0	0
Regency II	H	63	0	0	0
Regency III	H	60	0	0	0

TABLE I (continued...)
GUAM HOTEL AND CONDOMINIUM UNITS INVENTORY

VILLAGE/PROJECT (UNITS)	TYPE (UNITS)	EXISTING (UNITS)	APPROVED (UNITS)	PENDING	POTENTIAL
Regency IV	H	0	0	156	0
Royal Hotel (Bhnd. ITC)	H	0	0	90	0
Royal Hotel (near Tahiti)	H	0	0	0	600
Sachdev P & A	H	0	113	0	0
Saint Villa Resorts	H	0	0	0	96
Suehiro/Tumon Plaza Hotel	H	38	250	0	0
Sun Route Hotel/Regency I	H	66	0	0	0
Tamuning Plaza (Union)	H	40	0	0	0
Tamuning TLA Hotel	H	0	0	0	113
Terraza Hotel	H	22	10	0	0
Tropicana Hotel	H	192	0	0	0
Tumon Fountain Plaza	H	0	290	0	0
Tumon Holiday Plaza	H	130	0	0	0
Tumon Plaza Hotel	H	0	252	0	0
Tumon Royal Hotel	H	0	0	0	300
Tumon Villa Hotel	H	18	0	0	0
Unite Overseas Investment	H	0	85	0	0
Yamanoi Guam Hotel	H	0	61	0	0
Hyun Joon Construction	H	0	0	140	0
Akimoto Condo	C	0	0	20	0
Alupang Beach Tower	C	0	0	138	0
Baba Corporation	C	0	56	0	0
Chateau Michelle/G. Lee	C	0	0	25	0
City Hill Co. Guam Ltd.	C	0	0	67	0
Continental Dev. Corp.	C	0	19	0	0
Faifai Beach Resort Condo	C	0	400	0	0
George Lee	C	0	72	0	0
Guam Five Star Corp.	C	0	31	0	0
Guam Greyhound Inc.	C	0	66	0	0
Hyun Joon Corporation	C	0	15	0	0
Itoman Real Estate Sales	C	0	209	0	0
James JI Enterprises	C	0	44	0	0
Jonestown Condo & Villa	C	0	322	0	0
Kawasho International GU	C	0	220	0	0
Keijo Shoji Construction	C	0	21	0	0
Kim Yen Corp.	C	0	32	0	0
King's Garden	C	0	24	0	0
Kojimaya Dev. Guam	C	0	0	54	0
Loh Chiao Condos	C	0	15	0	0
Matsuzato Guam Resort Con.	C	0	719	0	0
Mutsumi Iwayama	C	0	16	0	0
Palm Seas Condo	C	0	0	9	0
Pia Resort Condominiums	C	54	0	0	0
Raymond Fleming	C	0	11	0	0
Regency Tower	C	0	0	14	0
Ryoko Guam Dev. Corp.	C	0	130	0	0
San He Villa	C	0	0	11	0
Segu International Inc.	C	0	40	0	0
Su Eur Huang	C	0	21	0	0
Sung Hee Dev. Inc.	C	0	0	102	0
Tumon Loop Condos	C	0	0	0	130

TABLE 1 (continued...)
GUAM HOTEL AND CONDOMINIUM UNITS INVENTORY

VILLAGE/PROJECT (UNITS)	TYPE (UNITS)	EXISTING (UNITS)	APPROVED (UNITS)	PENDING	POTENTIAL
Yamacho Guam, Inc.	C	0	0	32	0
Yamanoi Guam Condos	C	0	0	54	0
Young Lee	C	0	0	0	0
Subtotal:		***4,902***	***9,886***	***1,650***	***4,174***
TOTO/MAITE					
Kina Court	H	31	0	0	0
Maite Garden Hotel	H	48	0	0	0
Plumeria Garden Hotel	H	78	0	0	0
Chiang's Corporation	C	0	28	28	0
Subtotal:		***157***	***28***	***28***	***0***
URUNAO					
Urunao Resort Corp.	H	0	0	0	1,000
Subtotal:		***0***	***0***	***0***	***1,000***
YONA					
Manengon Hills Hotel	H	0	200	0	0
YLIG Shores, Inc.	H	0	0	0	891
Manengon Hills Condo	C	0	2,150	0	0
Subtotal:		***0***	***2,350***	***0***	***890***
TOTAL		**5,520**	**19,828**	**4,409**	**11,654**

Note: Project Type: H = Hotel; C = Condominium

Source: Guam Bureau of Planning, 1992
W.B. Flores/SPG

At the present time there are more than 5,500 existing hotel and condominium units on Guam. According to the Bureau of Planning, there are approximately 19,000 hotel and condominium units approved for development; over 4,000 units currently going through the permitting process; and another 11,654 units listed as potential development (i.e., no formal applications for development have yet been initiated).

The distribution of proposed development by village is outlined in Table 2 with the largest proportion of tourism-related development slated for Tumon/Tamuning, Barrigada, Yona, Mangilao, and Agat respectively. Significant increases in tourism-related development has also been proposed for many other villages which, to date, have not experienced significant hotel or condominium development. These include Dededo, Inarajan, Chalan Pago-Ordot, Asan, and Talofofo. Despite the tremendous amount of redevelopment and permitting activity, the recent economic recession in Japan and the U.S. has forced the slowdown or delay in many proposed projects. For this reason, the actual absorption rate of hotel and condominium development is expected to slow over the planning horizon.

TABLE 2
GUAM HOTEL AND CONDOMINIUM UNIT SUMMARY BY VILLAGE

APPROVED/VILLAGE	EXISTING	PERCENT	APPROVED PENDING	PERCENT
Agana	93	1.7	440	1.8
Agana Heights	34	0.6	130	0.5
Agat	70	1.3	1,378	5.7
Asan	0	0.0	708	2.9
Barrigada	0	0.0	791	3.3
Chalan Pago/Ordot	120	2.2	938	3.9
Dededo	0	0.0	1,042	4.3
Inarajan	26	0.5	920	3.8
Mangilao/Pago Bay	0	0.0	3,738	15.4
Merizo	118	2.2	0	0.0
Piti	0	0.0	48	0.2
Talofofo	0	0.0	190	0.8
Tamuning/Tumon	4,902	88.6	11,525	47.6
Toto/Maite	157	2.9	28	0.1
Yona	0	0.0	2,350	9.7
TOTAL	**5,520**	**100**	**24,226**	**100**

Source: Guam Bureau of Planning, 1992

The proposed development picture at the present time suggests a significant spatial shift in the distribution of new tourism-related projects on Guam. This pattern is indicative of a "spreading out" of the tourism development away from its traditional core area in Tumon and Tamuning. Of particular importance to this pattern is the growing number of golf course-related resorts which require more extensive land areas that are not necessarily available in the Tumon Bay area. Incumbent upon this type of development, as well, is the need for additional water supplies to provide irrigation for these golf courses in addition to the everyday needs for the tourist population. TABLE 3 presents the location and the number of holes for the existing and proposed golf courses on Guam.

POPULATION GROWTH

To develop a Land Use Plan, the future population level to be accommodated must be determined and the limitations to future development identified.

"How many residents and tourists must we plan our facilities to accommodate?" This question is of critical importance to the Territorial Planning Council (TPC) officials whose current policies and programs will shape the future of Guam. The population estimates and projections for the island are among the most important technical variables used in any planning and development process. The rate of population growth will provide important information to help identify capital requirements for housing, transportation, recreation, schools, public health and safety, and other public and private facilities and services related to a modern, developed environment in Guam.

TABLE 3
GUAM GOLF COURSE DEVELOPMENT PROJECTS
(number of holes)

LOCATION	PROJECT	EXISTING	APPROVED	PENDING	POTENTIAL	TOTAL
Agat	Guam Country Club	0	18	0	0	18
Asan	Lonfit New Town Golf	0	0	18	0	18
Barrigada	Marbo Cave Resort Golf	0	18	0	0	18
Dededo	Hatsuho International	18	0	0	0	18
Dededo	Hatsuho International CC	0	9	0	0	9
Harmon	PD Hemlani Driving Range	0	0	0	0	0
Inarajan	Dandan Estate & CC Golf	0	54	0	0	54
Mangilao	Mangilao Golf Course	0	18	0	0	18
Talofofo	Country club of the Pacific	18	0	0	0	18
Talofofo	Guam Talofofo Country Club	0	0	18	0	18
Talofofo	Kurason Guahan Inc.	0	0	18	0	18
Talofofo	Takayama Golf Course	18	0	0	0	18
Talofofo	Talofofo Garden Golf Course	0	0	18	0	18
Talofofo	Talofofo Golf Course	0	18	0	0	18
Tumon	Guam Plaza Driving Range	0	0	0	0	0
Upper Tumon	Matsuzato Guam Golf	0	9	0	18	27
Yigo	Guam Municipal Golf	0	18	0	0	18
Yigo	Pagat Pt. Memorial Golf	0	0	0	18	18
Yona	Coco Palms Golf Course	0	0	18	0	18
Yona	Guam First Green Golf Club	0	18	0	0	18
Yona	Manengon Hills Golf	0	45	0	0	45
Yona	YY Golf & Country Club	0	18	0	0	18
TOTAL		**54**	**243**	**90**	**36**	**423**

Source: Guam Bureau of Planning, 1992.

Absent a plan delineating a direction for economic growth on the island, it was necessary to produce a population model for the Land Use Plan that was based on a series of economic assumptions. These assumptions are:

a. That the current focus on tourism as a major economic player on the island will continue for a number of years.

b. That as a result of this focus, the projected population growth on Guam will be significantly impacted by the number of new hotel rooms to be built on the island.

c. That the impetus for economic diversity from local leaders will directly impact future population modeling that will necessitate an update of this population projection.

d. That the current model must correspond to population models currently being developed for other planning documents such as the Water Facilities Plan for Guam, the Highway Transportation Plan, Wastewater Treatment Plan and.etc.

Population and hotel room projections into the 21st century have been developed for the Department of Public Works as part of the Guam 2010 Highway Master Plan. Extrapolation of the 2010 Highway Plan projections to the Land Use Plan horizon year, 2015, indicates that the resident population of Guam in 2015 is expected to be approximately 263,000 permanent residents. This would indicate an increase of more than 130,000 persons over the next 25 years, or about a doubling of the current population. At the same time, the increasing number of hotel and condominium projects on the island illustrates the economy's growing reliance on tourism.

Utilizing similar extrapolation techniques based on the 2010 Highway Master Plan projections, Guam is likely to have approximately 19,000 hotel (tourist) units by 2015. This translates to a potential daily peak visitor population of approximately 32,500 tourists on the island, assuming a peak 95 percent occupancy rate and an average of 1.8 persons per room.

Determining where these new residents and tourists will live, shop, and work is the role of I Tano'-ta: The Land Use Plan for Guam.

AVAILABILITY OF PUBLIC FACILITIES AND SERVICES

One of the principal functions of government is to provide public services in the quantity and quality desired by the population being served. The Government of Guam has not always been able to accurately assess the levels of service it provides. This is due partly to the fact that the development of infrastructure has not always been tied to a projected level of growth and related standard(s).

For the Territorial Government to begin providing public services and facilities concurrent with the demand for these "public goods," the Land Use Plan proposes a systematic program to link and require future population growth (i.e., demand) with the adequate delivery of public services. The system, which is proposed to be incorporated into an overall Capital Improvements Program, is based on establishing, implementing, and monitoring appropriate levels of service for public facilities and services essential to improving the quality of life for the residents of Guam.

The purpose of incorporating public service coordination and standards into the Land Use Plan is three-fold: first, to insure that the provision of public services occurs at the proper level and at the proper time during the course of growth and development; second, to further the use of the delivery of public services as a positive planning tool; and third, to ensure that a tangible standard is set to measure the quality of life of the residents of the Territory. Through the use of these guidelines, the future growth (land use decisions) of the island can be guided through the provision of public facilities.

Public services and their facilities that have a direct effect on land use and are publicly managed are considered in the development of levels of services. These include park and recreation areas, public schools, police protection, fire/rescue services, transportation, wastewater treatment, potable water, solid waste, electrical power and health facilities.

The allocation of land uses in the Plan is based, to a large extent, on existing infrastructural conditions and planned remedial actions by the Public Utility Agency of Guam (PUAG) for the island's potable water and wastewater treatment systems, the Guam Power Authority (GPA) for the island's power generation system, and by the Department of Public Works (DPW) for the island's highway network. However, these have been utilized only to the extent that GovGuam agency proposed actions (plans) conform to the *overall* development criteria of the Land Use Plan.

The expansion of potable water and wastewater treatment systems and the improving and widening of roadways must be determined within the context of a rational land development policy. It makes little sense to propose an extension of sewer lines into an area where there is limited growth potential or serious environmental constraints. The Land Use Plan will provide the framework for guiding policy that will allow for the island to sustain additional growth.

Potable Water

Drinking water is obtained primarily from the northern water lens and from surface water sources in the south. The northern lens is the primary source of drinking water on Guam. The Northern Guam Lens Study, performed by the Guam Environmental Protection Agency in 1982, determined that an average of 112 million gallons of rainwater recharges the lens each day. This source could provide a sustained yield of approximately 60 million gallons of water per day (mgd). In 1991, groundwater supplied approximately 30 million gallons of water per day (including military consumption), or about 80 percent of the drinking water needs of the Guam population.

Preliminary studies have shown that significant sources of water are available in the northern portion of the island at Anderson Air Force Base. Currently, this property is not accessible to PUAG. These reserves may be separate from the rest of the aquifer in the northern lens. They are estimated to be able to supply sustainable yields of 18 mgd and are included in the 60 mgd estimate for the northern lens.

An additional concern of the northern lens is the concept of salt water intrusion. This concept describes the contamination of the northern lens by saltwater drawn into the aquifer by excessive water production at well sites. Current studies describe the aquifer as a connection of water troughs. The largest of these is referred to as the Yigo trough. Conventional theory assumed the northern lens was ubiquitous and that water was readily available from almost any location.

Existing Facilities

Potable water is provided to the island by the Public Utility Agency of Guam (PUAG). The agency meets Guam's water requirements in three major ways. These are through:

(1) Well production, primarily using the northern aquifer;
(2) Surface and spring supplies; and
(3) Water purchased from Navy and Air Force reservoirs.

There are currently 92 PUAG wells in operation, predominantly over the northern aquifer, which provides approximately 81 percent of the island's water supply. Surface supplies and springs, including Asan Springs, Santa Rita Springs, Geus River Dam, Siligin Spring, and Laelae (Piga) Spring, provide an estimated three percent of the overall water supply. The military supplies approximately 16 percent (four mgd) of the total daily island water needs. The Navy receives the majority of its water supply from the Fena Lake Reservoir system and the Air Force gets its water from the Tumon-Maui well and several other wells in the Marbo and Upper Marine Drive area. Presently, the U.S. Air Force, U.S. Navy, and private water systems withdraw over 16 million gallons per day from the northern aquifer.

Regional Water Service Areas

Public water service areas are delineated on FIGURE 3, and listed with their existing capacities in TABLE 4.

TABLE 4
EXISTING PUAG WATER CAPACITY BY SERVICE AREA

SERVICE AREA	WATER CAPACITY IN MILLION GALLONS
Regional Water Service Area "A":	5,500
Regional Water Service Area "B":	6,500
Regional Water Service Area "C":	1,000
Regional Water Service Area "D":	5,800
TOTAL CAPACITY:	**18,800**

Source: Barrett Consulting Group

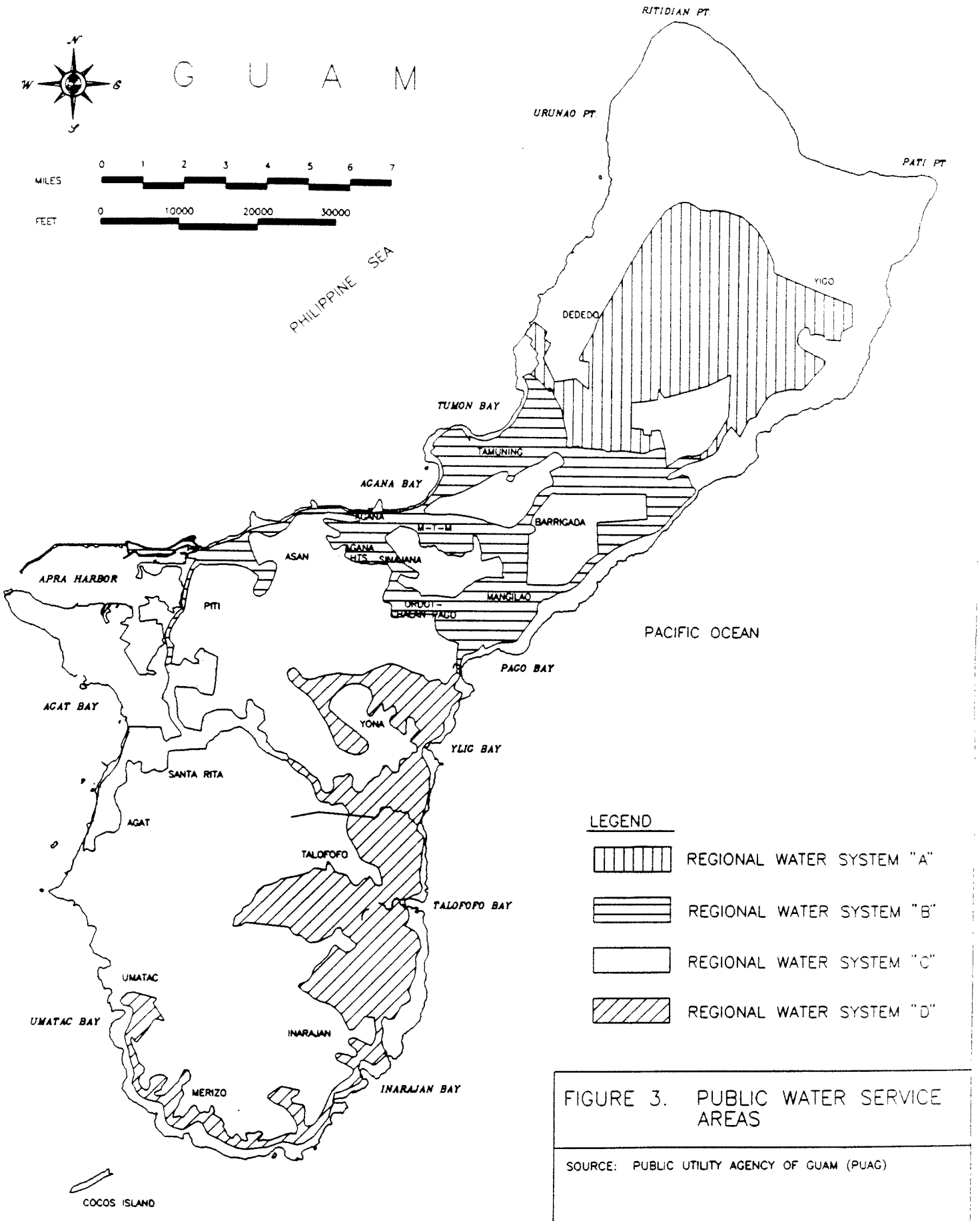


FIGURE 3. PUBLIC WATER SERVICE AREAS

SOURCE: PUBLIC UTILITY AGENCY OF GUAM (PUAG)

W.B.FLORES/STRATEGIC PLANNING GROUP JV

Guam is divided into four water service regions, "A" through "D" which are described as follows:

Regional Water Service "A", located in the northern portion of the island and including the communities of Yigo, Machanao (Agafa Gumas), Dededo, and Harmon Village, meets its water requirements through well production and purchased water from the U.S. Air Force. It contains no spring or surface supply sources.

Regional Water Service "B", situated in the north central portion of the island, includes the villages of Asan, Piti, Agana Heights, Sinajana, Chalan Pago-Ordot, Mongmong-Toto-Maite, Mangilao, Barrigada, and Tamuning, contains the Asan Springs facility. This facility, originally constructed in 1929, has a storage capacity of 30,000 gallons, and also includes several wells. Production pumps run continuously, supplying the Chaot Reservoir.

Regional Water Service "C", including the Agat-Santa Rita area, contains one major water facility, the Santa Rita Springs. This facility has a storage capacity of 105,000 gallons. Additional water requirements in this area are met by water purchased from the U.S. Navy via the Fena Reservoir.

Regional Water Service "D", serves the southern portion of Guam, including Yona, Talofofo, Inarajan, Merizo, and Umatac, and has historically been supplied by streams and springs for their water supply. However, most of these production facilities do not provide adequate treatment for available water supplies. Often, water pressure is inadequate due to power supply limitations and a lack of backup power supplies. Imported northern groundwater augments water supplies for the southern villages.

The Military Water System

The Navy's major water supply source is Fena Reservoir, located in the Naval Magazine area. This reservoir has a capacity of approximately 2.3 billion gallons. In addition, the Navy operates three wells in the Navy Communication Station - Finegayen area. In a 1956 agreement with the Government of Guam, the Navy committed itself to provide a portion of its water supply for Government of Guam use.

The northern groundwater lens is the Air Force's sole source of potable water. Their major facility is the Tumon-Maui well located in upper Tumon. Water is pumped to a reservoir in Dededo that has a capacity of 250,000 gallons. Additional wells are located in the Air Force Marbo Annex area and along Marine Drive. The Air Force and PUAG have discussed a trade in which the Air Force would acquire PUAG water from wells close to Andersen Air Force Base in exchange for its southern area sources, but an agreement has not yet been reached.

Water Consumption and System Capacity

The major problem with the water system, and the major reason for the system's reliance on the military supply for water supplements, is the unaccounted loss of large amounts of water. The primary cause for this loss (which may be as much as 30-40 percent of total water production) is the age of the water lines. Improvements to water lines along the island's roadways have been made as the roadway system has been upgraded. According to the 1990 Preliminary Water Master Plan Update, prepared by Barrett Consulting Group, the loss rate could be reduced to 15 percent by the year 2010 if comprehensive leak detection, meter maintenance, and water conservation programs are implemented.

Due to rapid growth over the last decade, annual water production (consumption plus water loss) has more than doubled - from four billion gallons in 1979 to almost nine billion gallons in 1989. The island-wide existing capacity of the PUAG system is more than 18 billion gallons. Current shortages are caused by the inefficiencies in the existing delivery system and are not due to a lack of available supply on the island. However, additional capacity will be required to meet the demand of pending and proposed major development projects.

According to the Guam Environmental Protection Agency, the northern water lens may have a production capacity of approximately 58-60 million gallons per day (mgd), while 1991 production is about 30 million gallons per day. Additional wells in this area will need to be developed in the future. However, past studies have suggested that the lens may be susceptible to significant saltwater intrusion if sustained yields reach 50 mgd. Approximately 18 mgd of yield from this lens is located under Andersen Air Force Base. PUAG does not have wells operating in this area of the island. Thus, the available supply to PUAG may only be in the 40-42 mgd range.

However, with significant additional yields, the potential for salt water to be drawn in and contaminate the groundwater (which supplies more than 80 percent of the overall water needs) is increased. An additional source of potential contamination is provided by the use, storage, and leakage of chemical substances anywhere that overlies the potable water supplies.

Two of PUAG's larger projects to develop new water sources for the island are, in the north, improvements to Yigo/Dededo water sources and, in the south, the utilization of the Ugum River as a reservoir. This reservoir is a primary surface water source for the Inarajan/Malojloj areas which began operating in late 1992.

PUAG has embarked in the identification of surface water alternatives and has contracted Barrett Consulting Group to conduct a Surface Water Study. The study, scheduled to be completed in late 1993, will provide a prioritization of surface water opportunities to supplement the potable water resources in the northern aquifer. These opportunities will focus on improving water service in the south and surrounding areas.

The development of surface water supplies has expanded over the last decade to a point where they have assumed a greater share of the overall water supply for the island. For example, in 1990 approximately 20 percent of the total island-wide water consumption was supplied by surface water supplies as compared to less than 10 percent of surface water supplies in the 70s. This trend is expected to continue as PUAG searches for other means to curtail the consumption rate from the northern aquifer and augment the total island-wide water supply with surface water sources from the southern areas of the island.

Nevertheless, the bulk of future sources are most likely to originate in the northern lens. Southern surface water sources are very expensive to develop, are particularly susceptible to droughts and are not seen as being as reliable as groundwater sources.

Residential users account for the largest share of water consumption. They consume 68 percent of PUAG's overall water demand. Commercial users account for the second largest group of consumers absorbing approximately 21 percent of total demand. Government and agriculture utilize the remaining 11 percent of average daily water consumption. (It should be noted that for the purposes of this breakdown of water use by type, hotel consumption is included in the commercial figures.).

The per capita level of service use, according to the Preliminary Water Master Plan Update, varies from 99 gallons per capita per day (gpcd) to 138 gpcd (excluding unaccounted-for water), with hotel water consumption estimated at a typical rate of 450 gallons per room per day. Golf courses are estimated to consume approximately 1,000 gallons of water per day for each hole. Based on the total number of existing, approved, and pending golf course holes (shown in Table 3), this would require approximately 387,000 gallons per day of additional water for irrigation purposes.

Wastewater Treatment and System Capacity

Sewage treatment services are provided by PUAG. There are eight major wastewater treatment plants that serve the island: the Agat, Agana, Baza Gardens, Umatac, Commercial Port, the Northern District (Dededo), and the Inarajan treatment plants. There is only one private wastewater treatment plant currently operating, this facility serves the Pago Bay Estates area. Fifty-five pump stations support this treatment system.

Public wastewater treatment service is provided to most of the more urbanized areas of the island. The service areas are shown in FIGURE 4. All of the existing treatment plants provide the minimal primary treatment process to effluent required by the U.S. Environmental Protection Agency. All plants have direct ocean outfalls except for Inarajan, which provides a land application process; Baza Garden, which discharges into a local stream that ultimately flows into the ocean; and Umatac, which also employs a land percolation process.

The rapid increase in population and hotel construction during the 1980s has, in some areas, overwhelmed the capacity of the wastewater collection and treatment system. Problems exist not only in the capacities of the treatment facilities to properly treat the effluent, but also in the capacities of the collection systems to transmit the flow of wastewater to the treatment plants.

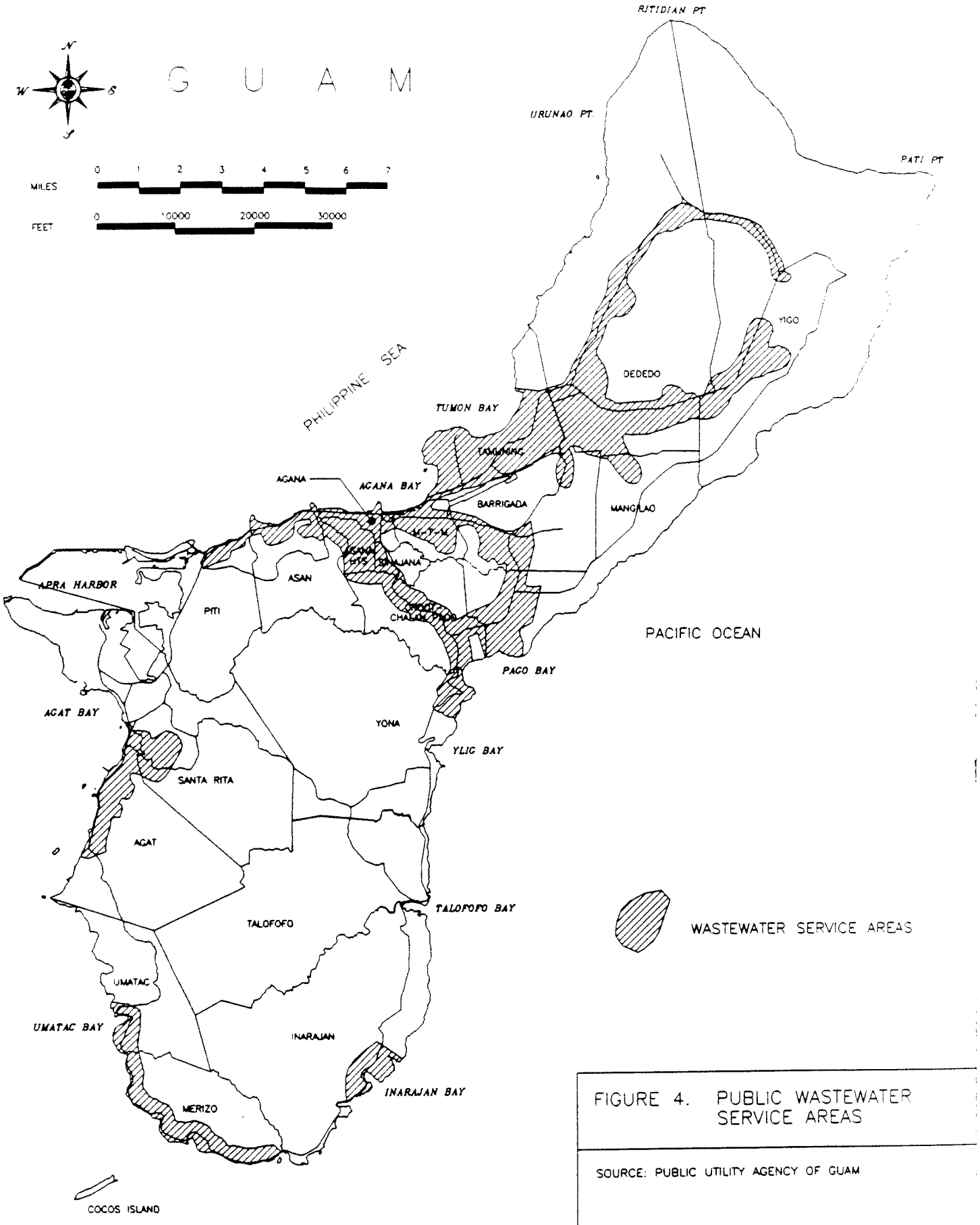


FIGURE 4. PUBLIC WASTEWATER SERVICE AREAS

SOURCE: PUBLIC UTILITY AGENCY OF GUAM

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This is especially true in the Tumon-Tamuning area, where untreated or poorly treated sewage effluent has overloaded the collection system and periodically overflowed onto streets and ultimately into the coastal waters of Tumon Bay. The problem was compounded during periods of heavy rainfall, when infiltration and inflow of stormwater into the collection lines quickly exceeds the capacity of the pipes. This situation has been alleviated through the Northern District Sewage Reversal Project. This process entails transferring the sewage flow from the Tumon-Tamuning area which flowed to the Agana plant, operating far above capacity, to the under-utilized Northern District wastewater treatment plant. More than three mgd of wastewater has been diverted to flow to the northern plant. The Agana plant is now operating at 75 percent of its capacity.

Another problem area is the Agat wastewater plant, currently operating well beyond its design capacity. The situation is exacerbated by significant inflow from stormwater on wet days and infiltration from groundwater caused by tree roots breaking the pipes. Localized flooding problems around the Umatac and Inarajan treatment plants frequently result in failure of the land application effluent disposal process, which increases the discharge of poorly treated effluent to coastal waters. Degraded water quality has been documented in areas served by ocean outfall points, including Agana Bay, Tanguisson, Apra Harbor and Agat.

It is recommended that when average daily flows reach 90 percent of treatment plant design capacity, no further development be allowed to connect into the plant system. This guarantees at least a 10 percent reserve capacity to treat potential fluctuations in flow rates. Based on this standard, the Agat and Commercial Port facilities are already at capacity, while the Agana and Umatac treatment plants have limited remaining capacity to handle significant additional growth, as indicated in *Table 5*.

TABLE 5
PUBLIC WASTEWATER TREATMENT PLANTS

TREATMENT PLANT	DESIGN CAPACITY	CURRENT TREATMENT (AVERAGE DAILY FLOW) (GPD)	TREATMENT/CAPACITY RATIO
Agat	750,000	1,200,00	160%
Agana	12,000,000	9,000,000	75%
Baza Garden, Talofofo	600,000	200,000	33%
Umatac	500,000	400,000	80%
Commercial Port	20,000	20,000	100%
Northern District	12,000,000*	6,000,000	50%
Inarajan	91,300	40,000	44%
Naval Station	3,200,000	- - -	- - -
TOTAL	**29,161,300**	**16,860,000**	

Note: * Approximately 4 mgd of capacity at the Norther Plant is reserved for military needs.

Source: Public Utility Agency of Guam, 1991 and the U.S. Navy (Ralph Mesa), 1993.

An increase in development proposals in areas not currently serviced by PUAG (for example, Talofofo, Yona, and portions of Mangilao) has resulted in many of these projects being allowed to develop individual wastewater treatment plants to serve individual developments. However, this will make eventual connection of these developments into a centralized wastewater treatment system more difficult and costly.

The amount of treated effluent is based on daily flow levels through the plants. Actual measurements of flows through the system are difficult to ascertain. However, general engineering standards estimate that between 80 and 90 percent of water consumption is returned through the wastewater collection system as effluent. Both PUAG and GEPA estimate that approximately 85 percent of metered water consumption returns through the wastewater collection system. Applying this standard to the range of per capita metered water consumption rates identified by the Water Master Plan Update (99-138 gpcd) yields an estimated wastewater treatment level-of-service range of 84-117 gpcd for planning purposes.

The amount of wastewater treated in the last three years has grown from an average of almost 13 mgd in 1989 to almost 17 mgd in 1991, while total treatment plant capacity has remained unchanged at approximately 26 mgd, as shown in Table 5. A faster then expected growth rate has outpaced the availability of new treatment facilities and, based on current trends, this is causing problems at the Agat and commercial port plants. PUAG is moving forward on a proposal for a new 9-12 mgd wastewater treatment plant in Agat to replace both the existing public facility and the Naval Station Wastewater Treatment Plant in order to upgrade effluent treatment to the secondary level. It is also likely that a new plant will be necessary to serve proposed development in the Mangilao and Pago Bay areas.

As the island continues to grow, the upgrading of the overall system will become increasingly important. PUAG's top priority future projects include the Baza Gardens Sewer Treatment Plant Modifications, Agat/Santa Rita Sewer System: Phase One, Agat/Santa Rita Sewer System: Phase Two, and the development of the Talofofo Village Sewer System.

ENERGY

Existing Facilities

The Guam Power Authority, GPA, provides most of Guam's power supply. In 1992, GPA served 36,364 customers. Generation, transmission, and distribution facilities are operated by GPA and the Navy. According to an agreement made between the Navy and GPA, the Navy became a transmission level customer of GPA on August 1, 1992.

There are three existing GPA operated generation plants, Cabras, Tanguisson, and Dededo, one Navy-operated generation plant in Piti. Nine GPA substations, Agana, Apra Heights, Barrigada, Dededo, Harmon, Macheche, Talofofo, Tamuning, and Tumon, provide power to the island. Three new generation plants are being constructed in Dededo, Marbo and Manengon. The Dededo and Marbo plants are scheduled to be completed in February, 1994. The Manengon plant is being built by the developers of the Manengon Hills Resort Community and will be energized in March 1994, after which time the generator will be turned over to GPA.

Total energy consumption increased by over 68 percent from 1980 to 1990. Increased demand for power from residential and commercial growth generated a peak demand for 206 mega watts (MW) in 1990. In 1992, the demand peaked at 240 MW compared to the total system capacity of 307 MW.

Guam experienced unprecedented growth during the late 1980s into the early 1990s which translated into an increase demand for energy consumption. Without additional capacity added to meet this power demand, GPA's ability to maintain a consistent power supply was negatively impacted. During 1992, power outages were common due to maintenance problems with some power-generating units and the need for "load shedding" occurred during peak demand periods. Limited back-up power systems on-island pose problems when major generating units are unable to meet the demand, interrupting public, private and any operation dependent on power.

Based on projected population growth, increase in tourism and military development, GPA anticipates that the demand for electrical energy for future needs will require a new base load generating station on Guam. GPA's peak electrical load is over 240 MW. The load growth in 1989 -1991 was approximately eight percent per year. Projected forecast for 1992-1993 is expected to taper to a growth of six percent, with 1995 at 4.4% and 1996- 2000 at 2.6%.

Future growth is expected to stabilize at this rate for the next decade. In order for GPA to meet this demand without any interruptions in service, the power system should have a reserve capacity between 60 percent to 70 percent. The reserve capacity will make up the generation short-fall should the two 66 MW Cabras units be down simultaneously for any reason.

As mentioned, to meet the future power supply needs of the island and to replace the old facilities, GPA plans to build a new baseload generation facility. Efforts to identify potential sites for this new facility are underway. Because of the unique features of power plant facilities (i.e. resource requirements and waste production), determining a site must include these specific criteria as well as careful consideration of surrounding land uses.

GPA conducted a study to investigate potential sites for a new baseload generation facility. The study team made a preliminary selection of general sites south of Cabras Island along the coastal area of Rizal Beach and Facpi Point. These areas are identified and recognized in the I Tano-ta Land Use Plan to show the efforts of GPA to locate potential sites for a baseload generation facility needed for Guam's future energy needs.

Roadways / Mass Transit

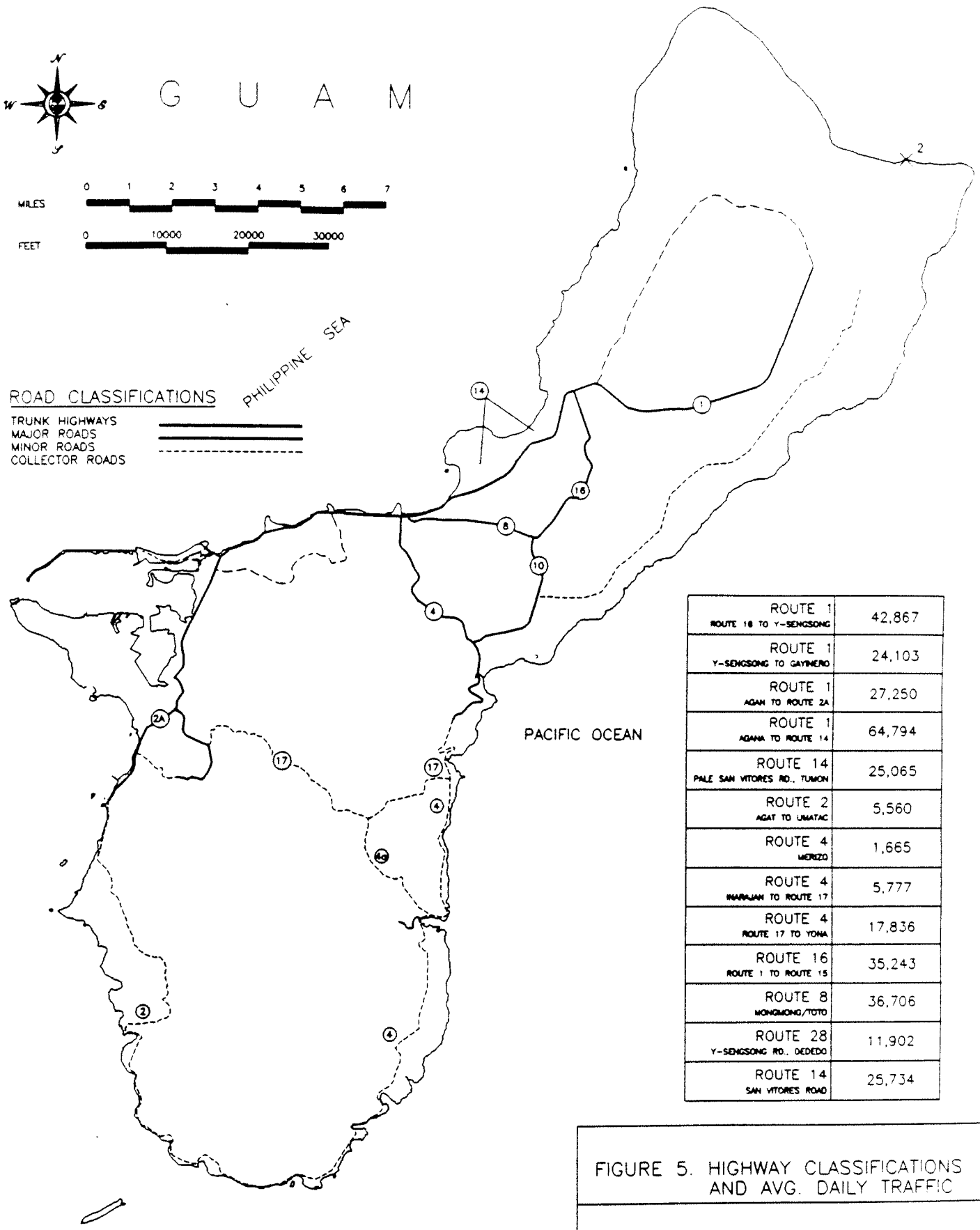
There have been several proposals to deal with the rapid increase in traffic levels. These include the widening of existing roads, constructing new roads, as well as considerations to reroute traffic flows. The most significant of the proposals is probably the development of the Cross-Island Expressway, an idea that has been talked about for many years. However, to truly come to grips with traffic problems, it will be necessary for the adoption and implementation of a Land Use Plan that calls for less reliance on the private automobile. To simply widen and improve roadways does not really solve traffic problems. In the final analysis, it only perpetuates them.

Functional Classifications of Streets and Highways

Guam's street and highway network is divided up into four types of roadway: trunk highway, major highway, minor highway, and collector road. A trunk highway, such as Route 1 (Marine Drive), connects major population centers and traffic generators and carries large volumes of traffic for long distances. A major highway, including Routes 7A and 10, connects major population centers and traffic generators to small population centers and carries moderately high volumes over long distances. A minor highway, Route 4, for example, from Umatac to Yona, connects smaller communities and traffic generators to trunk and major highways and carries moderate volumes of traffic. A collector road, such as Routes 14 and 14A, links traffic from residential, industrial, hotel, and institutional areas to trunk, major, or minor highways and generally carries light to moderate volumes. *Table 6* below describes the island's existing street and highway network by road classification and number of lanes.

Traffic Management

An island-wide Highway Master Plan was undertaken in 1991 - 1992 by the Department of Public Works (DPW). The Highway Master Plan will recommend specific improvements necessary to maintain an efficient level of service for the Territory's roadways. 1991 Average Daily Traffic Counts (compiled by DPW) are shown in FIGURE 5 and indicate some of the existing conditions found on Guam's highway network.



ROUTE 1 ROUTE 16 TO Y-SENGSONG	42,867
ROUTE 1 Y-SENGSONG TO GAYINERO	24,103
ROUTE 1 AGAN TO ROUTE 2A	27,250
ROUTE 1 AGANA TO ROUTE 14	64,794
ROUTE 14 PALE SAN VITORES RD., TUMON	25,065
ROUTE 2 AGAT TO UMATAC	5,560
ROUTE 4 MERIZO	1,665
ROUTE 4 MARAJAN TO ROUTE 17	5,777
ROUTE 4 ROUTE 17 TO YONA	17,836
ROUTE 16 ROUTE 1 TO ROUTE 15	35,243
ROUTE 8 MONGMONG/TOTO	36,706
ROUTE 28 Y-SENGSONG RD., DEDEDO	11,902
ROUTE 14 SAN VITORES ROAD	25,734

FIGURE 5. HIGHWAY CLASSIFICATIONS AND AVG. DAILY TRAFFIC

SOURCE: DEPARTMENT OF PUBLIC WORKS

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TABLE 6
ROAD CLASSIFICATIONS AND LANES PER ROAD

ROAD	NUMBER OF LANES
Trunk Highways:	
Route 1 (Santa Rita to Agana)	4
(Agana to Dededo)	6
Major Highways:	
Route 1 (Dededo to Yigo)	4
Route 2A	2
Route 2 (through Agat)	2
Route 4 (through Yona)	4
(Yona to Route 10 [Chalan Pago])	2*
(Route 10 to Route 7A [Agana])	4
(Route 7A to Route 1 [Agana])	6
Route 5	2
Route 10 (Chalan Pago to Barrigada)	4
Route 11	3**
Route 16	4
Route 7	2
Route 8 (Route 1 [Agana] to Route 7A [Maite])	4
(Route 7A [Maite] to Bunny Hardware [Maite])	6
(Bunny Hardware [Maite] to Route 10 [Barrigada])	4
Rt. 7A (Route 7 [Agana Hghts.] to Latte Stone Park)	2
(Latte Stone Park to Route 4 [Agana])	4
(Route 4 to Route 8 [Maite])	3**
Minor Highways:	
Route 2	2*
Route 4 (Umatac to Yona)	2
Route 3	2
Route 9	2
Route 12	2
Route 4A	2
Route 17	2
Route 6 (Route 1 (Piti) to Nimitz Hill [Asan])	4
(Nimitz Hill to Route 1 (Agana)]	2
Route 15	2
Route 27	2

TABLE 6 (continued...)
ROAD CLASSIFICATIONS AND LANES PER ROAD

ROAD	NUMBER OF LANES
Collector Roads:	2*
Route 10A	6
Route 14 (Route 1 [Tamuning] to Flores Circle)	4
(Flores Circle to Route 1 [Upper Tumon])	2
Route 14A	2
Route 14B	2
Route 30	2
Route 30A	2
Route 29	2
Route 32	2
Route 33	2
Route 34	2
Route 28	2
Route 26	

Note: Does not include center turn lanes.
* Climbing lanes provided on uphill sections.
** Two eastbound lanes; one westbound lane.

Source: Department of Public Works and Wilbur Smith Associates, Oct. 91.

The most heavily travelled routes are located in the most heavily urbanized areas of the island (as is to be expected) and include:

- Marine Drive (Route 1) between Agana and Tamuning, where approximately 60,000 vehicles - or about 60 percent of the total number of vehicles registered on Guam in 1990 - travel through this section on a daily basis.
- Marine Drive (Route 1) between Asan and Piti, where almost 30,000 vehicles pass through every day.
- San Vitores Road (Route 14) in Tumon, which handles more than 25,000 vehicles per day.
- Route 8 in Mongmong-Toto, which experiences almost 25,000 vehicles per day.
- Route 16 from Barrigada to Mangilao, which funnels more than 21,000 commuting vehicles every day to and from work places in Agana and Tumon-Tamuning.

The northern section of the island is also experiencing a significant traffic increase, most notably in Yigo on Marine Drive (Route 1) ,where over 18,000 vehicles pass through the area daily, and in Dededo on Route 28 (Y-Sengsong Road), where approximately 12,000 daily vehicle trips have been recorded.

Proposed development in Mangilao and Yona will place additional demand on expanding Route 4, which currently serves more than 11,000 vehicles per day but is projected to increase significantly over the next ten years.

The least traveled routes are in the southern sector of the island, including the Agat/Umatac Road (Route 2), which recorded less than 3,000 daily vehicle trips, and Route 4 in Merizo, which experienced only 2,000 daily trips.

A series of improvements to the island's circulation system are planned by DPW. These projects include the construction of new access roads in areas of Agat , Yigo, and Inarajan, the reconstruction of several roads, including San Vitores Road in Tumon, new sidewalks in the areas of Agat, Dededo, and Chalan Pago-Ordot, new signalization and streetlights on various streets, and maintenance of roadways island-wide.

Mass Transit

Guam's mass transit system, the Guam Mass Transit Authority (GMTA), was created in 1985. As of 1990, the GMTA has 14 buses running five scheduled bus routes serving the 19 villages. 1990 ridership was approximately 103,000 people comprised of the following groups: 42 percent elderly, 33 percent full fare passengers, three percent children, 21 percent handicapped, and one percent students. The system's cost is $0.99 per mile for the operation of nine vehicles compared with the U.S. average of $0.72 per mile.

GMTA's future plans for expansion include a feasibility study for a monorail in the Tamuning-Tumon area, island-wide bus shelter construction, and a bus transportation center.

Other important components of Guam's mass transit system are the taxis, tour buses, and shuttles (operated by tourist-oriented commercial and entertainment outlets), which provide tourists with other transportation options throughout the island.

Public Safety (Police, Fire, and EMS)

Police Services

Three police precincts serve the island, including the Southern precinct located in Agat, the Central (main) precinct located in Agana, and the Northern precinct located in Dededo. There are two substation, styled after a Japanese "Koban", located in Tumon on Hotel Row and Farenholt, Camp Watkins. Future plans for expansion include new "Koban"-type police boxes in Chalan Pago-Ordot, Mangilao, Yona, and Inarajan, and new substations in Dededo, Talofofo, Agat, and Tamuning.

According to the Guam Police Department, Guam's 1990 crime statistics are well below those of comparable sized cities on the United States mainland. The 1990 crime rate generally kept pace with the island's population increase. The population grew 2.7 percent from 1989, while the Uniform Crime Report (UCR) rate grew 2.4 percent per 1,000 population increase. Total crimes have risen slightly from 1985 to 1990 while violent crimes generally held steady. Crimes such as rape and assault increased, while the murder rate decreased.

At present, there are 330 officers in the Guam Police Department serving a total resident population of 133,152. This reflects a level of service of 2.8 police officers for every 1,000 permanent residents.

Adult Correction

The Department of Correction's Adult Correction Facility is located on Dairy Road in Mangilao. The facility has a design capacity of 78 inmates. In 1992, the facility was far beyond capacity with 223 individuals imprisoned. The Department has initiated the introduction of a bill into the Guam Legislature to study the feasibility of a new facility.

The new study will identify alternative sites for the facility. The area where the existing facility is now located continues to an increase in its residential population. Community residents have expressed grave concerns over the increasing prison population and for the facility to be located to an area that is less populated.

Youth Correction

Youth Correction is administered by the Department of Youth Affairs at their facility in Mangilao. The Youth Correction Facility is badly outdated and overcrowded, according to the Department. The existing facility has a design capacity of 24 male beds and 18 female beds. During peak periods, the facility houses double the design capacity (approximately 50 males and 40 females).

A master planning effort is currently underway and a major new facility is proposed. Construction was tentatively scheduled to begin in 1992. The new facility will have a capacity for 100 males and 60 females. The new facility is proposed to be built at the same location as the existing one, although other sites are being sought for possible consideration. Other youth correction facilities include two small cottage homes in Talofofo (one housing eight males, the other accommodating eight females) and three sanctuary shelters (two in Mangilao and one in Dededo) serving 31 clients.

Fire Protection and Emergency Medical Services

The Guam Fire Department serves the island with eleven fire stations. There are 273 certified firefighters in the Fire Department with 17 additional firefighters to be added in the near future. With a 1990 total resident population of 133,152 this translates into an existing level of service of 2.18 firefighters for every 1,000 residents.

There are two civilian search and rescue facilities on Guam - one at the Agana Boat Basin and the second at the Agat Marina. Emergency Medical Technicians and ambulance services are housed and dispatched out of the fire stations. There are nine active ambulances and two on standby status.

Future plans for expansion include a fire station in Yigo, near Anderson Air Force Base, on Route 3. This station would serve the proposed 1,000 unit Astumbo community housing project.

In addition to the facilities and services described above, federal fire and emergency services are available and have been used extensively for civilian emergencies. These services include U.S. Coast Guard, Navy, and Air Force personnel.

All firefighting on the island's military property is performed by either federally employed civilian or military firefighters. Guam's Fire Department personnel do not provide these services to military bases.

Schools

The delivery of educational services is one of the most important responsibilities the Territorial Government has to its citizens. Providing the opportunity for an adequate education has become one of the foundations for sound economic development policy. Producing a work force with the educational background to compete locally (Guam), regionally (Micronesia), nationally (United States), and internationally (Asia), will be one of the great challenges facing Guam during the next decade. Attending the University of Guam or other U.S. universities after completing compulsory elementary and secondary education is one of the most advantageous opportunities available to many young residents. Job skills,

vocational training, and higher education opportunities all rely on a fundamental quality public education system at the elementary and secondary level.

There are 34 public schools, 23 elementary schools, six middle schools, five high schools, and one special education school located on the island. The public schools are under the jurisdiction of the Department of Education and the Territorial Board of Education. Many of the public school facilities in Guam are illustrated in FIGURE 6.

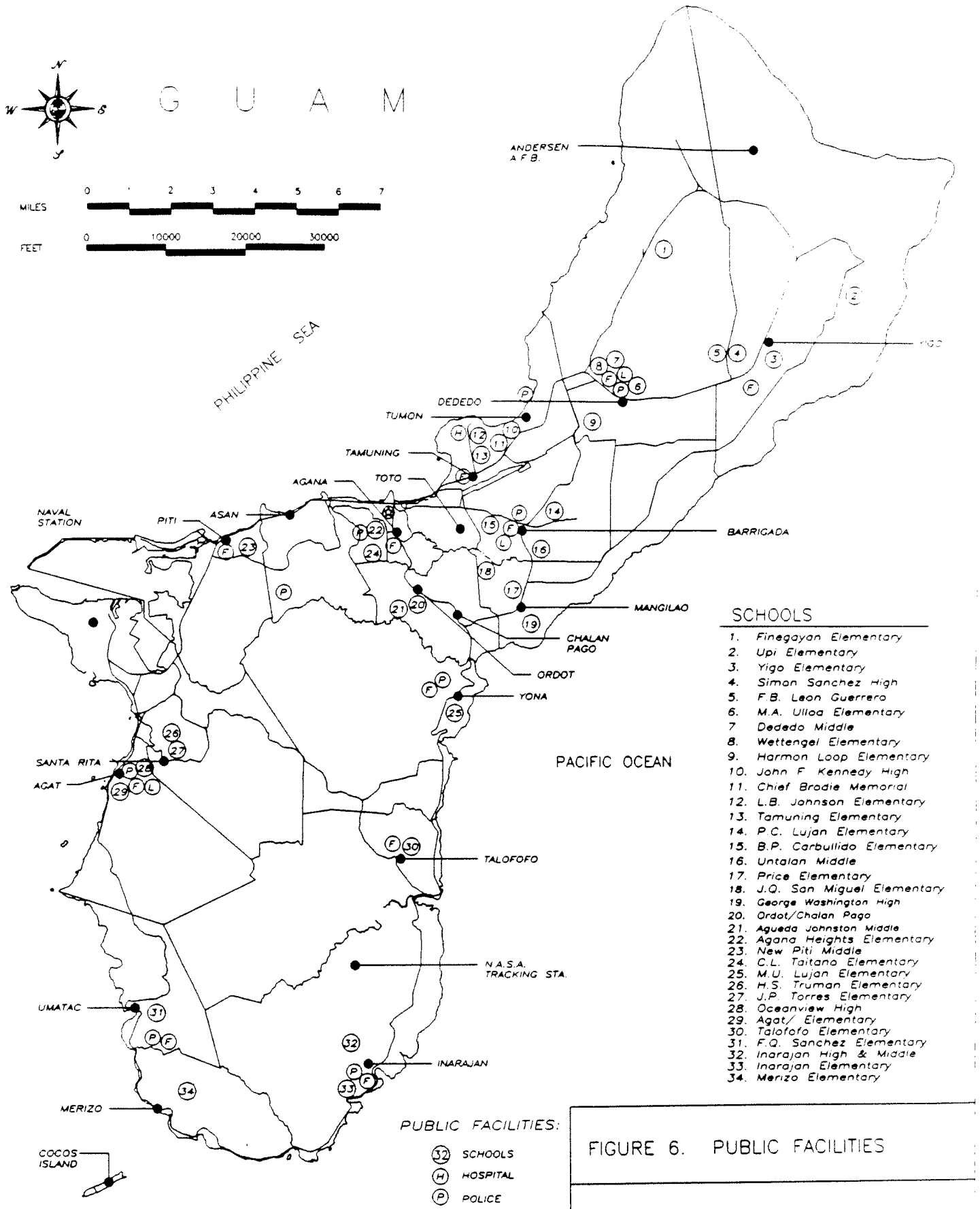
Immigration to the island has taxed the school system to the point where classroom overcrowding has been recognized as a significant problem. Responding to this problem, a new Central Elementary school is planned and two new high schools have been approved for construction, one for the northern sector of the island and one for the southern municipalities.

In the interim, numerous temporary classrooms have been constructed to meet the required student/classroom ratio. However, according to island residents, parents, students, and teachers, the problem is that the temporary structures tend to become "permanent". These temporary/permanent structures do not adequately meet the needs of the students and teachers and, furthermore, do not ease the strain on other school facilities, such as recreational facilities, cafeterias, and etc.

Public school enrollment has maintained a relatively stable population over the last five years. Total elementary and secondary enrollment topped 26,000 students in 1990. Projections from the Guam Department of Education indicate an increase to approximately 36,000 public school students by the year 2010.

The University of Guam and Guam Community College, both located in Mangilao, serve as the island's postsecondary institutions. The University offers programs in four different colleges: the College of Agriculture and Life Sciences, the College of Business and Public Administration, the College of Education, and the College of Arts and Sciences.

The University enrollment has exceeded 2,000 students during each of the past five years. The facility serves a wide range of students from throughout the Pacific Rim, including the U.S. mainland, Micronesia, the Philippines, Korea, Japan and China.



SCHOOLS

1. Finegayan Elementary
2. Upi Elementary
3. Yigo Elementary
4. Simon Sanchez High
5. F.B. Leon Guerrero
6. M.A. Ulloa Elementary
7. Dededo Middle
8. Wettengel Elementary
9. Harmon Loop Elementary
10. John F. Kennedy High
11. Chief Brodie Memorial
12. L.B. Johnson Elementary
13. Tamuning Elementary
14. P.C. Lujan Elementary
15. B.P. Carbullido Elementary
16. Untalan Middle
17. Price Elementary
18. J.Q. San Miguel Elementary
19. George Washington High
20. Ordot/Chalan Pago
21. Agueda Johnston Middle
22. Agana Heights Elementary
23. New Piti Middle
24. C.L. Taitano Elementary
25. M.U. Lujan Elementary
26. H.S. Truman Elementary
27. J.P. Torres Elementary
28. Oceanview High
29. Agat/ Elementary
30. Talofofo Elementary
31. F.Q. Sanchez Elementary
32. Inarajan High & Middle
33. Inarajan Elementary
34. Merizo Elementary

FIGURE 6. PUBLIC FACILITIES

SOURCE: DEPARTMENT OF COMMERCE
DEPARTMENT OF EDUCATION

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The Guam Community College is located immediately adjacent to the University of Guam. It offers a wide variety of programs, ranging from high school to adult extension and a two year college program. Recreational facilities are limited. The gymnasium, the major recreational facility at the college, is available to the public by prior arrangement only. Plans have been prepared for a new Community College campus near the site of the present facility on a 312 acre site owned by the Government. Detailed designs for the first phase of construction are expected to be completed in late 1993 or early 1994.

Starting in the 1970s, the increased demand for educational services resulting from immigration (especially other Pacific Islands and Southeast Asia), placed a tremendous burden on the Government's ability to provide schools, supplies, teachers, administrators, and support staff. Such has been the case that non-public educational services have helped to meet the demand for elementary and secondary education. As overcrowding spread out to many of the older public schools, the average classroom size increased, portable classrooms were rented or purchased, vandalism increased and the delivery of quality education was impacted. At the same time, socioeconomic factors were at work. A rise in the number of school-age children was experienced, especially those in single-parent households.

One consequence of this situation was that many parents began choosing non-public schools for their children. In 1980, non-public (i.e., private, parochial) school enrollment accounted for 12 percent of total student enrollment in the Territory. By 1990, the share of students attending non-public schools in Guam rose to 17 percent of the total student population. The fastest growing group in the private school sector were kindergarten and pre-school (day care) aged children.

Recreational Facilities

There are several different types of recreation and open space facilities on the island: national parks, territorial parks, natural preserves (which are to remain unimproved), conservation reserves (which can be improved to provide access to park users while still preserving natural features), historic sites, community parks, territorial recreation facilities, and community recreation facilities.

The national parks - the six parks designated as units of the "War in the Pacific National Historic Park" - are administered by the United States National Park System. These include the Asan Beach, the Asan Inland, the Mt. Tenjo/Mt. Chaochao, the Mt. Alifan, the Agat, and the Piti Guns Units. At the present time, the parks are not fully developed and not all have facilities available to the public.

The Territorial parks, natural preserves, conservation reserves, and historic sites come under the jurisdiction of the Department of Parks and Recreation. The remaining recreation facilities are managed by the appropriate village mayors. These parks and facilities are illustrated in Figure 7.

There are eleven major beach parks and numerous other scenic vista points and places of interest, including Ypao and Tanguisson Beaches in the north, and Talofofo, Saluglula, Merizo and Nimitz Beach Parks in the south.

Major projects planned by the Department of Parks and Recreation include the Dededo Sports Complex, the Inarajan boat ramp, a Speedway Park, and island-wide improvements to various sports facilities as well as Nimitz Beach in Agat The expansion to the Paseo recreation area in Agana has been completed.

As Guam's population continues to grow, new parks will have to be provided. The following Department of Parks and Recreation standards apply to new subdivisions of twenty or more units. There are four major park types: play lots (2,500 sq. ft. to one acre in size), vest pocket parks (also 2,500 sq. ft. to one acre), neighborhood parks (five acre minimum size), and district parks (20 to 100 acres in size).

Parks should be provided at one acre per 50 dwelling units or one acre per 43,560 square feet of building. Generally, parks should be geographically centered to the greatest extent possible within the development to provide greater access to all dwelling units (unless beach property or some other significant natural feature is utilized).

All parks should be deeded in fee simple to the Government of Guam Department of Parks and Recreation. Recreational facilities, ranging from play and picnic areas to swimming pools and baseball diamonds, are also required. Locating a park adjacent to a school site, such as a neighborhood park next to an elementary school or a district park next to a junior or senior high school, allows a developer to count some of the school's recreational facilities towards park facilities requirements.

PORT FACILITIES

Airport

The Guam Airport Authority, GAA, oversees all non-military air operations at the Guam International Airport. The GAA currently leases portions of the airfield facilities from the U.S. Navy through the Naval Air Station air operations command. Recent efforts to turn over the entire naval facility to the Territorial Government are slowly reaching fruition and development pressures in and around the surrounding areas are becoming evident.

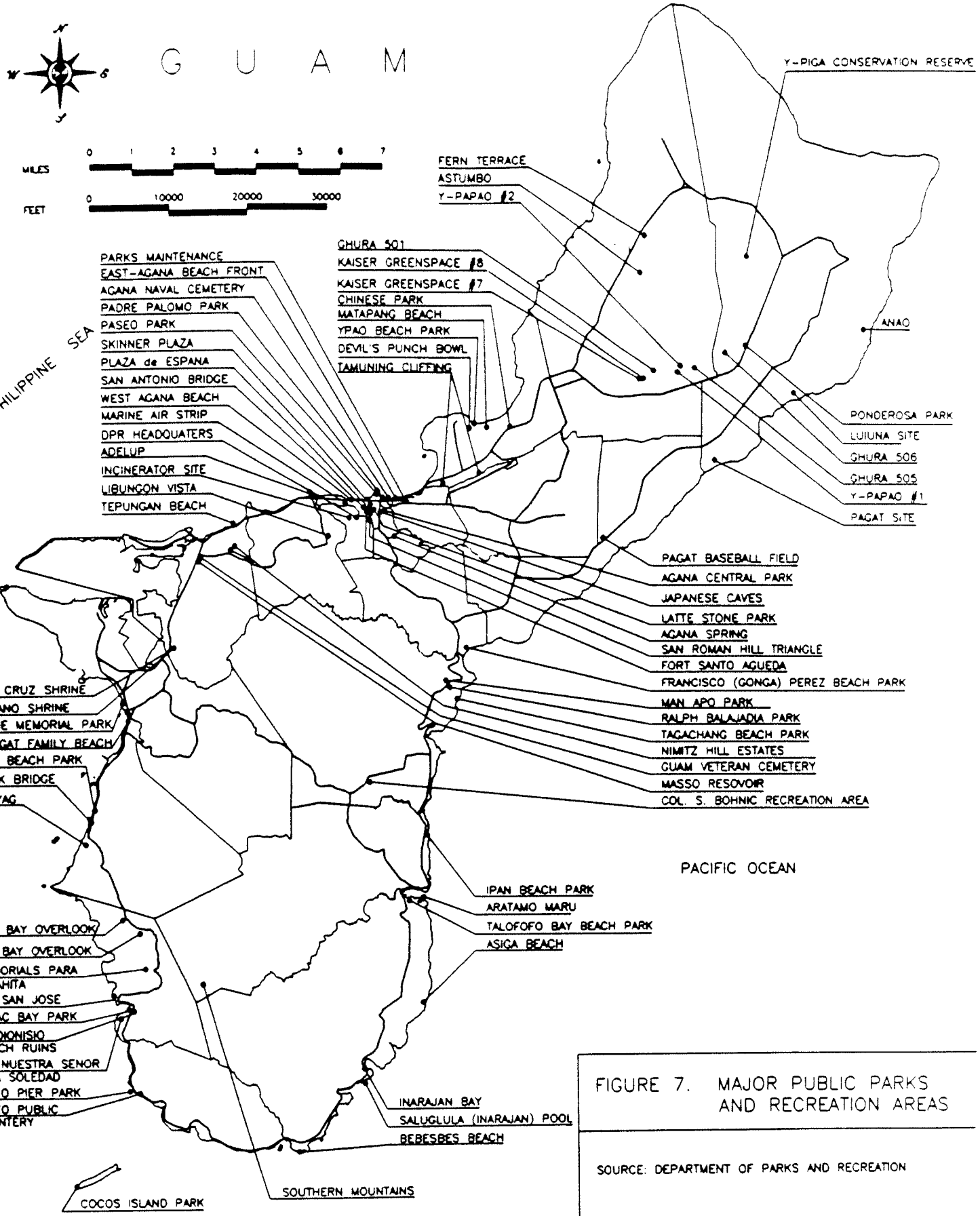

FIGURE 7. MAJOR PUBLIC PARKS AND RECREATION AREAS

SOURCE: DEPARTMENT OF PARKS AND RECREATION

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In anticipation of a final and complete reversion of NAS Agana to the local government, steps have been taken to initiate planning for various land use activities that would promote the goals and objectives of GAA, the purpose of the Land Use Plan for Guam, and the concerns of our entire island community.

The Proposed 5-year Zoning Plan for Guam delineates the various intensity districts as determined through the consideration of a study done by the Bureau of Planning, BOP and the GAA entitled, *The Recovery of Tiyan* as well as recommendations obtained from various TAC members and government officials. Much of the NAS Agana region is proposed to be included in Intensity District 8 which is the industrial district. Some reasons for this include:

1. the need for additional industrially zoned property
2. the need for airport expansion
3. the presence of existing support facilities for industrial uses
4. the desire to diversify Guam's economy and the benefits derived from siting traditional industrial activities such as transshipment, warehousing, and manufacturing in close proximity to a major port of entry.
5. the non compatibility of other alternative uses with a major airport.

A segment at the end of the runway clear zone is proposed to be included in Intensity District 1, Parks. The accident potential and sound impacts for the area are extreme and thus a program that discourages it's use may be most appropriate.

Much of the area currently used for housing at the edge of the tarmac on the Tamuning Cliff side is proposed to be Intensity District 8. The only exception will be the extreme southwestern portion which is in proposed for Intensity District 2, Low Intensity.

Much of what is currently barracks, recreation and support/administrative operations areas is included in Intensity District 2, Low Intensity. This would help provide some buffer between the industrial and airport activities and the residential limited commercial uses associated with Route 8 and the Barrigada Village. A small area designated intensity district 3 will take into account the existence of the Postal Service's main facility across from Radio Barrigada.

The objective of airport related land use planning and implementation is the achievement and maintenance of the compatibility between the airport and its environment. A careful balance of governmental actions is needed to:

a. Ensure that the airport can maintain or expand its size and level of operations to satisfy existing and future aviation demands;

b. Ensure that the people who live, work, or own property near the airport may enjoy the maximum amount of freedom from noise or other adverse impacts of the airport; and

c. Protect the public investment of airport facilities for which there may be no foreseeable future replacement.

However, land use planning is only part of the answer to ensuring that these objectives are met. A key to all land use planning efforts is an effective zoning program which incorporates a set of performance standards that can govern the types and levels of use of properties surrounding the airport facility.

Seaport

Guam's only major seaport is under the jurisdiction of the Port Authority of Guam. The commercial seaport is located in the northern portion of Apra Harbor, and is the site of all non-military shipping facilities on Guam. The southern portion of Apra Harbor is home to the Naval Ship Repair Facility and other ancillary U.S. Navy operations.

The commercial seaport serves a very critical role for the island. It is the "bloodline" that delivers or imports the basic goods that feed, support and maintain the lifestyle which the island has adopted. It also serves as a major industrial park facility that provides transition services and facilities between the deliverer and the receiver of goods.

The Port Authority of Guam has also initiated major expansion efforts to accommodate the substantial increase of ocean traffic to Guam. A seaport masterplan was recently approved by the Territorial Planning Council and will comprise one of the elements of the overall comprehensive plan. Recent natural disasters has hindered these efforts somewhat, however, expansion plans continue to receive top priority in the port's future.

ENVIRONMENTALLY SENSITIVE AREAS

As in any insular environment, the land supply in Guam is finite. During the economic boom of the 1970s and 1980s, land was viewed as a commodity to be bought and sold through the market system. Where land was inexpensive, environmentally sensitive areas (such as wetlands) were usually bypassed. This was generally the development process, except in areas where the short-term economic return outweighed the environmental consequences. This has been true, for example, of floodplains and areas of good agricultural soils .were relatively flat and dry land areas that are easily developable. As the demand for land increased with population growth and development, so did land values. Now, because land is expensive, it is more cost effective to build in areas by flattening, draining or filling them.

Most development proposals have been viewed with a strong belief in the market. If the economic benefits (in new jobs created and taxes generated) exceeded the cost, development generally proceeded.

Since that time, changing social values have increased the level of government intervention in the marketplace. The ecological consequences of development elevated the interest in environmental protection into the private and public decision-making process. Ecological value must now be considered alongside economic benefits, as well as social costs, in the future development of the Territory's finite land supply.

The necessity for governmental involvement in environmentally sensitive land comes from the essentially public character of these land resources. The destruction of environmentally sensitive areas does not mean just the possible loss of some "intrinsic" environmental values or benefits, but also loss to the social, cultural and economic welfare of the Territory.

Environmentally sensitive areas are land areas whose destruction or disturbance will immediately effect the life of a community by either, (1) creating hazards such as flooding and landslides, (2) destroying important public resources such as water supplies and the water quality of the coastal environment, or (3) wasting important productive lands and renewable resources, such as good agricultural lands. Each of these threatens the general welfare of the Territory and results in economic loss for everyone.
Too often, the impacts of development on residents of Guam are not adequately or appropriately considered. Economic growth is generally seen as a means of improving quality of life. The effects of economic change on specific aspects of social and cultural life have been left generally unexamined. The need to protect the natural environment is crucial to the people of Guam, Traditional cultural practices are dependent on the use of natural resources to perpetuate culture.

Local regulation is needed, not only because of the public character of the resources, but also because the real estate market does not adequately consider the costs and benefits of protecting these resources.

The functions of these environmentally sensitive areas are what economists call "public goods" -- if they benefit one person, they benefit all.

A wetland, for example, filters sediment and traps nutrients from upland runoff, thus cleansing water before it enters the aquifer or empties into the sea. These are important functions, but the landowner cannot sell this filtering capacity. If the land is providing a cleaner ocean for one man, it is providing it for all people who use and enjoy the ocean. Thus, in terms of maximizing profits, the landowner may be better off to develop the wetlands so that more land will be available to sell, but the larger community will then have to absorb the cost of lowered water quality. This example is particularly relevant to Guam.

Protecting these land areas involves important public costs and benefits that are inadequately considered by the normal market mechanisms. Therefore, it is logical that communities utilize their police powers to ensure a balance between the public interest -- the health, safety, and welfare of the community -- and the landowner's desire to use his property.

Guam is fortunate to be endowed with many natural resources. These resources contribute significantly to the islands' ecology, economy, and natural beauty, as well as its desirability as a place to live and visit. These features are important contributions to the quality of life. Certain areas or resources deserve special attention, for they are irreplaceable and their loss would deny future generations the benefits of their existence. Loss of a rare or unique resource, such as the loss of plant and animal species, implies man's disregard of the natural environment and its ecological processes.

In Guam, the retention of these ecologically sensitive areas, in addition to being environmentally and culturally proper, is also good business. Whether it is truly understood or not, all that the Territory has to sell is its environment. If the environment is degraded, so is the economic base.

Rare and unique natural areas have a value that is more than economic. These resources represent an intrinsic rather than a value-added economic base. As such, their economic return to the islands' is potentially greater and more stable, and, in some cases, economically indispensable. Fewer residents would stay and not as many tourists would visit the island if many of the waterfront areas were lost to overdevelopment or, conversely, lacked easy public access.

Natural areas also have important ecological values and serve as natural scientific laboratories. The study of natural sciences and the general understanding of the natural environment depend on these unusually rich areas. The coral reefs lying off the coast are some of the most complex, productive, and diversified ecological systems on earth.

In addition to ecological value, many environmentally unique areas, such as the limestone forest vegetation and mangrove mudflats, serve very important natural functions. The value of these areas for their drainage, soil retention, and natural habitat function is not replaceable. Mangrove stands serve as fish nurseries to enhance water quality and reduce degradation of coastal marine resources, such as coral reefs and seagrass beds, by acting to absorb the heavy impact of stormwater runoff, trapping sediments and filtering pollutants.

The rapid growth experienced in the Territory over the past 30 years and the potential for further encroachment of development onto significant natural areas have forced the issue of environmental preservation to the forefront of land-use planning. GovGuam and the citizens of the island face a turning point in deciding the importance of these areas relative to continued development. Whether these areas should be entirely preserved by inclusion in the Territorial Park System, protected to a limited degree from degradation by legal regulatory mechanisms, or allowed to incur development encroachment and the resulting impacts, must be resolved. The location of future land use activities outlined on the Land Use Plan maps and associated environmental performance standards serve as the venue for this process.

Wetlands

Wetlands are unique components of the island ecosystem. They are the swamps, marshes, mangroves, and river valleys. These are areas that are inundated or saturated near the surface and provide habitat for aquatic plants and animals. Many wetlands also act as a source of freshwater supply or assist in recharging the aquifer. They also provide a nursery ground for many juvenile animal species. Wetlands are one of the most biologically productive areas on the island. They provide a means for ridding surface water of sediments and pollutants. They provide aesthetic scenery and are valuable locations for scientific research and aquaculture development.

In areas on the coast, there is a transition from freshwater to saltwater wetlands with zonations of vegetation delineating the changes in salinity. A diversity of plant life is found in these areas, many of which assist in maintaining the balance of the habitat, supply nutrients to the water and have ethno-botanical value as food, medicine, or material culture. Wetland areas are often in floodplain areas and absorb excess overflow from rivers during periods of excessive rainfall.

The mangrove fringe, represented in only two locations on Guam, is not only an ecological habitat, but also functional as a shoreline stabilization mechanism preventing erosion during periods of storm wave inundation. Mangroves are particularly resistant to typhoon force winds. Numerous small reed marshes exist in inland savannah areas where surface drainage is slowed by level topography. Savannah marshes are mostly found in the Dandan, Sigua, Talofofo, and Umatac areas. Some unique salt marshes can also

be seen at Sumay on federal lands. These small savannah and salt marshes can be identified by on-site field inspection and development should follow the performance guidelines for all wetlands.

Jurisdictional wetlands are identified on U.S. Fish and Wildlife National Wetland Inventory maps utilized by the Bureau of Planning, Department of Land Management, and Department of Agriculture. Using aerial photographs, wetlands were identified based on vegetation, visible hydrology, and geography. The aerial photographs typically reflected conditions during the specific year and season when they were taken. In addition, there is a margin of error inherent in the use of aerial photographs for wetland delineation. Thus, a detailed site survey and historical analysis may result in revision of the wetland boundaries. In addition, some small wetlands and those obscured by dense forest cover may not be included on the USFWS map documents. Forested and scrub-shrub wetlands are estimated to cover 2,346 acres of Guam while emergent wetlands encompass approximately 1,400 acres.

The following is a list of generalized areas where substantial terrestrial and estuarine wetlands are mapped on Guam. General wetland areas on Guam are shown in Figure 8.

- Agana Swamp
- Sasa Bay Mangroves and Marsh
- Atantano River Valley and Mangroves
- Abo Cove Naval Station Marsh
- Camp Roxas Naval Station Marsh
- Namo River Flood Plain
- Umatac Marsh
- Geus River Estuary
- Achang Bay Mangroves
- Ajayan River Estuary
- Agfayan River Estuary
- Inarajan River Estuary
- Talofofo River Valley
- Pago River Estuary

It should be noted that this list, and those wetland areas depicted on FIGURE 8, represent only substantial wetland areas. Many smaller wetland areas are included in the USFWS National Wetland Inventory maps.

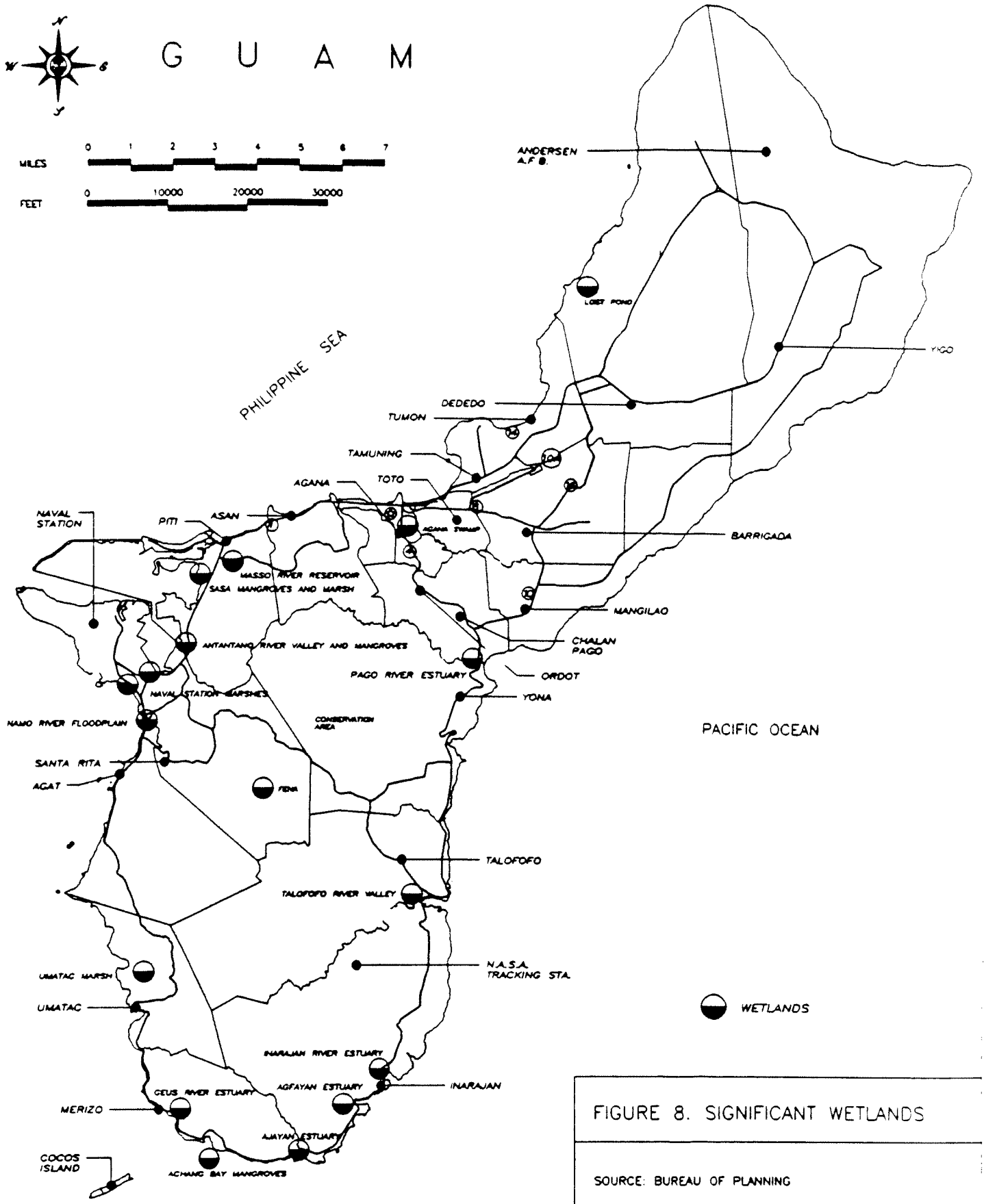

FIGURE 8. SIGNIFICANT WETLANDS

SOURCE: BUREAU OF PLANNING

W.B.FLORES/STRATEGIC PLANNING GROUP JV
PREPARED BY: PATTON HARRIS RUST & ASSOCIATES