GB2231.N95S26 1985 v.1

SAIPAN LAGOON USE MANAGEMENT PLAN

FINAL DRAFT

VOLUME I

DATA AND ANALYSES

Prepared for
Coastal Resources Management Office
Commonwealth of the Northern Mariana Islands

Prepared by
Duenas and Swavely, Incorporated
in Association with
Pacific Basin Environmental Consultants, Inc.

GB
2231
.N95
S25
1985
v.1

VOLUME I

TABLE OF CONTENTS

PART A

INTRODUCTION, METHODOLOGY FOR DATA COLLECTION
AND A SUMMARY OF DATA
FROM QUESTIONNAIRES, INTERVIEWS AND PLANNING ADVISORY TEAMS

		PAGE
I.	INTRODUCTION	1
	A. Purpose of Report	1
	B. Description of Project Area	2
	C. Guide to Use of Volume I	2
II.	METHODOLOGY FOR DATA COLLECTION	6
	A. Data Collection Procedures	6
	1. Office Methods	6
	2. Field Methods	6
	3. Planning Advisory Teams	8
	a. Saipan Lagoon Planning Advisory Teams	8
	b. SALAPAT One	8
	c. SALAPAT Two	9
	B. Interviews	10
	1. Questionnaires	10
	2. Personal Interviews	10
	C. Planning Areas and Ecological Zones	10
	1. General Description of Planning Areas	19
	2. General Description of Ecological Zones	21
III.	SUMMARY OF DATA FROM QUESTIONNAIRES, INTERVIEWS AND PLANNING ADVISORY TEAMS	22
	A. Fishing and Gathering	22
	B. Recreational Uses	22
	C. Commercial and Tourism Uses	22
	D. Personal Interviews	32
	E. Planning Advisory Team Objectives	32
	1. SALAPAT One	32
	2. SALAPAT Two	35

Property of CSC Library

PART B

PRESENTATION OF DATA AND ANALYSES
BY PLANNING AREA AND BY PROJECT AREAWIDE

PAGE

I. PUNTAN MAGPI PLANNING AREA I-1
A. Natural Resources I-1
1. Living Marine Resources I-1
a. Northern Portion - Inner and Outer Reef Flat I-1
b. Northern Portion - Reef Margin and Slope I-2
c. Near-shore I-3
d. Lagoon I-4
e. Reef Flat I-5
f. Reef Margin and Slope I-6
2. Physical Marine Resources I-7
a. Currents I-7
b. Water Quality I-7
3. On-Shore Resources I-8
a. Wetlands I-8
b. Rare Threatened and Endangered Species I-8
B. Manmade Resources and Human Uses I-8
1. Land Uses I-8
a. Existing Development and Public Facilities I-8
b. Public Land Ownership and Access I-10
c. Recreation Sites I-10
d. Historic Sites I-10
e. Beach Erosion and Stormwave Redistribution I-10
f. Stormwater Drainage I-10
2. Economic Resources I-11
a. Subsistence Fishing and Gathering I-11
b. Tourism Industry I-11

II. TANAPAG HARBOR PLANNING AREA II-1
A. Natural Resources II-1
1. Living Marine Resources II-1
a. Near-shore II-1
b. Lagoon and Patch Reefs II-3
2. Physical Marine Resources II-4
a. Currents II-4
b. Water Quality II-8
3. On-Shore Resources II-8
a. Wetlands II-8
b. Mangroves II-9
c. Rare Threatened and Endangered Species II-9
B. Manmade Resources and Human Uses II-10
1. Land Uses II-10
a. Existing Development and Public Facilities II-10
b. Public Land Ownership and Access II-10

PAGE

c. Recreation Sites II-10
d. Historic Sites II-11
e. Beach Erosion and Stormwave Redistribution II-11
f. Stormwater Drainage II-11
2. Energy Resources II-11
a. Existing Facilities II-11
3. Economic Resources II-12
a. Subsistence Fishing and Gathering II-12
b. Commercial and Sport Fishing and Facilities II-12
c. Port and Shipping II-12
d. Tourism Industry II-17

III. MANAGAHA ISLAND PLANNING AREA III-1
A. Natural Resources III-1
1. Living Marine Resources III-1
a. Lagoon and Patch Reefs III-1
b. Reef Flat III-2
c. Reef Margin and Slope III-3
2. Physical Marine Resources III-6
a. Currents III-6
b. Water Quality III-6
3. On-shore Resources III-6
a. Rare, Threatened and Endangered Species III-6
b. Terrestrial Vegetation III-7
B. Manmade Resources and Human Uses III-7
1. Land Uses III-7
a. Existing Development and Public Facilities III-7
b. Public Land Ownership and Access III-7
c. Recreation Sites III-7
d. Historic Sites III-10
e. Beach Erosion and Stormwave Redistribution III-10
f. Stormwater Drainage III-10
2. Economic Resources III-10
a. Subsistence Fishing and Gathering III-10
b. Commercial and Sport Fishing and Facilities III-11
c. Ports and Shipping III-11
d. Tourism Industry III-11

I V. PUNTAN MUCHOT PLANNING AREA IV-1
A. Natural Resources IV-1
1. Living Marine Resources IV-1
a. Near-shore IV-1
b. Lagoon IV-2
c. Reef Flat IV-4
d. Reef Margin and Slope IV-5
2. Physical Marine Resources IV-5
a. Currents IV-5
b. Water Quality IV-10
3. On-Shore Resources IV-10
a. Wetlands IV-10
b. Mangroves IV-12
c. Rare Threatened and Endangered Species IV-12

PAGE

B. Manmade Resources and Human Uses IV-13
1. Land Uses IV-13
a. Existing Development and Public Facilities IV-13
b. Public Land Ownership and Access IV-13
c. Recreation Sites IV-13
d. Historic Sites IV-13
e. Beach Erosion and Storm Surge Zones IV-15
f. Stormwater Drainage IV-15
1. Existing Development and Public Facilities IV-15
2. Economic Resources IV-21
a. Subsistence Fishing and Gathering IV-21
b. Commercial and Sport Fishing and Facilities IV-21
c. Ports and Shipping IV-21
d. Tourism Industry IV-21

V. GARAPAN LAGOON PLANNING AREA. V-1
A. Natural Resources V-1
1. Living Marine Resources V-1
a. Near-shore. V-1
b. Lagoon V-2
c. Reef Flat. V-3
d. Reef Margin and Slope. V-4
2. Physical Marine Resources V-5
a. Currents. V-5
b. Water Quality. V-5
3. On-Shore Resources V-6
a. Rare Threatened and Endangered Species. V-6
B. Manmade Resources and Human Uses V-6
1. Land Uses V-6
a. Existing Development and Public Facilities V-6
b. Public Land Ownership and Access V-6
c. Recreation Sites V-6
d. Historic Sites V-7
e. Beach Erosion and Stormwave Redistribution V-7
f. Stormwater Drainage V-7
2. Economic Resources V-7
a. Subsistence Fishing and Gathering V-7
b. Commercial and Sport Fishing Facilities V-8
c. Ports and Shipping V-8
d. Tourism Industry V-8

VI. PUNTAN SUSUPE PLANNING AREA VI-1
A. Natural Resources VI-1
1. Living Marine Resources VI-1
a. Near-shore. VI-1
b. Lagoon. VI-2
c. Reef Flat. VI-2
d. Reef Margin and Slope VI-3
2. Physical Marine Resources VI-4
a. Currents. VI-4
b. Water Quality. VI-4

PAGE

3. On-Shore Resources VI-10
a. Wetlands VI-10
b. Rare Threatened and Endangered Species. VI-10
B. Manmade Resources and Human Uses VI-10
1. Land Uses VI-10
a. Existing Development and Public Facilities VI-10
b. Public Land Ownership and Access VI-11
c. Recreation Sites VI-11
d. Historic Sites VI-12
e. Beach Erosion and Stormwave Redistribution VI-12
f. Stormwater Drainage VI-12
2. Economic Resources. VI-12
a. Subsistence Fishing and Gathering VI-12
b. Commercial and Sport Fishing Facilities VI-12
c. Ports and Shipping VI-13
d. Tourism Industry VI-13

VII. PUNTAN AFETNA PLANNING AREA. VII-1
A. Natural Resources VII-1
1. Living Marine Resources VII-1
a. Near-shore VII-1
b. Lagoon VII-1
c. Reef Flat VII-2
d. Reef Margin and Slope VII-3
2. Physical Marine Resources VII-4
a. Currents VII-4
b. Water Quality VII-4
3. On-Shore Resources VII-5
a. Rare Threatened and Endangered Species VII-5
B. Manmade Resources and Human Uses VII-5
1. Land Uses VII-5
a. Existing Development and Public Facilities VII-5
b. Public Land Ownership and Access VII-5
c. Recreation Sites VII-6
d. Historic Sites VII-6
e. Beach Erosion and Stormwave Redistribution . . . VII-6
f. Stormwater Drainage VII-6
2. Economic Resources. VII-6
a. Subsistence Fishing and Gathering VII-6
b. Commercial and Sport Fishing Facilities VII-6
c. Ports and Shipping VII-6
d. Tourism Industry. VII-6

VIII. PROJECT AREAWIDE VIII-1
A. Natural Resources. VIII-1
1. Currents VIII-1
2. Tides. VIII-1
B. Manmade Resources and Human Uses VIII-1
1. Land Uses and Infrastructure. VIII-1
a. Water Facilities VIII-1
1. The Existing System VIII-1

PAGE

2. Existing Plans for Saipan's Water Facilities VIII-9
3. Problems Associated with the Water Systems. . . VIII-14
b. Wastewater Facilities VIII-14
1. Central Wastewater System VIII-15
2. Southern Wastewater System VIII-15
3. Existing Plans for Saipan's Wastewater Facilities VIII-22
4. Problems Associated with the Wastewater Systems VIII-26
c. Beach Road VIII-29
2. Water Quality Management VIII-29
3. Energy Resources VIII-35
a. World Energy Supply VIII-35
b. Saipan's Energy Supply VIII-37
c. Present Energy Status in the CNMI VIII-38
d. Energy Alternatives for Saipan VIII-40
e. Energy Management on Saipan VIII-40
f. Alternate Energy Sources for the CNMI VIII-41
4. Economic Resources VIII-42
a. Tourism Industry VIII-42
C. Legislation and Policies VIII-42
1. Legislation VIII-42
a. Areas of Particular Concern VIII-42
b. Taxation and Revenue - Producing Legislation . . . VIII-52
c. Land Ownership VIII-53
d. Protection of Resources VIII-53
3. Policies VIII-55
a. Established CZM Goals and Policies VIII-55

LIST OF FIGURES

FIGURES		PAGE
PART A		
1.	Project Area of Saipan Lagoon Use Management Plan	3
2.	Sampling Transects within each Planning Area	7
3.	Marine and Terrestrial Fishing and Gathering Questionnaire	11
4.	Recreational Use Questionnaire	14
5.	Commercial and Tourism Use Questionnaire	16
7.	Six Ecological Zones	18
PART B		
I-1.	Quality Monitoring for Fecal Coliform (October 1984 - March 1985)	I-9
II-1.	Drogue Drift Paths for 20 March 1976	II-5
II-2.	Drogue Drift Paths for 12 June 1976	II-6
II-3.	Currents in and near Baker Bay	II-7
II-4.	Possible Berthing Plan for Tanapag Small Boat Harbor	II-13
II-5.	Tanapag Harbor Facilities	II-14
IV-1.	Currents. Location: Garapan, EBB Tide	IV-6
IV-2.	Currents. Location: Garapan, Flood Tide	IV-7
IV-3.	Currents. Location: Hafa Dai, EBB Tide	IV-8
IV-4.	Currents. Location: Hafa Dai, Flood Tide	IV-9
IV-5.	General Circulation Pattern, Garapan Drainage Basin	IV-11
IV-6.	Historic Sites in the Puntan Muchot Planning Area	IV-14

LIST OF FIGURES

FIGURES		PAGE
PART A		
1.	Project Area of Saipan Lagoon Use Management Plan	3
2.	Sampling Transects within each Planning Area	7
3.	Marine and Terrestrial Fishing and Gathering Questionnaire	11
4.	Recreational Use Questionnaire	14
5.	Commercial and Tourism Use Questionnaire	16
6.	Six Ecological Zones	18
PART B		
I-1.	Quality Monitoring for Fecal Coliform (October 1984 - March 1985)	I-9
II-1.	Drogue Drift Paths for 20 March 1976	II-5
II-2.	Drogue Drift Paths for 12 June 1976	II-6
II-3.	Currents in and near Baker Bay	II-7
II-4.	Possible Berthing Plan for Tanapag Small Boat Harbor	II-13
II-5.	Tanapag Harbor Facilities	II-14
IV-1.	Currents. Location: Garapan, EBB Tide	IV-6
IV-2.	Currents. Location: Garapan, Flood Tide	IV-7
IV-3.	Currents. Location: Hafa Dai, EBB Tide	IV-8
IV-4.	Currents. Location: Hafa Dai, Flood Tide	IV-9
IV-5.	General Circulation Pattern, Garapan Drainage Basin	IV-11
IV-6.	Historic Sites at American Memorial Park	IV-14

FIGURES PAGE

IV-7. Shoreline Erosion in the Puntan Muchot Planning Area IV-16

IV-8. Recommended Plan for Garapan Flood Control IV-19

IV-9. Typical Section, Garapan Flood Control IV-20

VI-1. Currents. Location: Saipan Grand, EBB Tide VI-5

VI-2. Currents. Location: Saipan Grand, Flood Tide. VI-6

VI-3. Currents. Location: Chalan Kanoa, EBB Tide VI-7

VI-4. Currents. Location: Chalan Kanoa, Flood Tide. VI-8

VI-5. General Circulation Pattern, Susupe/Chalan Kanoa Drainange Basin VI-9

VIII-1. Puntan Magpi Planning Area Water System VIII-2

VIII-2. Tanapag Harbor and Puntan Muchot Planning Areas Water System VIII-3

VIII-3. Garapan, Puntan Susupe and Puntan Afetna Planning Areas Water System VIII-4

VIII-4. Saipan Water System Demands and Flows. VIII-5

VIII-5. Central and Southern Sewage System VIII-16

VIII-6. Central Sewage System; Existing Facilities VIII-17

VIII-7. Garapan Outfall Plan VIII-18

VIII-8. Southern Sewage System Existing Facilities VIII-21

VIII-9. Agingan Outfall Plan VIII-23

VIII-10. Traffic Counts along Beach Road VIII-30

VIII-11. APC Map Index VIII-47

VIII-12. APC for Northern Lagoon VIII-48

VIII-13. APC for Garapan Area VIII-49

VIII-14. APC for Central Lagoon Area VIII-50

VIII-15. APC for Southern Lagoon Area VIII-51

FIGURES PAGE

IV-7. Shoreline Erosion IV-16

IV-8. Recommended Plan for Garapan Flood Control IV-19

IV-9. Typical Section, Garapan Flood Control IV-20

VI-1. Currents. Location: Saipan Grand, EBB Tide VI-5

VI-2. Currents. Location: Saipan Grand, Flood Tide. VI-6

VI-3. Currents. Location: Chalan Kanoa, EBB Tide VI-7

VI-4. Currents. Location: Chalan Kanoa, Flood Tide. VI-8

VI-5. General Circulation Pattern, Susupe/Chalan Kanoa Drainange Basin VI-9

VIII-1. Puntan Magpi Planning Area Water System VIII-2

VIII-2. Tanapag Harbor and Puntan Muchot Planning Areas Water System VIII-3

VIII-3. Garapan, Puntan Susupe and Puntan Afetna Planning Areas Water System VIII-4

VIII-4. Saipan Water System Demands and Flows. VIII-5

VIII-5. Central and Southern Sewage System VIII-16

VIII-6. Central Sewage System; Existing Facilities VIII-17

VIII-7. Garapan Outfall Plan VIII-18

VIII-8. Southern Sewage System Existing Facilities VIII-21

VIII-9. Agingan Outfall Plan VIII-23

VIII-10. Traffic Counts along Beach Road VIII-30

VIII-11. APC Map Index VIII-47

VIII-12. APC for Northern Lagoon VIII-48

VIII-13. APC for Garapan Area VIII-49

VIII-14. APC for Central Lagoon Area VIII-50

VIII-15. APC for Southern Lagoon Area VIII-51

LIST OF TABLES

TABLE		PAGE
PART A		
1.	Guide to Use of Volume One for Natural Resources . . .	4
PART B		
I-1.	Recreational Facilities in Puntan Magpi Planning Area	I-10
II-1.	Recreational Site at Tanapag Harbor Planning Area	II-10
III-1.	Checklist of Fish Species observed in the vicinity of the proposed Underwater Trail at Managaha Island	III-4
III-2.	Checklist of Terrestrial Flora identified along the Nature Trail and elsewhere on Managaha Island	III-8
IV-1.	Recreational Sites at Puntan Muchot Planning Area	IV-15
IV-2.	Measures for alleviating Garapan Flooding	IV-18
V-1.	Recreational Sites at Garapan Lagoon Planning Area	V-7
VI-1.	Recreational Sites at Puntan Susupe Planning Area	VI-11
VII-1.	Recreational Sites at Puntan Afetna Planning Area	VII-5
VIII-1.	Projected Residential Educational, Commercial and Industrial Water Consumption Demands	VIII-6
VIII-2.	Assumptions for projecting Water Consumption Demand	VIII-9
VIII-3.	Fire Flow Capacities are further calculated by Population	VIII-10
VIII-4.	Estimated Maximum Future Flow Rates	VIII-11
VIII-5.	Recommended Improvements to the Saipan Water System	VIII-12

TABLE		PAGE
VIII-6.	Central System Residential Sewer Service Connections	VIII-19
VIII-7.	Central System Number and Type of Wastewater Connections	VIII-19
VIII-8.	Wastewater Flows, Central System	VIII-20
VIII-9.	Southern System Residential Sewer Service Connections	VIII-24
VIII-10.	Number and type of Wastewater Connections for the Southern System	VIII-24
VIII-11.	Wastewater Flows for the Southern System	VIII-25
VIII-12.	General Wastewater System	VIII-27
VIII-13.	Southern Wastewater System	VIII-28
VIII-14.	End Uses of Fuels, CNMI, 1981	VIII-39
VIII-15.	Saipan Tourist Accomodations along Saipan Lagoon	VIII-43
VIII-16.	Saipan Tourist Attractions	VIII-45

VOLUME I

PART A

INTRODUCTION, METHODOLOGY FOR DATA COLLECTION AND A SUMMARY OF DATA FROM QUESTIONNAIRES, INTERVIEWS AND PLANNING ADVISORY TEAMS

CHAPTER I - INTRODUCTION

A. Purpose of Report

The purpose of this Volume I, SAIPAN LAGOON USE MANAGEMENT PLAN is to present and analyze in one bound volume all available, pertinent data pertaining to the PLAN'S project area. Much of this data are original and resulted from extensive field investigations as well as from surveys, interviews and input from Planning Advisory Teams. This Volume also contains excerpts from other relevant studies and reports dealing with both natural and man-made resources of the Saipan Lagoon and its on-shore project area.

Volume I is presented in three parts: Part A, Part B and Part C. Part A describes the project area and methodologies that were employed for data collection. It also summarizes much of the data that resulted from questionnaires, interviews and Planning Advisory Teams. All of Part A's pages are numbered sequentially from 1 through 30.

In Part B the actual data are presented and analyzed for each of the seven Planning Areas that comprise the Lagoon and on-shore project area. Much of these data are also depicted on the six-sheet, "SAIPAN LAGOON USE MANAGEMENT PLAN - Planning Areas" maps which are included as Volume III of the PLAN. Part B's page numbers are preceded by the chapter number or appendix letter, and pagination is sequential on a chapter by chapter basis. Each of the seven Planning Area chapters are described with the same format of data presentation which includes:

* Natural Resources
  - Living Marine Resources
  - Physical Marine Resources
  - On-Shore Resources
* Man-made Resources and Human Uses
  - Land Uses
  - Economic Resources

The final chapter of Part B describes Project Areawide data which cannot be usefully categorized into any particular Planning Area. This chapter presents project areawide data for:

* Natural Resources
  - Physical Marine Resources
  - Physical On-Shore Resources
* Man-made Resources and Human Uses
  - Land Uses and Infrastructure
  - Energy Resources
  - Economic Resources
* Legislation and Policies
  - Executive Orders
  - Legislation
  - Policies

Part C is a bibliography of this PLAN's references, and it should be consulted for bibliographic data when references are cited in either Volume I or II.

Volume I data and data analyses were utilized to formulate the various plans, policies and programs embodied by the SAIPAN LAGOON USE MANAGEMENT PLAN. These plans are presented in Volume II. The maps depicting existing data and proposed plans are in Volume III. An Executive Summary of the PLAN is presented in Volume IV.

B. Description of Project Area

The SAIPAN LAGOON USE MANAGEMENT PLAN project area is depicted on Figure 1. Generally, it is elliptical in shape, bordered on the west by the Lagoon's barrier reef and on the east by West Coast highway and Beach Road. The PLAN's seven Planning Areas are also shown in this figure.

C. Guide for Use of Volume I

Because of the comprehensive nature of data that are analyzed within this Volume a Guide was devised to facilitate the presentation of data collected throughout the Saipan Lagoon project area. The Guide is presented in Table 1. The Table is in two sections: Natural Resources; and Man-made Resources and Human Uses. Within each of these two major categories are the various sub-categories such as Living Marine Resources, Marine Physical Resources, Land Uses, and Economic Resources. Where these sub-categories are discussed in this Volume a check mark is denoted under the appropriate Planning Area.

Figure 1.

PROJECT AREA OF SAIPAN LAGOON USE MANAGEMENT PLAN

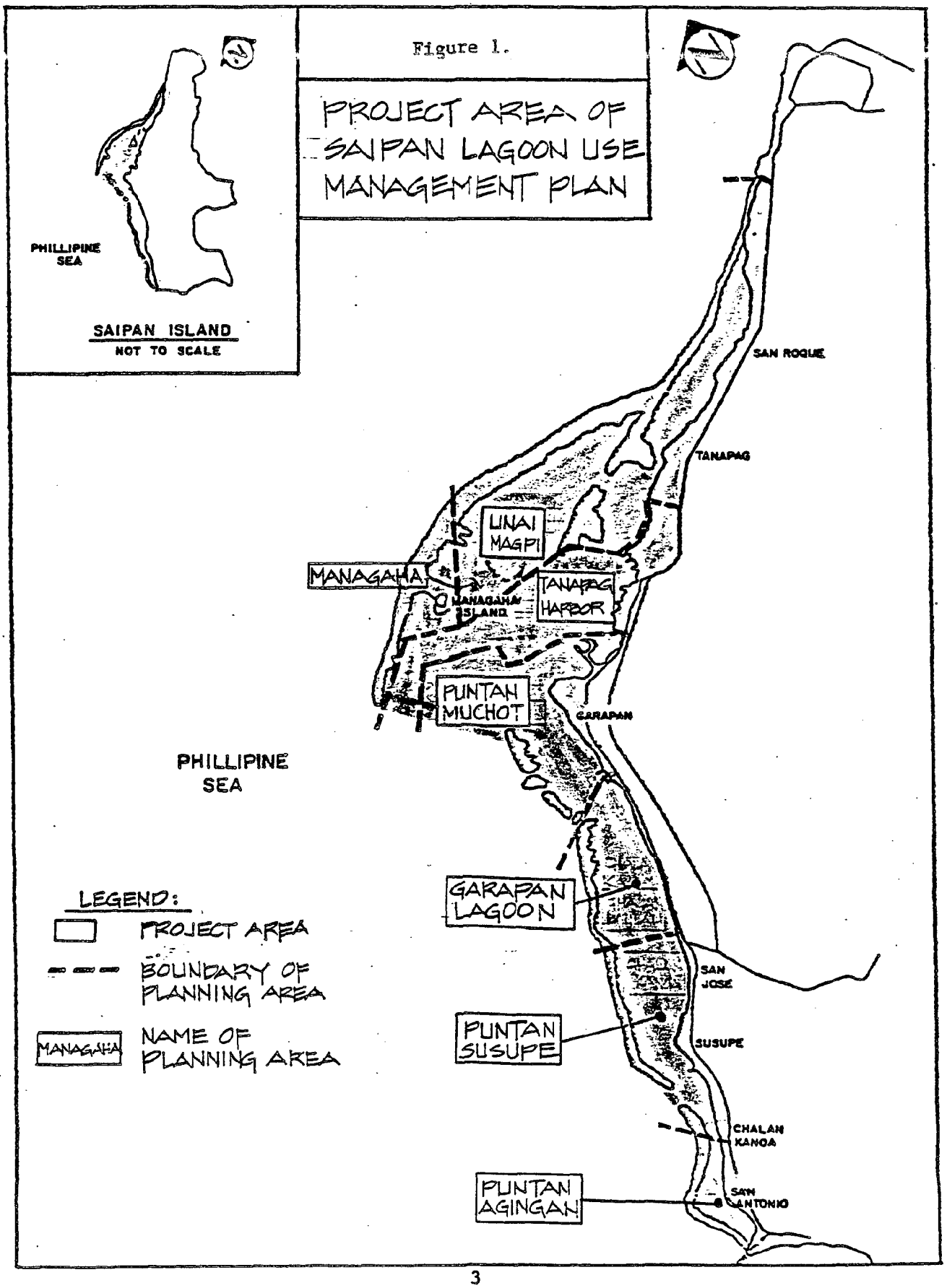


TABLE 1. GUIDE TO USE OF VOLUME ONE FOR NATURAL RESOURCES.

	PLANNING AREA							
	Puntan Magpi	Tanapag Harbor	Managaha Island	Puntan Muchot	Garapan Lagoon	Puntan Susupe	Puntan Afetna	PROJECT AREAWIDE
Living Marine Resources								
Corals	x	x	x	x	x	x	x	
Fishes	x	x	x	x	x	x	x	
Marine Plants	x	x	x	x	x	x	x	
RTE Species	x	x	x	x	x	x	x	
Marine Physical Resources								
Currents		x		x		x		x
Tides								x
Water Quality	x	x	x	x	x	x	x	
Hydrography								x
On-Shore Resources								
Wetlands	x	x						
Mangroves		x		x				
RTE Species	x	x						

TABLE 1 cont. GUIDE TO USE OF VOLUME ONE FOR MANMADE RESOURCES AND HUMAN USES.

	PLANNING AREA							
	Puntan Magpi	Tanapag Harbor	Managaha Island	Puntan Muchot	Garapan Lagoon	Puntan Susupe	Puntan Afetna	PROJECT AREAWIDE
Land Uses								
Existing Development and Zoning	x	x	x	x	x	x	x	
Historical Sites			x	x				
Recreation Sites	x	x	x	x	x	x	x	
Infrastructure								
Water								x
Sewer								x
Storm Water and Flood Control					x	x		
Scenic, Land								x
Scenic, Underwater								x
Beach Erosion and Storm Surge Zones	x	x	x	x	x	x	x	
Public Lands Ownership and Access	x	x	x	x	x	x	x	
Energy Resources								
Existing Facilities		x						x
Alternate Sources								x
Economic Resources								
Subsistence Fishing and Gathering	x	x	x	x	x	x	x	
Commercial and Sport Fishing	x	x	x	x	x	x	x	
Tourism Industry								x
Resource Extraction							x	
Port and Shipping		x						

CHAPTER II - METHODOLOGY FOR DATA COLLECTION

A. Data Collection Procedures

Various methodologies have been employed to generate the data and attain an understanding of the Lagoon environs in order to establish reasonable development objectives. Methods employed for this project fall into two basic areas: office or field related. Field data were collected both on land and in the Lagoon.

1. Office Methods

Methods employed in the office involved numerous standard project tactics such as identifying data needs and sources for specific aspects of the scope, i.e. general references for a comprehensive bibliography. Once the data sources had been identified, these reports, studies, notes, letters, maps, collections, policies, rules and regulations, laws, plans, photographs and samples were compiled so that the study team could periodically reference them throughout the project. Since this project involved a comprehensive study and evaluation of data from the entire Saipan Lagoon as well as from a significant portion of the western Saipan shoreline (both geographically and geopolitically), data collection methods were devised which enabled the compilation of a large volume of data within a relatively short period of time.

2. Field Methods

Field data were collected on both land and lagoon related issues. Since the project area is quite large, various means of transportation were used to adequately gather the data. The on-shore and shoreline portions were traversed by car and moped and by walking and jogging along the shoreline. Observations were made and notes taken on maps (scale 1:10,000 and smaller) within each of the planning areas. Particular areas of interest (expanding villages, rapid growth areas, port and harbor areas and critical habitats) were examined more carefully for details necessary to support in-depth analysis.

The Lagoon was surveyed by boat, skin and scuba diving, and by towing on an underwater sled along pre-established transects. Visual observations were made regarding human uses and natural resources. Notes were made on standard aerial photographs (scale 1:10,000 metric) and lists were compiled for natural resources in all areas of the Lagoon. Natural resources within the Lagoon were identified by noting observations after short tows (15-30 minutes). Figure 2 shows all transects where underwater tows were made. Particular areas of interest (identified from aerial photographs, discussions with CNMI officials and personal observations) were noted and site-specific skin or scuba dives were made to ascertain the nature of the resource. These areas are noted in Figure 2. Underwater tows were made in water 2 m or deeper in all areas of the lagoon and outside the barrier reef and over four ecological zones (reef margin and slope, reef flat, lagoon and nearshore). Whenever positive identification was not possible in the field, specimens were collected and verified later.

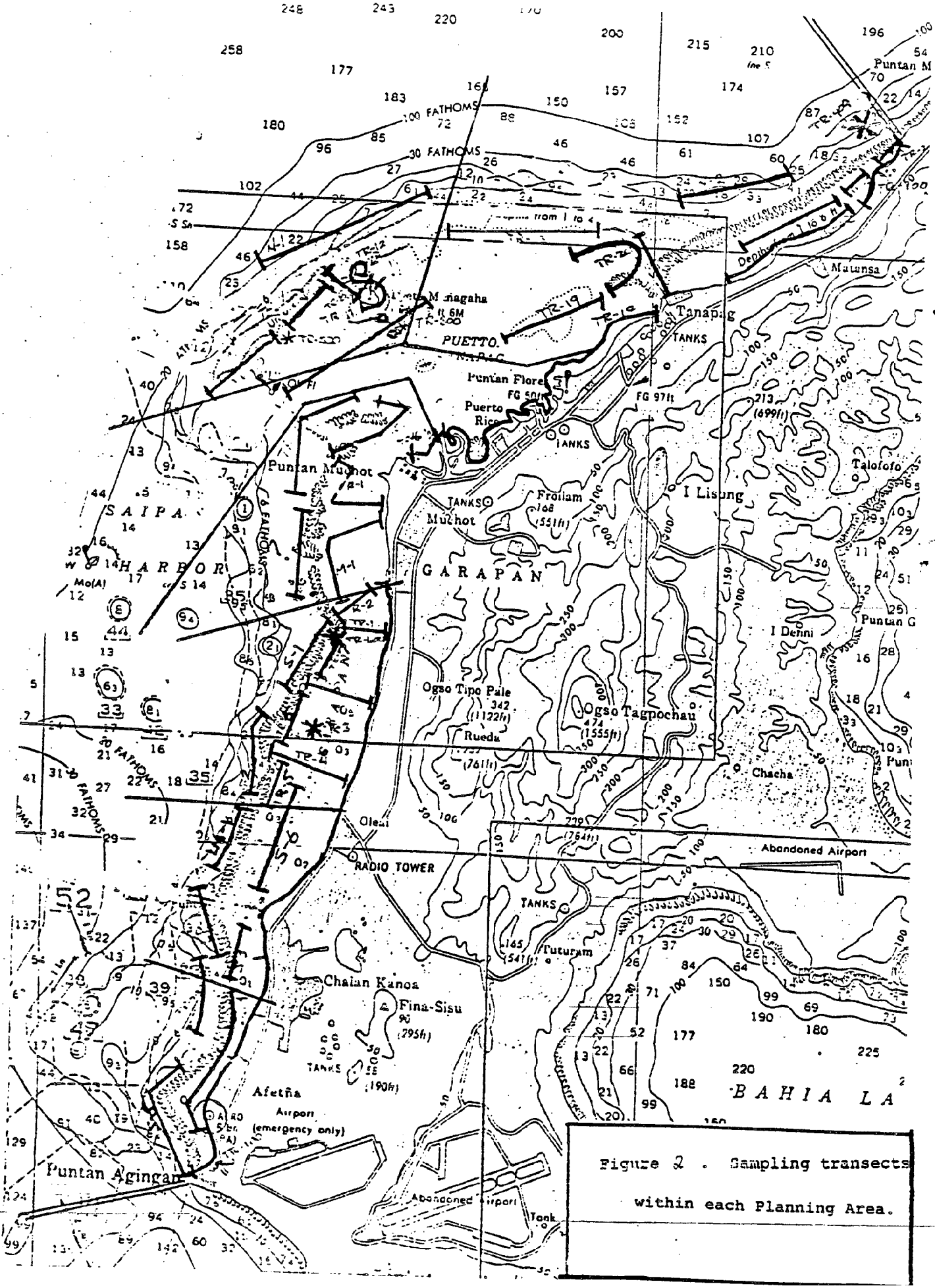


Figure 2 . Sampling transects within each Planning Area.

3. Planning Advisory Teams

a. Saipan Lagoon Planning Advisory Teams

Planning Advisory Teams were established to assure government-wide and community-wide input to the data collection and planning process. The term SALAPAT is an acronym for Saipan Lagoon Planning Advisory Team. These teams met on two different occasions for two days each.

The purpose of SALAPAT sessions was to achieve an informed, technical exchange of ideas and opinions about the future of the Saipan Lagoon and its shoreline area. From deliberations on several key discussion issues, master planning for Saipan Lagoon proceeded with the benefit of timely input from people representing a wide range of public and private concerns.

There were no guidelines or formalities imposed on SALAPAT participants. By restricting the sessions to rather small, informal groups at a secluded, comfortable location, these sessions presented the ideal environment to freely participate in the planning process. Reference data, including a SALAPAT information packet as well as other sketches and plans, helped to assure the participants of sufficient background information in order to productively contribute to the sessions.

b. SALAPAT ONE

SALAPAT ONE was held on May 23 and 24, 1984 and was attended by the following participants:

Pedro A. Tenorio	Lt. Governor
David M. Sablan	Microl Corporation
Bill Concepcion	Marianas Public Land Corporation
Al Hockett	Dept. of Public Works
Gordon Joyce	National Park Service
Bruce Lloyd	Coastal Resources Management Office
Felix Rabauliman	Special Assistant for Carolinian Affairs
Nicolas M. Leon-Guerrero	Dept. of Natural Resources
Bill Sakovitch	Dept. of Community and Cultural Affairs
Martin Cabrera	Coastal Resources Management Office
Liz Udui	Physical Planning Office
H. R. Guerrero	Pacific Development Inc.
Daniel Muna	Office of the Mayor, Saipan
Joe Songsong	Commonwealth Port Authority
Ben Concepcion	B. C. Water Sports Inc.
John H. Robinson	Robinson Associates and Marine Surveying
Jess Pangelinan	Historic Preservation Office
Donald Bufton	Saipan Construction and Salvage
Vicente C. Aldan	Coastal Resources Management Office
Debby Knutson	Coastal Resources Management Office
Roger Gridley	Gridley Reality
Jesus G. Villagomez	Marianas Public Land Corporation

John Funey	Marianas Visitors Bureau
Carl L. Goldstein	Division of Environmental Quality
Benigno M. Sablan	House of Representative
Brian P. Reyes	Coastal Resources Management Office
Tammi Grove	Coastal Resources Management Office
Ivan Groom	Northern Islands Company
Ron Strong	PBEC, Incorporated
Michael Wilder	PBEC, Incorporated
John P. Duenas	Duenas and Swavely, Incorporated
Dan Swavely	Duenas and Swavely, Incorporated

c. SALAPAT TWO

SALAPAT TWO was held on August 30 and 31, 1984 and attended by the following participants:

Pedro A. Tenorio	Lt. Governor
Benigno M. Sablan	Representative, Fourth Northern Marianas Commonwealth Legislature
Jose M. Rios	Mayor, Island of Saipan
Manuel T. Sablan	Administrator Coastal Resources Management Office
Tammi Grove	Coastal Resources Management Office
Debby Knutson	Coastal Resources Management Office
Martin Cabrera	Coastal Resources Management Office
Bruce Lloyd	Coastal Resources Management Office
Felix Rabauliman	Special Assistant for Carolinian Affairs Office
Gloria Hunter	Govenor's Special Assistant for Programs and Legislative Review
Roger Gridley	Gridley Realty
Meredith Glenn	Saipan Chamber of Commerce
Maryann Aldan	Duty Free Shoppers (SPN) Ltd.
Joe Camacho	Duty Free Shoppers (SPN) Ltd.
Joe Songsong	Commonwealth Ports Authority
Bill Concepcion	Marianas Public Land Corporation
Felix Sablan	Marianas Visitors Bureau
Gordon Joyce	American Memorial Park National Park Service
Al Hockett	Department of Public Works
Jesus R. Sablan	Department of Commerce and Labor
Bill Lopp	Division of Environmental Quality
Magdalena S. George	Associated Insurance of the Pacific
John H. Robinson	Marianas Aqua Sports
Herman Guerrero	Pacific Development Inc.
Lydia Sablan	Economic Development Loan Fund
Nick Leon Guerrero	Department of Natural Resources
Pat Bryan	Division of Environmental Quality
Ivan Groom	Northern Islands Company
Mike Wilder	PBEC, Incorporated
John P. Duenas	Duenas and Swavely, Incorporated
Dan Swavely	Duenas and Swavely, Incorporated

B. Interviews

1. Questionnaires

In order to gather information from various Lagoon use planning groups, interviews were conducted in the form of questionnaires. Three separate questionnaires were devised (Figures 3, 4 and 5) as identified here:

1. Marine and Terrestrial Fishing and Gathering
2. Recreational Use
3. Commercial and Tourism Use

The survey objective was to distribute the first two questionnaires over the heavily used areas first. Two Saipan residents were employed to conduct the interviews in order to minimize cultural and language problems "outsiders" often have in obtaining accurate information from the public.

Marine and Terrestrial Fishing and Gathering Questionnaires were distributed to known fishermen and gatherers wherever they were found, at home or in the field. Field visits were made to known fishing and gathering spots along the shore, boat launching sites and where catches are distributed or sold.

The Recreational Use Questionnaires were distributed throughout the project area depending on level of use. Attempts were made to interview individuals over 15 years of age where they were recreating. Interviews were also conducted at the high schools to determine how young adults (ages 15-18) view present Lagoon uses and how they might be improved.

Commercial and Tourism Use Questionnaires were distributed to selected organizations which relate closely to the tourist industry and deal with tourists on a daily basis. These organizations are associated with glass-bottom boat cruises, trips to Managaha, fishing, scuba diving, bus tours and various related tourist pursuits. A few of these questionnaires went to beach rental outlets that sell or rent equipment to tourists. Very few interviews (less than 10) were obtained from Japanese tourists. A breakdown of completed interviews follows:

Fishing and Gathering	65
Recreational Use	122
Commercial and Tourism Use	16

2. Personal Interviews

Personal interviews were also conducted to gain insight into particular aspects of the project area or Lagoon uses. These aspects were generally subjective areas involving politics and policy. Individuals within the CNMI government as well as private businessmen with a vested interest in the growth and development of Saipan commented on numerous issues. Although no specific questionnaire form was used, most of the issues in the questionnaires were also covered in these personal interviews.

C. Planning Areas and Ecological Zones

The Plan's project area is subdivided into seven Planning Areas (Figure 1) and six Ecological Zones (Figure 6). The Planning Areas

Figure 3

MARINE AND TERRESTRIAL
FISHING AND GATHERING
QUESTIONNAIRE

DATE:
TIME OF DAY:

TYPE OF RESPONDENT

_____Ethnic group
___Alone
___Group (Specify number)

FISHING/GATHERING

___Subsistence
___Commercial
___Sport

LOCATION

Generic: ___Backshore ___Shoreline ___Nearshore ___Lagoon
___Outer Reef
Actual: ___Quadrant location on map
Launching site if by boat: _____
Entry point if on foot or swimming or by vehicle: _____

METHOD OF FISHING

___Cast net
___Gill net
___Fish weir
___Trolling
___Handline
___Trapping
Spearfishing: ___Skin diving ___Scuba diving ___Boat
___Shore
Hook and Line ___Shore ___Wading ___Boat

SPECIES

What are you fishing for? _____
What species have you caught? _____

TYPE OF GATHERING

___Land crabs
___Coral
___Shells
___Sand
___Coconut branches
___Pandanus leaves

____Coconuts
____Aluminum cans
____Mangrove trees (Specify for what: _____)
____Firewood (What type: _____)
____Fruits (What kind: _____)
____Medicinal plants (What kind: _____)
____Flowers (What kind: _____)

TIME

____Hours per day fishing/gathering

FREQUENCY

____Days per month fishing/gathering

QUALITY

Has the quantity increased ____ or decreased ____ since you started fishing/gathering?

If yes, can you explain the change? _____

_____

Has the size of individual species increased ____ or decreased ____ since you started fishing?

If yes, can you explain the change? _____

_____

SPECIAL ISSUES

What type of fishing/gathering activities cause problems? _____

_____

_____

What problems do you experience during your fishing/gathering? ___

_____

_____

What kinds of hazards do you fear or encounter when fishing or gathering? _____

_____

Do you ever see any illegal fishing/gathering in the lagoon area (poison, dynamite, chlorox, sand mining, live coral harvesting or other)? _____

_____

If yes, please give the location(s) by quadrant on the map. _____

_____

PERSONAL

____Age
____Sex
____Age began fishing/gathering
____Annual family income
Do you fish/gather in the same ____ or different ____ areas as when you started?
If not, then why? _____
Do you live in ____ lagoon area or not ____?
Do you drive to the lagoon area ____ or walk ____?
If you drive to the lagoon area where do you park? _____
What support facility or facilities do you need for your fishing/gathering activities? _____
_____

ADDITIONAL COMMENTS

Figure 4
RECREATIONAL USE
QUESTIONNAIRE

DATE:
TIME OF DAY:

TYPE OF RESPONDENT

___Chamorro
___Carolinian
___Local Resident (Specify: _____)
___Expatriate
___Tourist

ACTIVITY

___Swimming ___Snorkeling ___Scuba ___Waterskiing
___Sailing ___Motor Boating ___Fishing ___Gathering
___Shelling ___Picknicking ___Sightseeing ___Walking
___Park use ___Biking ___Other

LOCATION

Generic: ___Backshore ___Shoreline ___Nearshore ___Lagoon
___Outer Reef
Acutal: ___Quadrant location on map
Access point by boat: _____
Access point by car or on foot: _____

SPECIAL ISSUES

Name your favorite sights in the lagoon area _____
_____

What is your favorite beach? _____

How should the lagoon area look? _____
_____

Do you enjoy your activity in the lagoon area? ___ yes ___no

How could each of the above sights, beaches and activities be improved? _____
_____
_____

Do you use the Managaha beach ___yes ___no?

If no, then why not? _____
_____

Are there sufficient public areas for recreation and access to them? ___yes ___no

If no, indicate where access should exist for a particular recreation spot. _____

_____

What uses should be encouraged? _____

_____

What uses should be regulated? _____

_____

What uses should be prohibited? _____

_____

What kinds of hazards do you experience during your activity? ____

_____

What fears do you have regarding your activity? _____

_____

What should public beach lands be used for? _____

_____

What should private beach lands be used for? _____

_____

PERSONAL

____Age
____Sex
_____Ethnic group
_____Family annual income

Do you drive ____ or walk ____ to the lagoon area?
Where do you park if you drive to the lagoon area? _____

ADDITIONAL COMMENTS

Figure 5
COMMERCIAL AND TOURISM USE
QUESTIONNAIRE

DATE:
TIME OF DAY:

TYPE OF BUSINESS

____Hotel
____Tour Operator (Land)
____Tour Operator (Water)
____Rental
____Dive Shop

NAME OF ESTABLISHMENT _____

ACTIVITY

____Deep Sea Fishing
____Skin Diving (For what:_____)
____Scuba Diving
____Swimming
____Transportation to Managaha Is.
____Motorboats (Type:_____ For what:_____)
____Skiing
____Sailboats/Windsurfers
____Jet Skis
____Mopeds
____Bicycles
Sightseeing
____Bus transportation to Lagoon use
____Glassbottom Boats
____Dinner Cruises
____Other (Explain:_____)

TYPE OF EQUIPMENT AND QUANTITY (specify)

LOCATION/DESTINATION

____Backshore
____Shoreline
____Nearshore
____Lagoon
____Outer Reef
____Managaha Is.
____Other (Specify:_____)

FREQUENCY OF ACTIVITY

___Number of trips/rentals per week
___Number of tourists per week

SPECIAL ISSUES

What kind of fears do tourists express prior to engaging in these activities? _____

_____

What kinds of problems do the tourists complain of during these activities? _____

_____

What kind of problems do the tour operators experience during these activities? _____

_____

What kind of special support facilities do you require for these activities? _____

_____

Do these facilities exist in the lagoon area ___yes ___no.

If no, please explain what is needed. _____

_____

What future recreational or commercial uses can you forsee for the lagoon and shoreline in the lagoon area? _____

_____

Who uses your services?

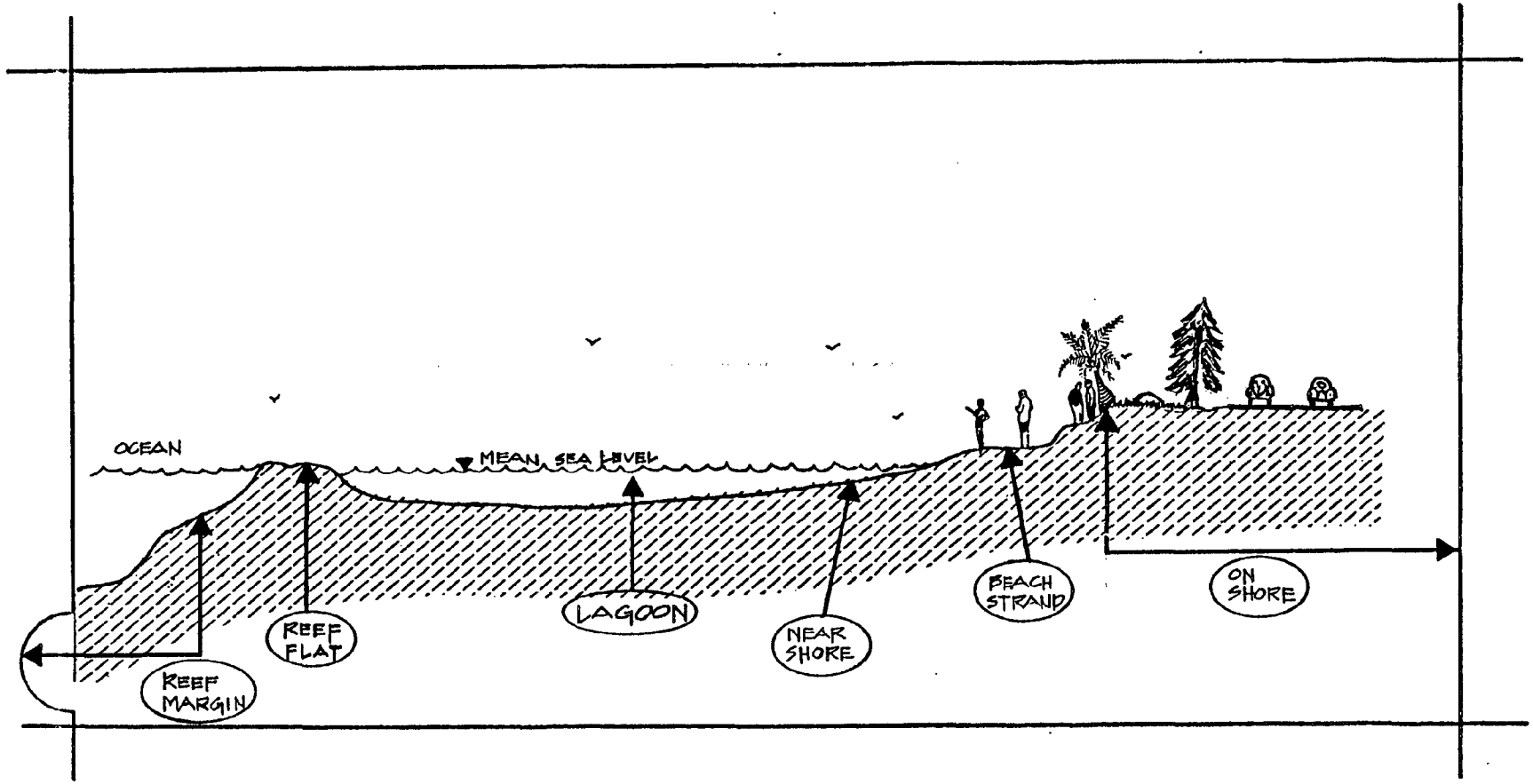
PERCENT EACH
___Tourists
___Local residents

ADDITIONAL COMMENTS

Figure 6.

ECOLOGICAL ZONES

SAIPAN LAGOON USE MANAGEMENT PLAN
TYPICAL PROFILE
NOT TO SCALE



are configured to include geographical areas (land and lagoon) with similarities in development and natural resources. Also, by subdividing the overall project area into several smaller areas, the data for human uses and natural resources can be presented in a more manageable fashion. The number and names of the seven Planning Areas from north to south are:

1. Puntan Magpi
2. Tanapag Harbor
3. Managaha Island
4. Puntan Muchot
5. Garapan Lagoon
6. Puntan Susupe
7. Puntan Afetna

1. General Description of Planning Areas

The northernmost Planning Area, Puntan Magpi, has 6,536 m (21,445 ft.) of coastline (the largest of all the Planning Areas) and stretches from northern Wing Beach to approximately 518 m (1700 ft.) south of Tanapag Village. The Lagoon portion of this Planning Area reaches farther southwest, to the vicinity of the Tanapag Harbor and Managaha Island. The villages of San Roque (1980 population of 623) and Tanapag (1980 population of 917) are part of this Planning Area. Except where the proposed Village and Residential Zone of these villages crosses West Coast Highway and penetrates inland, the highway constitutes the eastern inland boundary of this Planning Area.

The Tanapag Harbor Planning Area encompasses Saipan's port and industrial center. The land portion of this area is approximately 1,598 acres in size, with 3,459 m (11,350 ft) of shoreline, of which about 1,402 m (4,600 ft) are developable for docks and wharfs. The Lagoon portion is bounded by the harbor, turning basin and channel.

The Managaha Island Planning Area is comprised of Managaha Island and its nearby waters, all totalling about 590 acres in size.

The Puntan Muchot Planning Area reflects the Lagoon's most intensively used shoreline due to the adjacent resort, commercial and park facilities. This area's coastline is 3,840 m (12,600 ft) not counting the isthmus at Smiling Cove of which 2,225 m (7,300 ft) are bounded by publically-owned land and 1,615 m (5,300 ft) are bounded by privately-owned land. The inland boundary is Beach Road slicing through the Village of Garapan (1980 population of 2,063). The major public landmarks of this area are the American Memorial Park and the Garapan Wharf; the major private landmarks are the Hyatt, Saipan Beach and Hafa Adai Hotels.

The Garapan Lagoon Planning Area is characterized by sparse development on-shore, due to the narrow band of inland area between the shoreline and Beach Road, as well as the Lagoon's physical dominance. The coastline of the area is about 3,200 m (10,500 ft) long.

In the Puntan Susupe Planning Area is Saipan's seat of Government and the second largest concentration of tourist-related industries. The 4,039 m (13,250 ft) coastline contains both public parks

and privately maintained beaches. The Civic Center, Sugar Dock and associated channel are the most prominent public landmarks in this Planning Area. The Royal Taga and Grand Hotels are the most prominent private developments. San Jose (1980 population of 808), Susupe (1980 population of 722) and Chalan Kanoa (1980 population of 2,678) all lie partially within this Planning Area.

Puntan Afetna is the southernmost Planning Area. It begins just north of Hopwood Junior High School and stretches to Agingan Point, encompassing 2,947 m (9,670 ft) of shoreline. This Area includes nearly all of San Antonio Village (1980 population of 1,257) as well as large parcels of public land at the Agingan Sewage Treatment Plant, Hopwood Junior High School and the former U.S. Coast Guard Station. The recently re-opened White Sands Hotel as well as through-traffic to Koblerville significantly increase the average daily traffic volume through this Planning Area.

2. General Description of Ecological Zones

Ecological zones (Figure 7) were established in order to subdivide the project area into zones of ecological similarities. Ecological zones encompass six environmentally distinct areas which parallel, more or less, the Saipan Lagoon coastline. Each zone lies in a generally northeast/southwest alignment and traverses the length of the PLAN'S project area. These ecological zones are described as follows:

ON-SHORE - All fast land in each of the planning areas from 50 m (150 ft) inland of the high tide line to the project limit boundary. Includes Managaha Island.

BEACH STRAND - All land (beach or shoreline) within 50 m (150 ft) inland from the high tide line.

NEAR-SHORE - In the Lagoon to approximately 50 m (150 ft) from the high tide line.

LAGOON - The deeper water portion (3-15 m) within the barrier reef including the harbor and channels through the barrier reef.

REEF FLAT - Shallow water (less than 3 m) just inside the barrier reef.

REEF MARGIN AND SLOPE - Deeper water (3-20 m) outside the barrier reef.

The on-shore ecological zone represents the eastern, or inland-most boundary of the project area and generally lies between the Lagoon's beach strand and the West Coast Highway/Beach Road corridor. This transportation corridor is the most convenient approximation of the project area's eastern boundary, although the actual area of influences generally reaches one lot deep along the corridor's eastern side. Within Tanapag, the project area extends inland to Middle Road between Lower Base and American Memorial Park.

The Lagoon's influence and this PLAN's project area actually falls short of the West Coast Highway and Beach Road corridor at several places. These places include:

* Roadside commercial development which caters primarily to traffic along West Coast Highway and Beach Road. This

occurs within each of the seven coastline villages of San Roque, Tanapag, San Jose, Susupe, Chalan Kanoa and San Antonio. In Garapan, the tourist commercial area is closely linked with the adjacent, shoreside hotels.

* Non port-related development at the Lower Base industrial complex.
* The retail sales and services business district in Garapan between "hotel row" and Beach Road.
* The residential area of Chalan Kanoa between Beach Road and the coastline, which maintains its strongest ties inland, towards the village center.

At one location, between the Garapan Wharf and north San Jose, the Lagoon's influence reaches somewhat beyond Beach Road to the adjacent inland properties. For these reasons it is impractical to precisely define the inland boundary of the on-shore ecological zone area wide. In general, however, it is the West Coast Highway/Beach Road corridor.

The Lagoon-side boundary of the on-shore ecological zone is also somewhat amorphous. Generally, it lies about 50 meters inland from the high tide line and includes beach strand vegetation which is transitional between the sandy beach or rocky coastline and the permanent stand of flora.

CHAPTER III - SUMMARY OF DATA FROM QUESTIONNAIRES, INTERVIEWS AND PLANNING ADVISORY TEAMS

A. Fishing and Gathering

One hundred and sixteen (116) fishermen and food gatherers were questioned as part of this survey. By a 2 to 1 majority, lagoon fishermen reported they fish to feed their families, rather than for sport or commercial purposes. The most favored catch is the Mafuti (Snapper), followed by Tuna, Grouper, Ee (Juvenile Jacks, Caranx sp.), Parrotfish and Octopus. Fish are not the only thing fishermen and gatherers collect. Many people gather clams, crabs, edible algae and Tangan-tangan for firewood.

Sugar Dock is the favorite launching site for fishermen who use boats, though fishermen also use Charlie Dock, Smiling Cove, the Seaplane Ramp and a few other sites along the west coast. Fishermen reported the major problems on-shore as vandalism to their cars and harassment by troublemakers.

Fishermen agreed that the size and number of fish in the Lagoon has declined. They have blamed illegal fishing with dynamite and chlorine for some of the decline in their catch during recent years. Other problems mentioned included the absence of limits on the number of fish taken, netting of juvenile fish and water pollution. Few fishermen reported seeing dynamite or chlorine fishing taking place, but many reported knowing persons who used such illegal methods.

Litter was also a major concern of fishermen, who complained of cuts and other injuries caused by junk in the water and along the shoreline. The fishermen favored improvements in parking, better marinas, more channel buoys and lights on docks.

B. Recreational Uses

One hundred and twenty two (122) users of the beach areas and Lagoon were questioned in this survey. Not surprisingly, the largest number of recreational users of the Saipan Lagoon are beach picnickers and swimmers, whose favorite picnic site is Micro Beach. Managaha Island was the second most popular recreational site. The picnickers were not happy about persons who drive on the beach or dump litter and junk on the shoreline. Those questioned asked for more picnic facilities and favored having lifeguards and more police patrols at popular beaches. The Lagoon users also favored tighter regulations on pollution and fishing. Recreational users called for a cleaner beach and Lagoon area by an 8 to 1 majority.

C. Commercial and Tourism Uses

Sixteen (16) commercial and tourism use questionnaires were distributed during this survey. Results were discouraging since only a few (less than 10) were completed and returned. Of these, only three (3) were from tourists of whom one was a Japanese.

Based on these sketchy results, commercial establishments related to tourism are concerned that their patronage suffers from common problems associated with rapid growth areas. These include the lack of tourist free-time to pursue other than programmed activities, inadequate local public transportation and poor infrastructure.

QUANTITATIVE RESPONSES
Marine & Terrestrial
Fishing and Gathering
Questionnaire

Type of Respondent

Chamorro	43	Palauan	4
Carolinian	15	Hawaiian	2
Japanese (non-tourist)	5	Caucasian	2
		Tourist	1

Fishing/Gathering

Subsistence	48
Commercial	24
Sport	27

Location

Generic

Backshore	2	Nearshore	6	Outer reef	22
Shoreline	22	Lagoon	14		

Actual Quardrant

1-1	2-17	3-0	4-25	5-2

Launching Site By Boat

Sugar Dock	12	San Jose	2
SaiShip	8	Fishing Basin	3
Lower Base Sea-plane ramp	3	Grand Hotel	3
San Antonio Dump	1	Chalan Lolo	2
Smiling Harbor	2	Mobil Dock	1
Charlie Dock	1	Near Hong Kong Rest.	1

Entry Point on Foot

Civic Center	2
Public Works	1

Method of Fishing

Hand line	30
Trolling	15
Fish weir	8
Cast net	5
Gill net	3

Spearfishing

Skin Diving	11
Scuba (boat)	7
Scuba (shore)	3

Hook & Line

Shore	17
Boat	10
Wading	9

Species

Fished For & Caught

Mafuti	26	Skipjack	3	Yellow Fin	1
Tuna	13	Sea Urchin	3	Mullet	1
Grouper	11	Striped Surgeon	3	Unicorn fish	1
EE	9	Goatfish	2	Gadao	1
Parrotfish	5	Snappers	2	Sagamulum	1
Octopus	4	Marlin	2	Mahi	1
Reeffish	4	Soldierfish	2	Eels	1
Agas	1	Triggerfish	1	Clams	1
Hangun	1			Anything	4

Type of Gathering

Land Crabs	11
Shells (small clams)	1
Algae (Caulerpa)	1
Firewood (tangan-tangan)	1
For bait	2

Time (hours per day)

1-4	4-9	9-12	More than 12
15	38	4	1

Frequency (days/month)

1-6	6-11	11-20	20-30
13	11	13	33

Quality

Increased	4
Decreased	28
Same	6

Size

Increased	0
Decreased	32
Same	7

Reasons

Increased

- if you watch the seasonally

Decreased

- Illegal activities
- No limit on size
- Too many people fishing or gathering
- Overfishing in some areas
- Lagoon pollution
- Too many different activities in lagoon
- Fish are smarter

Special Issues

Fishing Problems

- Illegal activities (dynamite, chlorox)
- Too many boats working a school or area
- Cast nets wipe out juveniles

Personal Problems

- Cuts, bruises
- Broken glass & dangerous debris
- Inconsiderate fishermen
- Nets being hit by boats
- Not being able to sell the catch

Hazards

- Sharks, eels, jellyfish
- Capsizing
- Vandalism to auto while fishing
- Being hit by a boat while spearfishing
- Engine failure
- Harassment by young men (boys), trouble makers
- Bad weather
- Currents

Illegal Activities

- Only a few respondents ever observed illegal activities taking place

Location Of The Illegal Activities

Lagoon - Reef near fishing basin, Grand Hotel Reef, Civic Center Reef, San Jose Reef, Especially Quads 1 & 4

Other Areas - Laulau Bay, Forbidden Island, Tank Beach

Personal

Age

Less than 15	16-20	21-30	31-40	41-50	greater than 50
5	3	24	22	7	4

Sex

Male	Female
40	10

Age Began Fishing

Less than 15	16-20	21-30	31-40	41-50	greater than 50
12	9	7	0	0	1

Fishing in Same/Different area

Same	5
Different	10

Live in (5) or out (36) of plan area

Drive (30) or walk (30) to Lagoon

Where Do You Park	
Near shore	12
Shoreline	8
Home	3
Within view	3
Near lights	2
Beach Road	1
At launch ramp	1

Support Facilities

- Safe Parking
- Channel Buoys
- Channel Lights
- Dock Lights
- Cleaner Shoreline
- Better Marina

QUANTITATIVE RESPONSES
Recreational Use Questionnaire

Type of Respondent

Chamorro	52	Carolinian	26
Expatriate	35	Local Resident (other than Chamorro)	28
American	9	Caucasian	6
Japanese	5	Filipino	6
Filipino	1	Japanese	5
Indian	1	Chamorro/American	3
Palauan	1	Palauan	2
Unknown	18	Korean	1
Tourist	10	Carolinan/Filipino	1
Japanese	5	Unknown	1
American	2	Chinese/American	1
Canadian	1	Filipino/American	1
Australian	1	Chamorro/Palauan	1
Unknown	1		

Activity

Picknicking	145	Motor Boating	36
Swimming	123	Shelling	35
Snorkeling	89	SCUBA	30
Walking	78	Biking	30
Gathering	61	Waterskiing	28
Fishing	60	Sailing	24
Park Use	59	Other	5
Sightseeing	59	Drinking	3
		Beach combing	1
		Sex	1

Location

Generic

Shoreline	69	Lagoon	54	Outer Reef	34
Nearshore	64	Backshore	53		

Actual Quadrant

4-39 2-13 1-4 3-1 5-1

Access Point by Boat

Fishing Basin	9
Smiling Cove	3
Grand Hotel (Taguchi Beach House)	4
Seaplane Ramp (Lower Base)	3
Boat Basin	1

Access Point by Foot or Car

Grand Hotel	11
Micro Beach	10
Civic Center Beach	10
Chalan Lolo	7
Fishing Basin	3
Intercon Hotel	3
Hyatt Hotel	2
Quarter Master	2
San Jose	2

(Beach Road, Pau Pau Road, American Memorial Park, Saiship Sagman, Morrow Retail Store, Smiling Cove - 1 each)

Special Issues

Favorite Sights in Lagoon

Reefs	48	Sunsets	3
White Sand Beaches	22	Seaward Nearshore	2
Managaha Island	16	Surf	2
Ocean & Lagoon	12	Anchors, Sharks, Mike, Ron	1
Fish & Coral	8	Women	1
Coconut Trees	3		

Favorite Beach

Micro Beach	27	Pau Pau Beach	5
Managaha Island	11	Wing Beach	5
Obyan Beach	7	Taga Hotel Beach	3
Tank Beach	7	San Antonio Beach	2
Civic Center Beach	7	Marine Beach	2
All West Coast	7	Bantalan Beach	2

(Hyatt, Grand, Townhouse, American Memorial Park - 1 each)

How Should the Lagoon Area Look

Cleaner	88
Okay as is	10
Plenty of fish & coral	8
Beautiful	7
Alive	5
People enjoying themselves	4
Lots of picnic areas	3
Better roads	2
Better in general	2

(No wild animals, calm & peaceful, less junk - 1 each)

Do You Enjoy Your Activity in the Lagoon Area

Yes - 87 No - 13

Improvements

32 More picnic tables & better ones (island style)
17 More & bigger shelters

10 More garbage cans
16 More recreational activities available (volleyball, soccer, tennis, badmitton, football)
8 Showers
7 More restrooms
7 More lights in recreational areas
6 Fast food outlets in vicinity of recreational areas
6 Cleaner restrooms
5 Playground facilities for children
5 Plant more trees for shade
4 More bar-b-que pits
4 Chairs for lounging
3 Stop dumping junk along shoreline
3 Remove junk along shoreline
3 Get peopole involved in cleaning up their mess
3 Rope off swimming areas used frequently
2 Beach Patrol
2 Life guards
2 Build more piers
2 More women who speak english & wear bikinis
1 (Initiate water safety, regulate taking small fish, clean beach daily, public meeting halls, better enforcement, regulate pollution, more parks, stop illegal activites - dynamite, chlorox, litter)

Do you use Managaha Beach

Yes-86 No-31

If No Then Why?

11 No transportation
3 Not enough time to go there
2 Do not like people who work there
2 Do not know where it is
2 Not accepted by people who work there
1 (New to island, boring there, too far)

Are there sufficiant Public Areas for Recreation and Access to them?

Yes-63 No-16

What Uses Should Be Encouraged

13 Sports Clubs; Windsurfer Clubs
12 Cleanliness
6 Lifeguards
4 Parks
2 Volleyball
2 Fishing
2 Parties
1 Swimming & Snorkeling

What Uses Should Be Regulated

12 Littering
9 Enforce existing regulations
7 Maintenance
4 Dumping
4 Parking areas
3 Taking sand
2 Picknicking
1 (Clean beaches, scaring tourists, fishing, polluting water, destruction of lights)

What Uses Should Be Prohibited

12 Dumping
3 Drugs
1 (Driving cars on beach, illegal fishing, parking cars on shoreline, swimming in boating areas)

What Kinds of Hazards Do You Experience...

25 Sharp objects in water
13 4-wheel vehicles on beach
11 Currents
6 Trouble makers
3 Fresh men
3 Rough surf
2 Harrassment
2 Low tides

What Fears Do You Have...

18 Drowning
16 Vandalism
15 Water safety
10 Bums
9 Loss at sea
7 Rapists & murderers
5 Drunks
2 Leg cramps while swimming
2 Outsiders
1 (Injuries, not enough women)

What Should Public Beach Land Be Used For

35 The Public
13 Family Gathering
7 Picknicking
7 Public Beaches
5 Sports
5 Tourists
4 Fishing
2 Swimming
2 Recreation

What Should Private Beach Lands Be Used For

20 The Public
20 Private
11 Owners choice
7 Beaches should be owned by everyone
5 Any function
3 Respect of owners desire
1 Fun

Personal

Age

less than 15	16-20	21-30	31-40	41-50	greater than 50
5	42	20	8	2	0

Sex

Male	Female
64	52

Annual Income ($)

Less than 5,000	5,000-10,000	10,000-20,000	20,000-30,000
1	2	1	3

30,000-40,000	40,000-50,000	greater than 50,000
1	0	2

Ethnic Group

31 Chamorro
27 Caucasian
22 Carolinian
8 Japanese
6 Filippino
2 Palauan
1 Chinese
1 Marshallese

Drive	Walk
57	45

Where Do You Park

24 Parking lot
17 Beach
10 Backshore area
5 Near shoreline
2 Lagoon area
1 (Grand Hotel, Townhouse, Micro Beach)

Comments

- Government should clean the beaches on Thursdays prior to the weekend & Mondays after the weekend
- More lights for bar-b-que areas
- Beaches should belong to everyone
- Have the young people clean the beaches and pay them
- Wing Beach needs some improvements
- This survey was a good idea. It should make the beaches better for us and the tourists

Tourists complained of inadequate personal safety as a result of harassment and the constant fear of danger. They claimed these problems could be reduced or eliminated with improved safety programs and better street lighting.

D. Personal Interviews

At least five (5) personal interviews were conducted during this survey. These interviews were conducted with individuals in the public and private sector who exhibited a vested interest in the development of Saipan and the Saipan Lagoon, although numerous individuals were questioned on a variety of subjects regarding the project. Although these interviews often followed the format of the questionnaires, numerous other issues were discussed.

The majority of issues raised during these interviews were either political or developmental in nature. Government officials recounted a number of political issues involving legislation, management planning, taxation and continued federal aid in the future development of Saipan and the Saipan Lagoon. Of particular importance is the development of Tanapag Harbor and the Commercial Port, infrastructure and public utilities. Private businessmen recounted different objectives for development on Saipan in the vicinity of Saipan Lagoon. Most of their concerns dealt with providing more and better services for the tourists, such as hotels, restaurants, nightclubs and a myriad of smaller commercial activities.

E. Planning Advisory Team Objectives

1. SALAPAT ONE

The Planning Advisory Team for SALAPAT ONE discussed the following objectives for various issues of the project area.

* Objectives for the Project Area
  - Preferable land use mixes among residential, commercial, tourism and industrial uses.
  - Identification and preservation of certain unspoiled or threatened natural resources, undeveloped areas and historically significant areas.
  - The need for, and kinds of, additional public recreation opportunities.
* Objectives for Lagoon and Beach use
  - Maintaining or enhancing the Lagoon's water quality.
  - Accommodating both passive and active water recreation activities in the Lagoon.
  - Exclusive use of recreation opportunities for the local public.
  - Fishing, swimming, boating and harbor use conflicts.
  - Beach parking restrictions for motorized vehicles.
  - Identification and preservation of certain unspoiled or threatened natural resources, undeveloped areas and historically significant areas.

- Managaha Island development and its use by the local public and by tourists.
- Providing pedestrian access to the beaches.
- Alternate beach set-back schemes for buildings.
- Public Safety patrolling of beaches and park area.

* Objectives for the Port and Industrial Area
  - Harbor and port improvements to accommodate increased boat and ship traffic.
  - Water quality within the harbor area and its effect on nearby prime tourist and public recreation beaches.

* Objectives for Infrastructure, Public Facilities and Public Services
  - Matching the intensity of development with supporting infrastructure.
  - Storm water disposal alternatives for direct discharge into the Lagoon.
  - Effectiveness of the CNMI planning process.
  - Cost sharing of public infrastructure improvements which support tourist and commercial facilities.
  - Role of the Coastal Resources Management Program.
  - Solid waste management programs for dealing with trash and beach litter.
  - Public Safety patrolling of beaches and park areas.

* Objectives for Building and Physical Design Standards
  - Landscaping requirements for shoreline commercial developments.
  - The Government's responsibility for complying with standards and for enforcing the standards.
  - Reasonable parking requirements and sign regulations.
  - Establishing density, height and bulk standards for structures.
  - Maintaining view corridors.

The following is a list of primary objectives and opinions elicited from SALAPAT #1 Participants.

- Limit Saipan's industrial area to the present northern boundary of Lower Base.
- Develop regulations to control stormwater runoff and erosion.
- Intersperse hotel/resort development along the Saipan Lagoon shoreline.
- More developed public beach sites are needed along the southern shoreline.
- A boat launching ramp and reef pass in the northern lagoon would be very helpful to fishermen.
- Strongly protect the mangrove swamps (Northern Port and at Memorial Park), lagoon wrecks and the Managaha

Island reef (perhaps an underwater park and marine sanctuary).

- Eliminate and seal-off the Puerto Rico dump as soon as possible.
- Establish a small boat operator's licensing and safety program.
- Prohibit motorized vehicles on beaches.
- Increase public beach restrooms and improve maintenance of existing beach restroom facilities.
- Dredge harbor basin and access channel to accommodate larger and deeper draft vessels.
- Establish engineering plans for abatement of storm water discharge into the Lagoon.
- Step-up public relations within the CRM program.
- Need enforcement and fines for littering and illegal dumping, including dead animals.
- Provide for CRM inspectors to issue littering citations.
- Increase room rate taxes to help defer costs of lagoon and beach improvements.
- Establish landscaping regulations for commercial and resort development projects.
- Prohibit fencing of beachfront properties.
- Pass legislation to enact a zoning law and promulgate the necessary rules and regulations to accompany that legislation.
- Small boating facilities need general upgrading.
- Fish and wildlife rules and regulations should be expanded to include the Lagoon.
- Uphold traditional uses of the Lagoon and shoreline whenever and wherever possible, especially in the villages of San Roque and Tanapag.
- Use of trees as windbreaks for barbecue fires is causing irreversible damage to many shoreline trees.
- Continue to regulate the taking of coral.
- Identify underwater, historically-significant properties.
- Developers should share in the cost of providing basic infrastructure.
- Consider relocation of Hopwood High School to an inland site.
- Public lands which are leased for resort development purposes should require a portion of the area to be dedicated for public use.
- Include a village representative when planning for a project in a particular village.
- Total disrepair of the sanitary sewer system deserves priority attention.
- Revoke MPLC lease permits which are not being developed in accordance with the terms and conditions of the lease.
- Correct the sewage backwash problem at Agingan Point.
- Investigate cause and abatement of jellyfish which are a seasonal nuisance around the Micro Beach area.

- Repair sewage outfall at Charlie Dock, and possibly relocate to outer reef as an ocean outfall.
- Government should require safe swimming areas in front of hotels.
- Consider centralized location for rental of beach paraphernalia.
- Provide better visitor information regarding water recreation in the Lagoon.
- Provide a plan for maintaining view corridors to the Lagoon.
- Emphasize property coverage rather than height limitations for hotel development. However, a height limit should be set.
- Consider relocating the Legislature away from Civic Park.
- At the upcoming Constitutional Convention, seek a minimum amount of funds to be dedicated for new CIP's.
- Consider levying impact fees when large developments (hotels and subdivisions) hook-up existing public infrastructure.
- Provide for more parking near to beach accesses.
- Curtail the junk car business along Beach Road.
- Limit the authentic "fisheries" activities to the Port area, not the other docks.
- Consider an International Market Place at the American Memorial Park.
- Follow the OTSP Master Plan for Beach Road.
- Consider the acquisition of lands bordering Beach Road.
- Establish areas for aquaculture and mariculture.
- Require mandatory sewer hook-ups for residences and businesses.
- Make provisions for local stormwater drainage based on natural developments.
- Coordinate the Saipan Lagoon Use Management Plan with the Chalan Kanoa Redevelopment Plan.
- Consider property taxes as a revenue source.
- Establish a sign control law.

2. SALAPAT TWO

The primary purpose of SALAPAT TWO was to get participants' opinions about the proposed plans of action and other ideas about how to best achieve the Saipan Lagoon Use Management Plan objectives from the SALAPAT One consensus. Reference materials and proposed alternative plans were provided to all participants. This material included the following:

- A synopsis of the objectives that were established during SALAPAT ONE.
- A general description of proposed plans of action to achieve each of these objectives.
- Several sets of proposed regulations for such subjects as landscaping, signs and shoreline setbacks.

Major discussions about issues relating to project areawide objectives as well as to ecological zone objectives are listed below.

* Project Areawide Objectives
  - Public Information
  - Community Planning
  - Financing
  - Land Use Planning

* On-shore Ecological Zone Objectives
  - Zoning and Land Use
  - Public Recreation Facilities
  - Public Facilities and Infrastructure
  - Conservation of Resources

* Beach Strand Ecological Zone Objectives
  - Beach Use
  - Beach Protection
  - Beach Structures

* Near-shore Ecological Zone Objectives
  - Water Supply
  - Stormwater Discharge
  - Mangrove Protection

* Lagoon Ecological Zone Objectives
  - Water Quality
  - Sea Farming
  - Preservation of Resources

SALAPAT TWO participants generally agreed with the proposed and/or alternative plans that were recommended for the project areawide and for the various ecological zones for achieving each objective.

The following comments, grouped by category of objectives within each ecological zone, were underscored by various groups of participants.

* Project Areawide
  - Public Information
    - Visitor information should be improved in both quality and comprehensiveness of data.
    - Public information regarding CIP data should be made available on a regular basis. Local businesses must be kept informed of the planned improvements resulting from this project.

  - Community Planning
    - The formation of a Planning Commission for review of public and private projects was supported.
    - Retaining traditional values and uses are extremely important objectives. However, rather than only "preservation of traditional uses," per se, as an objective, the emphasis should be on "enhancing the overall quality of life."

- This Saipan Lagoon Use Management Plan must be adopted by legislation in order to be fully effective.

- Financing
  - Earmarking a fixed percentage of the Hotel Tax for lagoon-oriented infrastructure improvements is feasible.
  - EDLF loans now earmarked for marine industries can be targeted for Saipan Lagoon improvements.
  - Assessments for new, large scale developments may attain some success, but they should not be applied to such an extent that they become a disincentive to economic growth. Such assessments should not be applied within areas that are specifically targeted for development. The existing Utility Rate Structure should be used as the basis of such assessments.
  - Any financing scheme for the Saipan Lagoon project area is likely to overlap islandwide and this impact must be understood and accounted for in the final recommendations for financing.
    Quite likely, the financing of improvements will have to be worked into the CNMI annual operating budget.
  - Taxes, per se, are an unacceptable form of financing the recommended improvements.
  - Federal Funds (especially UDAG) should be sought to finance as many improvements as possible.

* On-shore Ecological Zone
  - Land Use and Zoning
    - The proposed Zoning and Land Use District Legislation should be adopted in its entirety, along with adjustments that may result from this PLAN. The proposed zoning and land use recommendations should be implemented immediately on all CNMI owned lands.
    - In developing the Public Market Place, special attention must be paid to maintaining adequate sanitation.
    - Businesses should organize among themselves to self-police the proposed sign regulations.
    - Conflicts must be removed among the land use plans of this project; the proposed Zoning and Land Use District Legislation and MPLC's Land Use Plans.
  - Public Facilities and Infrastructure
    - Public Works has already adopted the OTSP Transportation Plan for the Beach Road and Middle Road Corridors.
    - Mandatory sewer hook-up should be pursued. Possibly, this program can be initially bankrolled from a revolving loan fund.

- O & M of public infrastructure requires a guaranteed source of funding. Future Federal grant conditions may carry O&M requirements as a prerequisite for funding.
- Conservation of Resources
  - Control of litter requires more than stepped-up enforcement. Societal education is required, starting in the early school years.
  - CRMO must work more closely with DPS to achieve "low-level" enforcement.
  - All "Saipan Lagoon project area" proposed infrastructure should be integrated with islandwide infrastructure planning and development.

* Beach Strand Ecological Zone
  - Beach Use Objectives
    - The Department of Defense, specifically the Army Reserve, should be contacted for assistance in removing or relocating hazardous war relics.

* Near-shore Ecological Zone
  - Mangrove Protection
    - The proposed Garapan Flood Control Project will create an estuary for planting of new mangroves.

VOLUME I

PART B

PRESENTATION OF DATA AND ANALYSES

BY

PLANNING AREA

AND

PROJECT AREAWIDE

CHAPTER I - PUNTAN MAGPI PLANNING AREA

For discussion purposes, Planning Area 1 (Puntan Magpi) is divided into two sections. The northern portion extends from the point just south of Unai Dikike Matuis (Boomtown Beach) north to the far end of Wing Beach. This portion of the Saipan Lagoon essentially consists of an inner and outer reef flat and the reef margin but does not contain a deeper lagoon or moat area as does most of the rest of the Lagoon. Therefore, for this northern portion of Area 1 the ecological zones will consist of the near-shore zone (inner and outer reef flat) and the reef margin and reef slope zones. The remainder of Area 1,. south to Unai Tanapag, includes the majority of the northern Saipan Lagoon and contains the four ecological zones described earlier.

A. Natural Resources

1. Living Marine Resources

a. Northern Portion - Inner and Outer Reef Flat (near-shore)

The near-shore or reef flat zone of the northern portion of Area 1 is characterized by a rocky shoreline with relatively steep slopes and low cliffs along a limestone terrace. Many locations of the northern lagoon consist of cut benches or a rocky shoreline which borders the inner reef flat platform. Isolated pockets or short stretches of beach deposits are common and are comprised primarily of sand with some gravel and coral/algal rubble.

From the area known as Unai Dikike Matuis (sometimes known as Boomtown Beach) to the northern extremity of Wing Beach the reef flat platform averages approximately 160 m wide. Predominant corals include Acropora formosa, Acropora aspera, Pocillopora damicornis, Pocillopora eydouxi, Porites lutea, Psammocora sp. and Heliopora coerulea.

Other corals common in this area include species of the genus Favia, Hydnophora, Leptastrea, Stylophora and Galaxia. The outer reef flat is characterized by a rich and diverse coral community with 75 - 100% coral cover in much of the area. Depth of the outer reef is shallow, between 0.5 - 1.0 m. Some of the Acropora beds and portions of the reef margin are awash at low tide.

Coral cover lessens to 25 - 40% midway to shore and averages only 10 - 20% along the inner reef flat. Coral species are similar to the outer reef flat with Acropora and Pocillopora being the dominant forms. Water depth increases near shore to an average of 1.0 - 1.5 m.

There are no seagrasses present in this area and only a few species of algae were observed, including Turbinaria ornata, Halimeda opuntia, Padina tenuis, Chlorodesmis fastigiata and Schizothriz calcicola. None of these algal species were dominant or comprised a very high percentage of substrate cover.

Fish fauna in this area is quite rich and several schools of fish were observed moving through the reef flat. A large school of goatfish (Mulloidichthys flavolineatus) comprised of approximately 500 individuals and a group of approximately 50 mullet (Liza vaigiensis) were observed. Other common fishes included parrotfishes (Scaridae), wrasses (Labridae), rabbitfish (Siganidae), surgeonfishes (especially Acanthurus triostegus), needlefish (Belonidae) and damselfish (Pomacentridae). One small (1.2 m) reef blacktip shark (Carcharhinus melanopterus) was also observed.

Amesbury, et. al. (1979) reports that this habitat contains a moderate diversity of fish. Important fishes include goatfish (Mullidae), juvenile parrotfish, surgeonfish (Acanthuridae), snappers (Lutjanidae), wrasses and rabbitfish.

b. Northern Portion - Reef Margin and Slope

The reef margin and slope at the north end of Wing Beach is accessible from shore by divers who enter and exit via a narrow cut in the reef. This is a popular dive spot for residents and tourists and entry is usually possible, except during times of rough sea conditions.

Coral cover is rather sparse as one moves away from the margin and the rich coral fauna found in the surge zone. Species here are comprised mostly of hearty, wave-resistant forms such as Pocillopora eydouxi, Stylophora mordax, Porites sp., Psammacora sp., Acopora nasuta, A. humilis, A. wardi, A. surculosa, Pocillopora setchelli, P. elegans and P. verrucosa. Coral cover in this zone varied from approximately 50 - 80%.

Deeper water (3 - 20 m) coral fauna is also very diverse with coral cover in many sections of the reef ranging from 30 - 50%, although other areas had significantly lower coverage. Except for the reef opposite Wing Beach, there is very little apparent reef damage from Acanthaster planci (crown-of-thorns starfish). In fact, no Acanthaster were observed during a tow along the outside of the barrier reef which covered approximately one kilometer.

Dominant corals along the outer barrier reef of Planning Area 1 include Stylophora mordax, Acropora nasuta, Pocillopora eydouxi, Acropora smithi, Millepora platyphylla and M. dichotoma, and Porites lutea. Soft corals (Sinularia sp.) were patchy but very abundant in some areas. Other conspicuous corals observed were Favia stelligera, Stylaster sp., Acropora palifera sp., Goniastrea retiformis, Fungia sp., Pavona duerdeni, Porites rus, Diploastrea heliopora and Leptoria phrygia.

Fish diversity is high in this area and all along the seaward portions of the barrier reef north of the Tanapag Channel. Amesbury, et. al. (1979), reported that the greatest fish diversity he observed occurred in this habitat. The highest abundance was recorded here for surgeonfishes (especially Acanthurus lineatus), parrotfish (Scaridae), large wrasses

(Labridae), groupers (Serranidae) and rudderfish (Kyphosus sp.). Other fishes observed include the reef whitetip shark (Triaenodon obesus), spotted reef ray (Taeniura melanospilos), a very large tanguisson (Cheilinus undulatus), barracuda (Sphyraena barracuda), breams (Scolopsis cancellatus), emperors (Lethrinus sp.), snappers (Lutjanus sp.), jacks (Caranx sp.), squirrelfish (Adioryx sp.) and bigeyes (Myripristis sp.).

Conspicuous macroinvertebrates observed in this area include the starfish Acanthaster planci (Wing Beach area only), Culcita novaeguineae, Linckia laevigata, L. multifora and L. guildingi, the sea urchins Echinometra mathaei and Echinothrix sp., miscellaneous sponges and a few crinoids.

c. Near-shore

The near-shore area of the remainder of Planning Area 1 encompasses the area from just north of the seaplane ramps in Tanapag Harbor north to the point just south of Unai Dikike Matuis. The near-shore environment is comprised mostly of seagrasses and algae growing on a substrate of sand, silt and coral/algal rubble with occasional rocky shoreline sections and several beaches.

The near-shore area from the point south of Unai Dikike Matuis to Unai Paupau consists mainly of the seagrass Halodule uninervis on a sand and rubble substrate. Just south of the point is an area where the alga Turbinaria ornata is dominant, forming clumps and accounting for approximately 40% coverage in spots. Halodule, however, is the overall dominant form and accounts for 10 - 50% coverage along the shoreline and near-shore zone. Other algae present include Dictyota sp. and Padina tenuis. Scattered corals are rare near-shore but occasional small size Pocillopora damicornis and Porites lutea are present in rubble areas. Occasional beds of Acropora are present near-shore but are much more common in the lagoon and reef flat areas.

The shoreline area opposite San Roque is characterized primarily by Halodule which accounts for 40 - 50% of the cover. Other common species are the blue-green algae Schizothrix calcicola and Microcoleus lyngbyaceus, as well as Lobophora variegata, Padina tenuis, and Dictyota bartayresii.

Opposite and just south of Puntan Achugau the near-shore algal community is dominated by Sargassum polycystum (50 - 75%) with the remainder being mostly Halodule. Further south, dominant species include Dictyota, Halimeda opuntia and Caulerpa sp. In the area of Unai Achugau the seagrass Enhalus acoroides becomes the dominant species, with some Halodule and Dictyota. Enhalus is often found in clumps (beds) and in some areas, such as off Puntan Dogas and in the bay north of Commercial Port (Unai Tanapag), it accounts for 40 - 80% cover. Occasional Porites lutea and Pocillopora damicornis are found scattered throughout this area but are minor contributors to the substrate coverage.

The only near-shore area of significant coral development occurs directly offshore of Tanapag village, opposite Puntan Dogas. This area is quite diverse in coral species but only averages 20 - 30% live coral cover, with quite a lot of the coral being dead. In isolated spots coral cover reaches approximately 50 - 60%. Thick Halodule beds occur just offshore and to the east and west of the reef, with Halimeda macroloba also quite common. Common corals found in this reef area include Pocillopora damicornis, P. setchelli, Porites lutea, Acropora virgata, A. formosa, Heliopora coerulea (large heads, 8 - 10m in diameter), Lobophyllia hemprichii, Psammocora contigua, Pavona venosa and Montipora sp. Less common corals observed were Millepora dichotoma, Pocillopora danae, Stylophora mordax and Favia sp. The starfish Culcita novaeguineae and Linckia laevigata and the sea cucumbers Holothuria atra, H. edulis and Synapta maculata were common along the near-shore zone and in the coral areas.

Amesbury, et. al. (1979), reports that this near-shore habitat, dominated by Enhalus and Halodule, contained the highest counts of rabbitfish (Siganus spinus and S. argenteus) and snappers (mostly Lutjanus fulvus, L. kasmira and L. monostigmus). Many of these snappers observed were juvenile forms. Also common in this habitat are goatfish (especially Parupeneus barberinus), silversides (Atherinidae), breams (Scolopsis cancellatus) and emperors (Gnathodentex aureolineatus, Lethrinus harak and Monotaxis grandoculis).

d. Lagoon

The deeper Lagoon waters of Area 1 are generally characterized by a sand and/or rock and rubble substrate with various species of algae and seagrass along with scattered corals and occasional small patch reefs. The Lagoon from the point south of Unai Dikike Matuis to approximately opposite Puntan Dogas is mostly a sand and coral rubble bottom with scattered corals usually comprising less than five percent coverage. The lagoon areas opposite Unai Paupau and San Roque are characterized by rich Acropora beds which at times account for up to 30% coverage. These zones of Acropora extend out to the landward fringes of the outer reef flat. Lagoon depth varies from two to three meters here.

Dominant corals in the Lagoon from Puntan Dogas north include Acropora formosa, A. aspera, Pocillopora damicornis, Stylophora mordax and Porites lutea. Some of the Acropora beds cover 90% of the substrate as in the areas north of San Roque and Unai Paupau. Many times the Acropora is dead underneath with only portions of the upper surface and periphery being alive. Fishing (especially spearfishing) is common around these Acropora thickets. The branching corals provide shelter for several species of squirrelfish (Holocentridae), damselfish (Pomacentridae), goatfish (Mullidae), snappers (Lutjanidae) and juvenile parrotfish (Scaridae). Common species include Flammeo opercularis, F.

sammara, Mulloidichthys flavolineatus, Lutjanus kasmira, Chromis sp. and Adioryx spinifer.

The sand and rubble areas of the Lagoon support patchy growth of algae and seagrasses such as Schizothrix calcicola, Microcoleus lyngbyaceus, Halodule uninervis, Halophila minor, Avrainvillea lacerata, Dictyota bartayresii, Caulerpa sp., Halimeda macroloba and H. opuntia.

The remainder of the Lagoon zone in Area 1 offshore of Unai Tanapag west to the boundary near Managaha Island is mostly a sand and coral/algal rubble bottom, varying in depth from 3 - 10 m. Water depth is generally greatest near the center of the Lagoon and near the Tanapag Harbor channel and basin. Although there is no extensive coral development on the Lagoon bottom, numerous patch reefs and isolated coral heads occur throughout the Lagoon. Major species include Porites lutea, Pocillopora damicornis, Millepora dichotoma, Heliopora coerulea, Stylophora mordax, Pocillopora danae, P. elegans, Acropora aspera, A. hebes, A. tenuis, A. nasuta, A. studeri, A. palifera, Favia sp., Platygyra pini, Lobophyllia sp., Porites cylindrica and Pavona venosa.

Algae and seagrasses common in the deeper Lagoon include Microcoleus lyngbyaceus, Halodule uninervis, Halophila minor, Halimeda opuntia, H. macroloba and Dictyota sp. In the mid-Lagoon area east of Managaha Island and north of the port and harbor close to the reef flat are large patches of Halodule intermixed with lesser amounts of Microcoleus. Cloud originally described these areas in 1959, but they were much more extensive at the time, extending from just east of Managaha to Unai Tanapag and Puntan Dogas. Amesbury, et. al. (1979) described the area as being covered with a mat of the blue-green alga Microcoleus but reported no Halodule. It is possible that areas such as this may change with time, and that algal and seagrass species coverage could vary depending on changing environmental conditions. Influences such as substrate disturbance from storms or typhoons or changes in water quality or temperature could affect these fast growing marine plants.

Fish species found in the deeper Lagoon areas are mostly bottom feeding species such as goatfish and mullet, and other fish such as jacks, wrasses, cardinalfish and emperors. Amesbury, et. al. (1979) reports that fish diversity is low in this type of habitat and that no economically important food fishes are abundant here. Some species observed include Lethrinus harak, Parupeneus barberinus, Mulloidichtys flavolineatus, Dascyllus aruanus, Halichoeres trimaculatus, Stethojulis sp., Scarus sp., Siganus spinus, Bothus mancus, Rhinecanthus aculeatus and Scomberoides lysan. While cruising slowly along sandy bottom areas unidentified stingrays (possibly Taeniura melanospila) were often observed.

e. Reef Flat

The reef flat within Area 1 is fairly similar along its entire length. Water quality is excellent as the clear ocean water

moves across the barrier reef into the Lagoon and exits through the main Tanapag channel and other low areas and cuts in the reef. As one moves from the Lagoon to the reef flat a rubble and boulder/rubble zone appears with both coral coverage and diversity increasing. Generally, the zone close to the reef margin and just inside the margin are characterized by greater species diversity and higher percent cover. Species common in the outer reef flat include Acropora smithi, A. formosa, A. nasuta, A. palifera, A. irregularis, A. hebes, A. aspera, Porites lutea, P. cylindrica, P. australiensis, P. convexa, Pocillopora damicornis, P. danae, P. setchelli, P. verrucosa, Stylophora mordax, Psammocora digitata, P. contigua, Millepora dichotoma, M. latifolia, Leptoseris sp., Pavona venosa, P. divaricata, Fungia fungites, Favia favus, F. matthaii, Goniastrea retiformis, G. pectinata, Diploastrea heliopora and Platygyra pini. Other species include Alveopora sp., Astreopora myriophthalma, Leptastrea sp., Goniopora sp., Leptoria phrygia, Montipora ehrenbergii, M. sp. and Plesiastrea versipora.

Coral cover within the reef flat zone varies from approximately 5 - 20%, increasing closer to the reef margin. This area of the barrier reef, including that from north of Tanapag channel and opposite Managaha Island (Area 2) is by far the richest and most diverse in terms of coral development and abundance of food fishes. At the time of this study, the northern part of the barrier reef also showed less damage from Acanthaster, with fewer individuals than on reefs south of Tanapag channel.

Amesbury, et. al. (1979) reported that this zone is diverse in regards to fish fauna with greater than 60 - 80 species recorded. Particularly abundant are goatfish (Mullidae), juvenile parrotfish (Scaridae) and surgeonfish (Acanthuridae), and it was one of the only areas where sharks were seen inside the lagoon. Other common fish here include snappers (Lutjanidae), wrasses (Labridae), parrotfish, rabbitfish (Siganidae) and blue Chromis (damselfish). A complete species listing can be found in Appendix A.

f. Reef Margin and Slope

The reef margin and reef slope within Area 1 are well developed and diverse in terms of coral species and fish fauna. Water quality is very good and the overall health and productivity of the area is much better than the barrier reef south of the harbor which has been impacted more by fishing, harvesting, coral predation, siltation and decreased water quality.

Common corals observed along the reef margin and slope include Stylophora mordax and Pocillopora eydouxi which form heads up to 1m in diameter; Acropora nasuta, A. tenuis and A. sp. (up to 2m in diameter); Millepora platyphylla, M. dichotoma, Porites lutea, Acropora smithi, A. surculosa, Favia stelligera, F. pallida, Stylaster gracilis, Distichopora gracilis, Goniastrea retiformis, Pavona duerdeni, P. clavus, Porites rus and Lobophyllia corymbosa.

Coral cover varies from approximately 40 - 70%, and approaches 85% cover near surge channels and other areas that favor coral development. Soft corals were observed all along the barrier reef and in a few locations accounted for as much as 20 - 25% of the total coral cover. The most common soft corals observed were Sinularia sp. and Sarcophyton sp.

Fishes observed in this zone include the large tanguisson (Chelinus undulatus), the snappers Lutjanus bohar and Macolor niger, skipjack (Caranx melampygus), the groupers Cephalopholis argus and Epinephelus fasciatus, sweetlips (Plectorhynchus sp.), rudderfish (Kyphosus cinerascens), several species of parrotfish (Scarus sp.), surgeonfish (Acanthurus lineatus, A. triostegus, A. mata, Ctenochaetus striatus and Naso literatus), barracuda (Sphyraena barracuda) and the whitetip reef shark (Triaenodon obesus). Amesbury, et. al. (1979), describes this zone of the barrier reef as having high species diversity, with the spur and groove system (surge channels) having the greatest fish diversity of all areas of the surgeonfish (especially Acanthurus lineatus), adult parrotfish, large wrasses and large groupers. Other common fish include rabbitfish, juvenile parrotfish, needlefish, squirrelfish, jacks, snappers and goatfish.

2. Physical Marine Resources

a. Currents

No specific or detailed investigations concerning water movements in the Puntan Magpi Planning Area have been conducted. However, based on general information and field observations by Cloud (1959) and this investigative team it appears that there is a general movement of water from the northeast to the southwest. The prevailing current is influenced by both the north equitorial current and the northeasterly trade winds. Oceanic water enters the Saipan Lagoon across the barrier reef and is carried west and southwest along the shoreline and across the Lagoon to an exit area. As there are no large cuts or channels in the northern Lagoon, the majority of the water exits out the mouth of Tanapag Harbor.

b. Water Quality

Water quality is generally excellent in the northern Saipan Lagoon. Clear, oceanic water is continually entering the lagoon over the barrier reef and moves towards Tanapag Channel. There are no rivers that empty into the Lagoon in this planning area. San Roque and Tanapag villages each have one storm-water outfall which empties into the Lagoon. There are no sewage outfalls in Planning Area 1.

The CNMI Division of Environmental Quality (DEQ) currently has 29 shoreline sampling stations within the project area, and another 25 shoreline and 12 off-shore sampling points at Managaha Island (currently sampling is taking place at only 11 stations at Managaha Island). The four sampling stations

located within the Puntan Magpi Planning Area are Wing Beach, Paupau Beach, San Roque School and the Tanapag Meeting Hall. Data for various water quality parameters are available at the DEQ office. Figure 1-1 depicts locations the DEQ sampled for fecal coliform and indicates the number of samples and violations for the Puntan Magpi Planning Area as well as for the other six planning areas.

Recent data available from the DEQ covering the period October 1984 - March 1985 shows only one sample greater than 200/100 ml fecal coliform. The mean fecal coliform count for the six-month period is 63/100 ml.

3. On-shore Resources

a. Wetlands

Only one wetland is located in Planning Area 1, a 4.7 acre site located just south of Tanapag Village and bisected by West Coast Highway. This wetland is almost a pure strand of the reed Phragmites karka (Karriso).

b. Rare, Threatened and Endangered Species

The only endangered species likely to occur in this planning area is the Nightengale Reed Warbler (Acrocephalus luscinia) which is found in forested areas and wetlands. Although not that uncommon on Saipan at the present time, the species is listed as endangered in the Federal Register throughout its range. The Reed Warbler once occurred on Guam, primarily in the Agana Swamp area, but became extirpated on Guam in the mid-1970's.

The green sea turtle (Chelonia mydas) is known to have nested in significant numbers on Wing Beach and the Division of Fish and Wildlife reports that they still nest there in small numbers. Green sea turtles are classified as threatened species in the CNMI under Federal Law and very limited harvesting for subsistence purposes only is presently allowed. Efforts should be made to control development along Wing Beach and appropriate measures should be instituted to protect the nesting turtles and their eggs from illegal activities by man.

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

This rural-character Planning Area, which includes the northernmost villages of Tanapag and San Roque escapes the urban activity of nearby Garapan and Tanapag area. The Tanapag and San Roque village areas are each closely clustered and provincial in nature. The remaining land in this Planning Area is now either undeveloped or in small scale agricultural production.

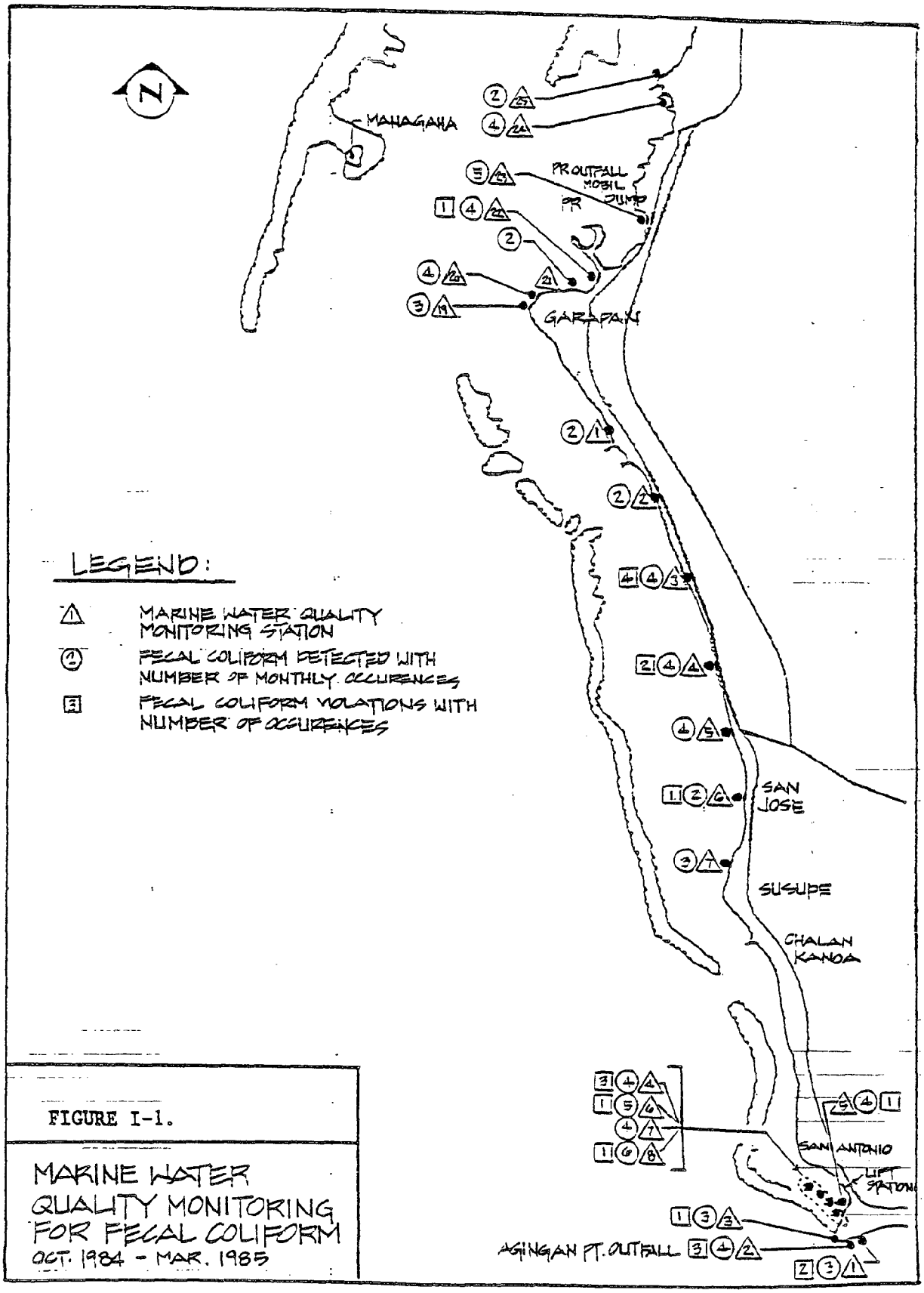


FIGURE I-1.

MARINE WATER QUALITY MONITORING FOR FECAL COLIFORM
OCT. 1984 - MAR. 1985

b. Public Land Ownership and Access

Several scattered sites of public land exist throughout this Planning Area. In addition to three developed beach parks (Unai Achugau, Unai Paupau and Wing Beach), the largest tract of public land lies just southwest of Tanapag Village. This tract is reserved by the Marianas Public Land Corporation for a future homestead.

c. Recreation Sites

The following park and recreation facilities now exist within Planning Area 1 (Table I-1).

Table I-1
RECREATION FACILITIES IN PUNTAN MAGPI PLANNING AREA

Park or Recreation Area	Existing Facilities
Wing Beach	Access Road, compacted coral, 1500 linear feet (lf)
Unai Dikike Matuis	Access Road, coral, 1200 lf
Unai Paupau	Access Road, compacted coral, 600 lf Picnic Tables 6 Camping Areas Pavilion
Unai Achugau	Access Road, coral, 200 lf
Unai Tanapag	Pedestrian accesses, two at 300 lf each Parking along access road (back road between Public Works and Tanapag)

d. Historic Sites

Underwater properties that are potentially historically significant located in this planning area include a Japanese Navy Flying Boat (Kawanishi H8K) sunk in approximately 35 feet of water and a popular dive location for tourists; a Japanese 46-foot landing craft located approximately 25 feet deep; the badly damaged hull of a Japanese cargo ship known

as the "Buoy Wreck"; and a partially destroyed Japanese Submarine Chaser (locally referred to as the "Submarine") which is sunk in approximately 30 feet of water and regularly visited by the glassbottom boat tours.

e. Beach Erosion and Stormwave Redistribution

There are no beach erosion sites within this Planning Area. However, stormwave redistribution does deplete these beaches.

f. Stormwater Drainage

San Roque Village is located within the major natural drainage of a 150-acre watershed basin. Run-off is collected and discharged at the southeastern corner of the village by means of an open concrete culvert about four feet wide and six feet deep. The culvert leads for 1000 feet to Cross Island Road where the stormwater is intercepted and conveyed northward along the highway by a series of shallow earth-lined ditches and small culverts.

The capacity of existing drainage is about 450 cubic feet per second (cfs) or about half of the necessary capacity to accommodate runoff from a storm with a frequency of occurrence of ten years. Thus, the capacity is inadequate to accommodate runoff from storms of even light to moderate intensity. Aside from these inadequacy, the concrete channel is also a safety hazard because of its depth and proximity to the roadway.

2. Economic Resources

a. Subsistence Fishing and Gathering

The near-shore and lagoon areas of the Puntan Magpi Planning Area are important for subsistence fishing, especially along Tanapag and San Roque villages and Unai Achugau and Unai Paupau. Throw-net (Talaya) fishermen were observed walking the beaches and shoreline in search for schools of small fish. Snorkelers and spearfishermen were also observed in the Lagoon, and the park area just south of the church at Tanapag is frequently used as a launching area for small boats.

b. Tourism Industry

There is no tourism industry at the present; however, Japan Air Lines is planning to construct Hotel Nikko Saipan, a 12-story, 320 room resort complex just north of San Roque village.

CHAPTER II - TANAPAG HARBOR PLANNING AREA

Planning Area 2 includes the Tanapag Harbor channel, harbor basin and the deeper areas of the harbor proper. For the near-shore environment, Area 2 encompasses the shoreline from the two seaplane ramps at Puntan Flores south to the southeastern boundary of the Puerto Rico Dump. Much of the marine environment in Area 2 has been altered or disturbed over the years through such activities as dredging, filling, construction, effluent discharges and impacts associated with the dump. Saipan's harbor, commercial port and power plant are also located in Area 2.

A. Natural Resources

1. Living Marine Resources

a. Near-shore

The near-shore zone of Area 2 represents the most disturbed shoreline of the entire Saipan Lagoon. The harbor and basin areas have been dredged, primarily during the 1930's and 1940's and several fastland piers and spits of land have been constructed, subdividing the shoreline into several small embayments. Wreckage, primarily dating from World War II and shortly thereafter, provides a major substratum in shallow near-shore areas. Numerous barges, probably used as floating piers, exist along the shoreline and in shallow bays.

A small embayment just north of Delta Dock contains the only significant mangrove stand on Saipan. The mangrove tree Bruguiera gymnorrhiza extends from the shallow inner portion of this fine silt and sand substrate embayment approximately 400 m into the small drainage basin/wetland area across the bridge from the bay. This is one of only two mangrove areas left on Saipan, and it should be protected from filling or other construction activities or discharges which would have a negative impact on them.

The dominant organisms comprising the highest percent coverage of the near-shore environment are the marine plants. The seagrass Enhalus acoroides is the dominant species along shore in the many embayments where it comprises 30 - 95% of the bottom substrate. Other common marine plants which are locally dominant include Schizothrix calcicola, Polysiphonia scopulorum, Halophila minor, Microcoleus lyngbyaceus, Halimeda macroloba, H. gigas, H. opuntia, Halodule uninervis, Lobophora variegata, Dictyota bartayresii and Gelidium pusillum. Doty and Marsh (1977) did a comprehensive marine biological survey of the area from Unai Sadog Tasi to Puntan Flores in February and June 1976. Data from this study indicate percent coverage for marine plants varied from a low of 22% in Baker Bay and 23% in outer Charlie Bay to a high of 96% off Able Dock and 91% along the southwestern side of Baker Dock. A total of 63 species of marine plants was reported for the study area in this report.

Corals in the near-shore environment of Area 2 are generally sparse or absent to locally common, depending upon the

substrate. Piers and wharfs, many sunken barges, pilings and other wreckage provide excellent substrate for corals and keep them above the bottom where they would otherwise not survive because of heavy siltation. The major corals found attached to metal or concrete objects are Pocillopora damicornis, Porites lutea and Millepora dichotoma. Small scattered colonies of P. damicornis and P. lutea were observed in the bays and among seagrass beds and where rock or coral rubble substrate afforded a place of attachment.

Doty and Marsh (1977) reported a total of 28 species of corals from their study area with percent cover ranging from a low of 8.4% at the end of Able Dock to a high of 49.2% on the northeastern side of Baker dock. Charlie Bay averaged 29.8 percent coral cover. In this study the most abundant corals were Pocillopora damicornis, Porites lutea, Millepora dichotoma, Montipora lobulata, M. verrilli, Leptastrea purpurea, Goniastrea retiformis, Acropora aspera and A. palifera.

The fish fauna of the inshore zone of Area 2 is not very diverse or rich and contains rather low numbers of desirable food fishes. The sand and silt substrate, mangrove area, low visibility and lack of larger forms of corals and reef structure which provides holes for protection are factors affecting the abundance of fish fauna in this zone. Fishes observed during this study and by Amesbury, et. al. (1979), include mullets (Mugilidae), slipmouths (Leiognathus sp.), rabbitfish (Siganus spinus and S. argenteus), snappers (Lutjanidae) and damselfish (Pomacentridae).

Doty and Marsh (1977) censused fishes in this area over a period of four months. More than 5000 fishes of nearly 75 species were counted in the area. The damselfishes (Pomacentridae) were the most abundant group, with the two species Chromis caerulea and Dascyllus aruanus accounting for approximately 50% and 20%, respectively of the number of fishes seen. The sharp-backed puffer, Canthigaster solandri (Canthigasteridae), was the most ubiquitous fish. The surgeonfish Ctenochaetus striatus (Acanthuridae) was also frequently seen. There are undoubtedly a considerable number of fish species which occur in Tanapag Harbor which were not observed during this study, particularly roving predators such as jacks (Carangidae), snappers (Lutjanidae), and goatfishes (Mullidae), seasonally abundant fishes, such as rabbitfishes (Siganidae), nocturnally active fishes, such as squirrelfishes (Holocentridae) and cardinal fishes (Apogonidae), cryptic or secretive fishes (Gobiidae, Blenniidae, Scorpaenidae) and various eels. The fishes which are best represented in these surveys are those most closely tied to specific defended territories or limited home ranges (Doty and Marsh, 1977).

Benthic invertebrate assemblages were studied in six areas during the 1977 report by Doty and Marsh. The only species occurring in all areas studied was the gastropod mollusc Lambis lambis. Other common organisms were the gastropod Cypraea erosa, the bivalve Saxostrea mordax, the echinoid Mespilia

globulus, and the sea cucumber Holothuria atra. The greatest diversity was found from Able Dock to Unai Sadog Tase. Baker Bay and deeper parts of Charlie Bay both were similarly poor in invertebrate fauna, but the shoal areas in Charlie Bay were richer. Molluscus and echinoderms were found more frequently with distance away from the dredged area around the power barge. Shifting fine sediments and turbid water resulting from past dredging and wind and wave action probably inhibit colonization of Baker bay by most macroinvertebrates. Other common species observed in the nearshore environment include the gastropod Cerithium sp., the bivalve Grafrarium pectinatum, the starfish Linckia laevigata and Culcita novaeguineae and the sea cucumbers Bohadschia argus, B. bivittata, Holothuria leucospilota, Stichopus chloronotus and S. horrens.

b. Lagoon and Patch Reefs

The Lagoon zone of Area 2 includes the deeper portions of the harbor basin, main channel and other portions of the Lagoon that eventually grade out past the patch reefs at the month of the channel into the deep oceanic water west of the Lagoon. There is no barrier reef or reef margin zone in this Planning Area.

The Lagoon floor is composed of large stretches of sand and coral/algal rubble overlain in the deeper areas and by a layer of fine silt and clay in those portions of the Harbor that have been dredged. Visibility in this zone is generally poor as wind driven waves and currents easily disturb the fine bottom sediments. Scattered throughout the Lagoon floor are isolated outcrops of coral and patch reefs, some rising 3 - 6 m from the bottom. Many of these patch reefs are mostly dead corals, with encrusting forms such as sponges, with only 5 - 10% live coral. Some of the sand and rubble areas contain Halodule uninervis, Caulerpa racemosa, C. serrulata, C. verticillata, Halimeda opuntia, H. gigas, H. macroloba, Padina tenuis, Dictyota bartayresii and Schizothrix calcicola.

Corals common to the numerous patch reefs and attached to the myriad of junk that lies on the bottom (mostly near the harbor basin and in the vicinity of the main ship channel) include Pocillopora damicornis, P. eydouxi, Acropora hebes, A. palifera, A. nasuta, A. surculosa, Stylophora mordax, Porites lutea, P. cylindrica, Montipora lobulata, M. verrilli, Millepora dichotoma, Sarcophyton sp. (soft coral), Heliopora coerulea, Pavona decussata, P. divaricata, Acrhelia horrescens and Stylocoeniella armata. Many of these species are encrusting forms that are tolerant to siltation or branching forms that grow rather rapidly.

The patch reefs tend to become more numerous away from the harbor basin where the bottom is less silty and water quality is better. Towards the mouth of the channel and close to the tip of the northern barrier reef water quality increases as does the number and size of the patch reefs. Water depth ranges from 8 - 12 m in this area, whereas the deeper

(dredged) portions of the basin and inner harbor extend to 18 m. Coral cover in the western portion of Area 2 ranges from approximately 5 - 20%, and the patch reefs have a higher percent of live coral than the central and eastern portions of the channel and harbor (10 - 50%).

The patch reefs near the channel mouth and south of the barrier reef are one of the few places in the Saipan Lagoon where significant amounts of reef building coralline algae were observed. Goreau (1969) states that the slope just south of the top of the barrier reef had the richest growth of coralline algae he observed anywhere on Saipan. Dominant algae include Porolithon sp., Lithothamnium sp. and Amphiroa sp.

The patch reefs along the Lagoon floor of the channel and harbor basin support a moderate diversity of fishes. Snappers (Lutjanidae), juvenile and adult parrotfish (Scaridae), rabbitfish (Siganidae) and goatfish (Mullidae) were among the most common groups of fishes observed. Amesbury, et.al. (1979), identified between 40 - 60 species here, with juvenile parrotfish and snappers (especially Lutjanus kasmira) comprising their highest counts anywhere in the Lagoon. Other common fishes include parrotfish, surgeonfish (Acanthuridae), Cardinalfish (Apogonidae), blue Chromis, squirrelfish (Holocentridae), groupers (Serranidae) and wrasses (Labridae). The most important species were Apogon saipanensis, Epinephelus merra, Lutjanus fulvus, Aprion virescens, Lethrinus harak, L. ramak, Monotaxis grandoculis, Parupeneus barberinus, P. trifasciatus, P. pleurostigma, Cheilinus chlorurus, C. trilobatus, Halichoeres trimaculatus, Thalassoma lutescens, Scarus chlorodon, S. forsteri, S. ghobban, S. sordidus, S. venosus, Acanthurus mata, A. olivaceous, A. xanthopterus, Naso brevirostris, N. literatus, N. unicornis and Siganus spinus.

2. Physical Marine Resources

a. Currents

The currents in the Tanapag Harbor and Commercial Port area have been previously investigated by the University of Guam Marine Laboratory (Doty and Marsh, 1977). The currents in outer Tanapag Harbor and channel are less well known.

The 1977 study of the area around Baker Bay showed that wind speed and direction primarily control the movement of surface waters in the harbor. Drogues released in Baker Bay generally moved downwind toward the west or southwest. Evidence of an eddy system in the bay near the outfall was also observed, especially by the deeper (5 meter) drogues. The maximum average current speed recorded was 0.13 m/sec (0.25 knots). No evidence was observed to indicate any tidal movements. Figures II-1 - II-3 show some typical results obtained during the 1977 survey.

Surface currents in Tanapag Harbor generally move towards the mouth of the Harbor. Deeper currents move generally in the same direction but are slower than the surface currents.

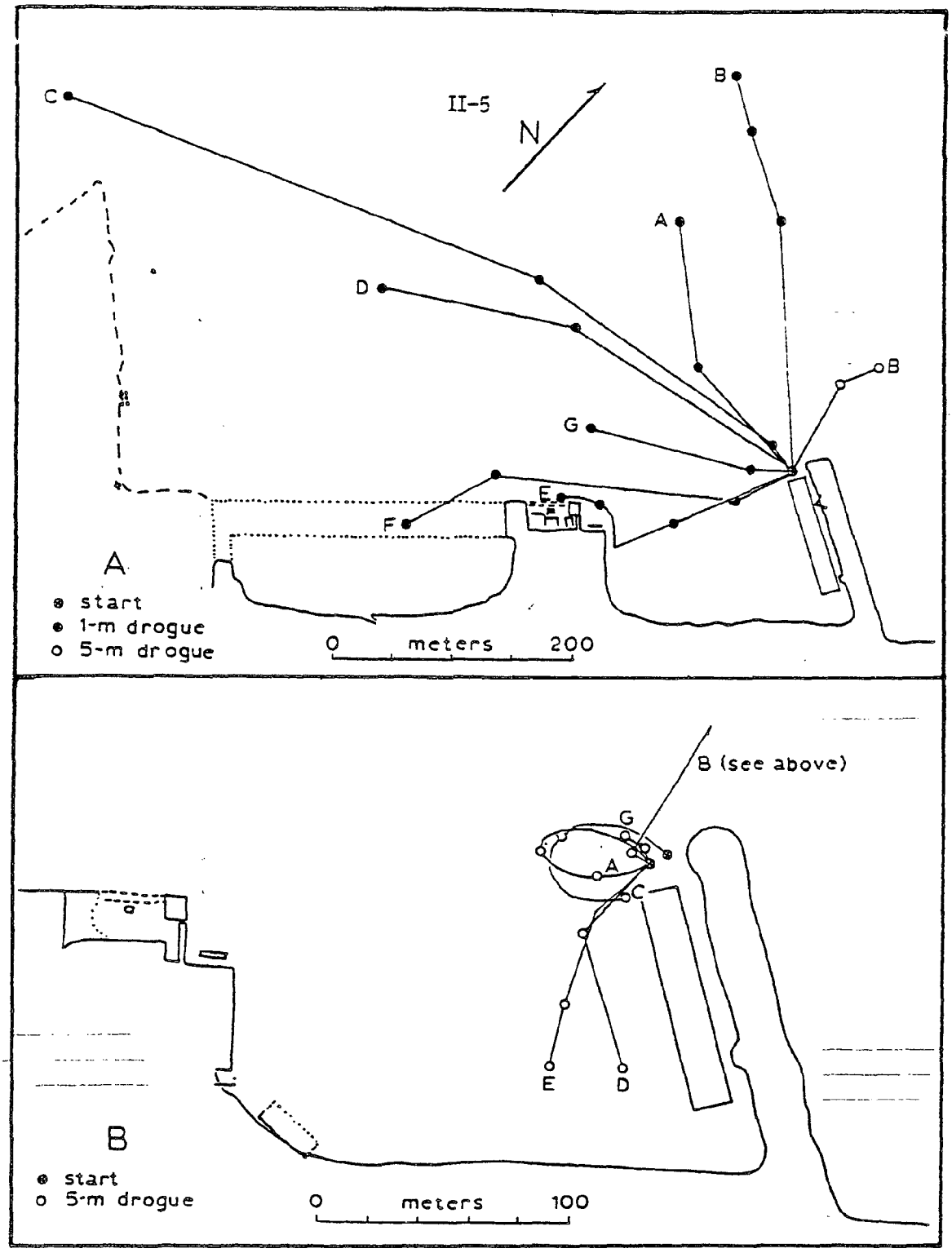


Figure II-1. Drogue drift paths for 20 March 1976.
Source: Doty and Marsh, 1977.

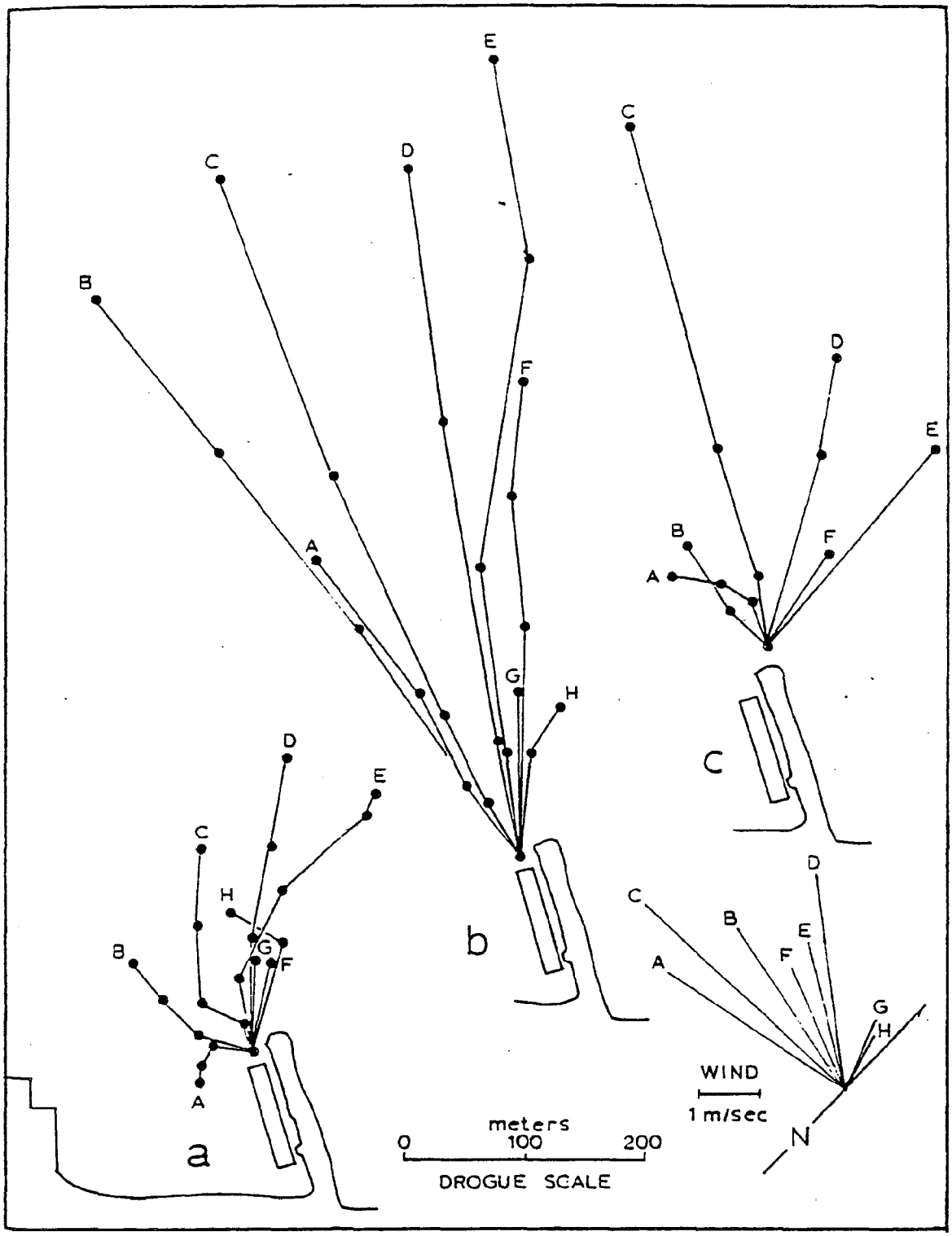


Figure II-2. Drogue drift paths for 12 June 1976. a and c. 5-m drogues. b. 1-m drogue. Source: Doty and Marsh, 1977

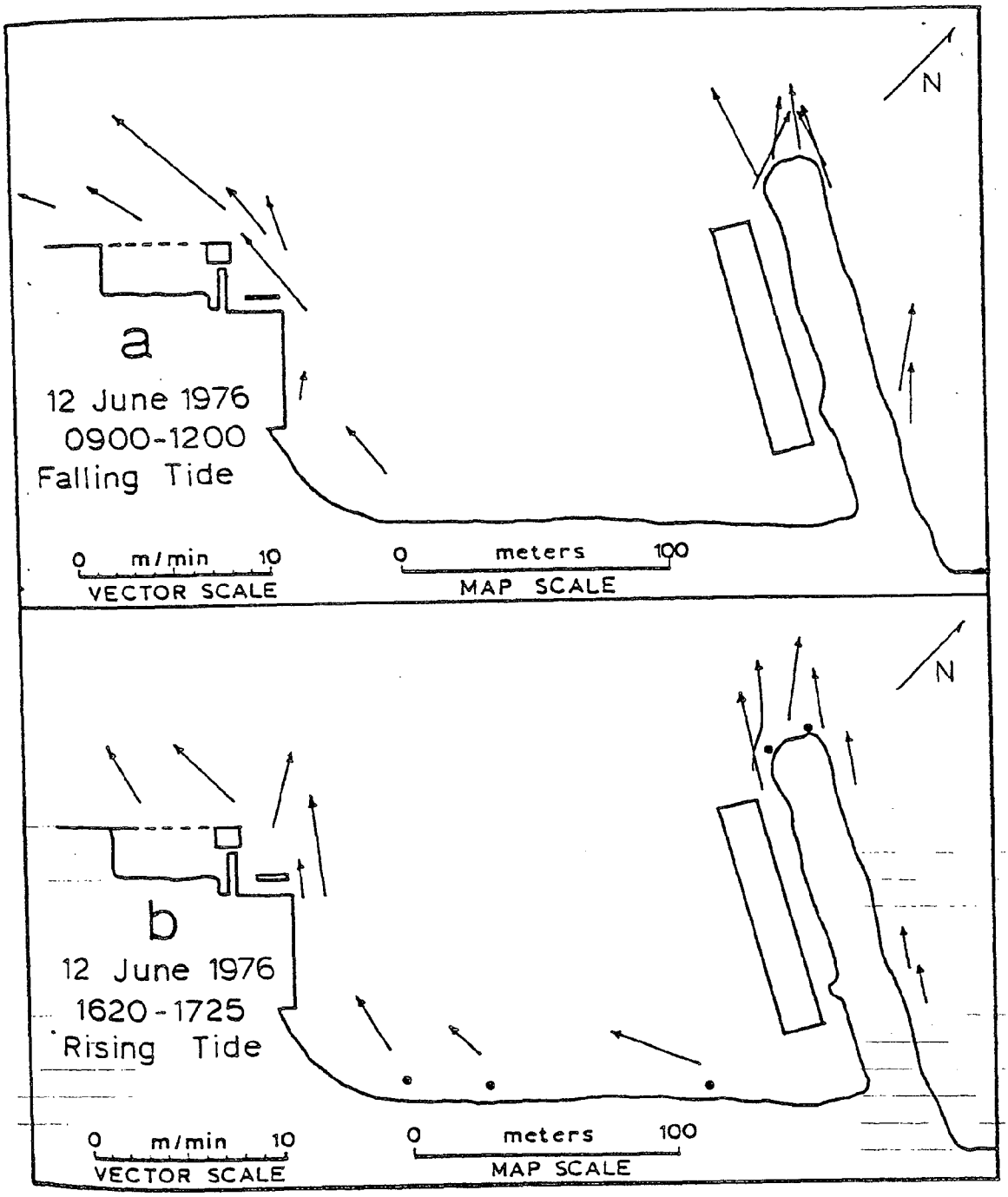


Figure II-3. Currents in and near Baker Bay. Arrow lengths are proportional to current speed. • = no movement. Source: Doty and Marsh, 1977.

In a 1980 survey for the Army Corps of Engineers, M & E Pacific, Inc. reported that the outflow from the harbor and basin area is transported seaward through both the harbor entrance and through openings in the noncontinuous reef structure. These findings are in agreement with the generalizations postulated by Cloud (1959).

b. Water Quality

The water quality of the harbor is generally poorer than the rest of the Lagoon as it receives runoff from the port, the sewage effluent from the outfall south of Charlie Dock and leachate and debris from the Puerto Rico Dump. The Division of Environmental Quality (DEQ) currently has three water sampling stations in this Planning Area (seaplane ramp, lower base drainage channel/outfall and next to Puerto Rico Dump). In addition, the DEQ has recently set up several sampling regimes near the dump and outfall to monitor short and long term environmental impacts caused by these facilities. Data on water quality parameters analyzed by the DEQ lab are available from their office. Although it varies according to location these parameters include Fecal Coliform, BOD, Chloride, Salinity, Dissolved 0_2, $_p$H, Turbidity, Temperature, Total Coliform, Suspended Solids, Total Nitrogen, Ammonia Nitrogen and Total Phosphorus. Water quality monitoring station sites and data regarding occurrence and violations of fecal coliform standards are depicted on Figure I-1 of this Volume.

Recent data of the eight sampling stations at Mobil Oil Beach, all around Puerto Rico outfall and a control (both surface and bottom samples at each location) indicates only those stations directly above the outfall and 100 ft. north of the outfall had fecal coliform values exceeding 200/100 ml. The mean for the surface samples above the outfall was 12,200/100 ml, for bottom samples at the outfall was 375,268/100 ml and for the surface samples 100 ft. north of the outfall was 103/100 m (two individual samples of 201/100 ml were collected).

The combination of a fine silt/mud bottom in the harbor and the silt-laden water entering the Lagoon from the port area severely reduces water clarity (visibility). Winds and currents coming from the northeast tend to stir up and suspend these fine bottom sediments. It is obvious when riding along the surface or towing underwater when one has entered the port/harbor area as there is a distinct border between the clear Lagoon water and the silt plume which normally extends as far as 1000 - 1500 m from shore.

3. On-shore Resources

a. Wetlands

Two wetland areas occur in the Tanapag Harbor Planning Area. One is a small tidal estuary and associated wetland located at the north end of the Commercial Port area where a small stream flows under the road and empties into a small

embayment between Delta Dock and Echo Bay. The outer portion of this wetland is described in the section below (b. Mangroves).

It is likely that this entire wetland was once a small bay which opened into the harbor. With the placement of roads and fill the outlet has been reduced to a streambed. The drainage ditch is dominated by the reed Phragmites karka (Karriso). Other common vegetation includes Hibiscus tiliaceus (Pago), Leucaena leucocephala (Tanagan-tangan), Pithecellobium dulce (Kamachile) and various common grasses such as Panicum and Pennisetum. The entire wetland area occupies approximately 44.2 acres.

The second wetland area is located on both sides of West Coast Highway opposite Unai Tanapag. This somewhat small site (4.6 acres) is primarily a Phramites karka marsh on the north side of the road. To the east, the area is more open and somewhat drier and dominated by Ludwigia octivalvis (Primrose willow), cultivated Ipomoea aquatica (Kangkun), Leucaena leucocephala (Tangan-tangan) and Hibiscus tiliaceus (Pago).

b. Mangroves

The extent of mangroves in Planning Area 2 is limited to an extremely small tidal estuary at the mouth of a storm drainage basin at Lower Base toward the northern extreme of Puntan Tanapag. The area of tidal influence extends to the road, through a culvert and north along the road approximately 20 m. This area continues north along the road another 50 m as a depressed wetland fed by a natural spring and rainwater run-off. It is only moderately affected by the tides. It has been reported that at one time the entire wetland was probably a small bay open to the harbor. However, because of extensive filling from wartime activities and development over the years, the outlet has been reduced to a narrow streambed. One estimation puts the mouth of this stream approximately 600 m from the harbor. Most likely, the stream drained a large lowland area presently covered by fill and supporting buildings in the vicinity of Puntan Flores.

Only one species of mangrove plant exists in this limited area, Brugiera gymnorrhiza. This species extends from the mouth of the estuary along both sides fairly equally to the bridge. A few mangrove trees can be seen on the opposite side of the road, but they dissipate rapidly.

c. Rare, Threatened and Endangered Species

The small area of the mangrove Brugiera gymnorrhiza near Delta Dock should be considered rare and given protection from pollution, filling or dredging activities and other environmentally detrimental actions. This site, the shoreline south of the Puerto Rico Dump and a small area adjacent to the American Memorial Park east of Beach Road are the only mangrove areas in all of Saipan.

The mangrove area at lower base supports a population of the endangered Nightengale Reed Warbler (Acrocephalus

luscinia) in addition to the colorful Bridled White-eye (Zosterops conspicillata). Although relatively common on Saipan, the White-eye has virtually disappeared from the forests of Guam where it was once quite common. Although not observed, it is possible that the endangered Gallinule (Gallinula chloropus), a rather secretive bird that lives in swamps and wetlands seeking cover from ferns and other dense vegetation, might also occur in this area.

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

This is Saipan's industrial area and, as such, the Tanapag Harbor Planning Area includes the island's solid waste dump, port and harbor, energy generating facilities, warehouses, and public works operations. Much of the Area remains undeveloped at this time.

Puerto Rico Dump, Saipan's only authorized disposal site for solid wastes, is a well-chronicled public health nuisance and eyesore. It has been a dump since post WWII and continues in operation primarily because sufficient funds for improvements have not been allocated and because no acceptable, alternative site has been designated. Approximately 8,000 cubic yards of waste are dumped at the Puerto Rico Dump each month.

The CNMI Government is now reviewing ten alternative sites which have been identified as potential sanitary landfill sites for Saipan. The government plans to select one site, begin a sanitary landfill operation there, and then permanently close the Puerto Rico Dump site and convert it into a public recreation area.

b. Public Land Ownership and Access

Most of this area is publically owned, with some area leased to private enterprises. It also includes the somewhat remote, but attractive, Unai Tanapag. The Lagoon and harbor are accessible throughout the length of this Planning Area.

c. Recreation Sites

The following park and recreation facilities now exist within Planning Area II.

Table II-1
RECREATION SITE AT TANAPAG HARBOR PLANNING AREA

Park or Recreation Area	Existing Facilities
DPW Beach	Access Road, Coral, 400 lf

d. Historic Sites

Two Japanese landing craft are located underwater within this Planning Area. Both craft, a 56-foot model and a 46-foot model, are close together in approximately 25 feet of water and are regularly visited by the glassbottom boat tours. These two properties may be historically significant due to the low number produced and the fact that few exist today.

e. Beach Erosion and Stormwave Redistribution

No beach erosion or discernible beach depletion occurs in this Planning Area.

f. Stormwater Drainage

Cross Island Road in the village of Tanapag does not have adequately-sized drainage culverts at road crossings. This results in stormwater flooding problems along an area of approximately 3000 linear feet north of the Public Works complex. Stormwater runoff from this 77 acre watershed exceeds the capacity of the existing pipe culverts, which consist of one 12 inch and two 18 inch diameter concrete pipes. Only one of the 18 inch culverts is currently functional. The depth of the water over the road rises as much as two feet during intense storms. This flooding is characterized by strong velocities and heavy sediment and debris loadings.

Stormwater runoff also flows from a 1400 acre watershed into the Lower Base Industrial Complex. The area is characterized by flat terrain, underlain by sandy soils of high permeability. Runoff from upland tributary areas pond on the flatlands and cause severe flooding. These flood waters primarily drain to the Saipan Lagoon via the Sadog Tase drainage canal. This canal winds through Lower Base and discharges to the Lagoon at two points. Tidal estuaries and mangrove vegetation have developed at the interfaces between the drainage canal outlets and the Lagoon. Inland portions of the canal are heavily overgrown and do not function effectively in disposing of stormwater. These flooding problems have been further aggravated by improper grading which has resulted in depressions and tend to pond water rapidly.

2. Energy Resources

a. Existing Facilities

Existing energy facilities in this planning area are located within the Tanapag Harbor and lower base areas. These include the power plant, back-up generators, pipelines associated with the power plant and Mobil Oil, Mobil Oil storage tanks, Department of Public Works storage area, ship bunkering pipelines at Charlie Dock and the marine terminal at Baker Dock. Refer to Figure II-5 for locations of these facilities.

3. Economic Resources

a. Subsistence Fishing and Gathering

Some subsistence fishing occurs within this planning area, especially throw-net (Talaya) fishing along Unai Tanapag and hook and line fishing off the seaplane ramps and various docks and piers in the port area. Launching and harboring of small boats used for various types of fishing in other locations of the Lagoon and open ocean occurs in the port area as well. Some subsistence fishing does occur in the deeper waters of the harbor and basin but generally less than that which occurs along the shoreline and in the richer patch reefs and barrier reef of the lagoon. This is due primarily to generally poor coral development, turbid water and low species diversity.

b. Commercial and Sport Fishing and Facilities

A March 1981 report by the U.S. Army Corps of Engineers recommends two alternative plans for Tanapag Harbor in the vicinity of the old seaplane ramps. This would satisfy the requirements of a light-draft harbor created around small-scale commercial and subsistence fishing and recreational boats by providing capacity for about 50 boats up to 60 feet in length.

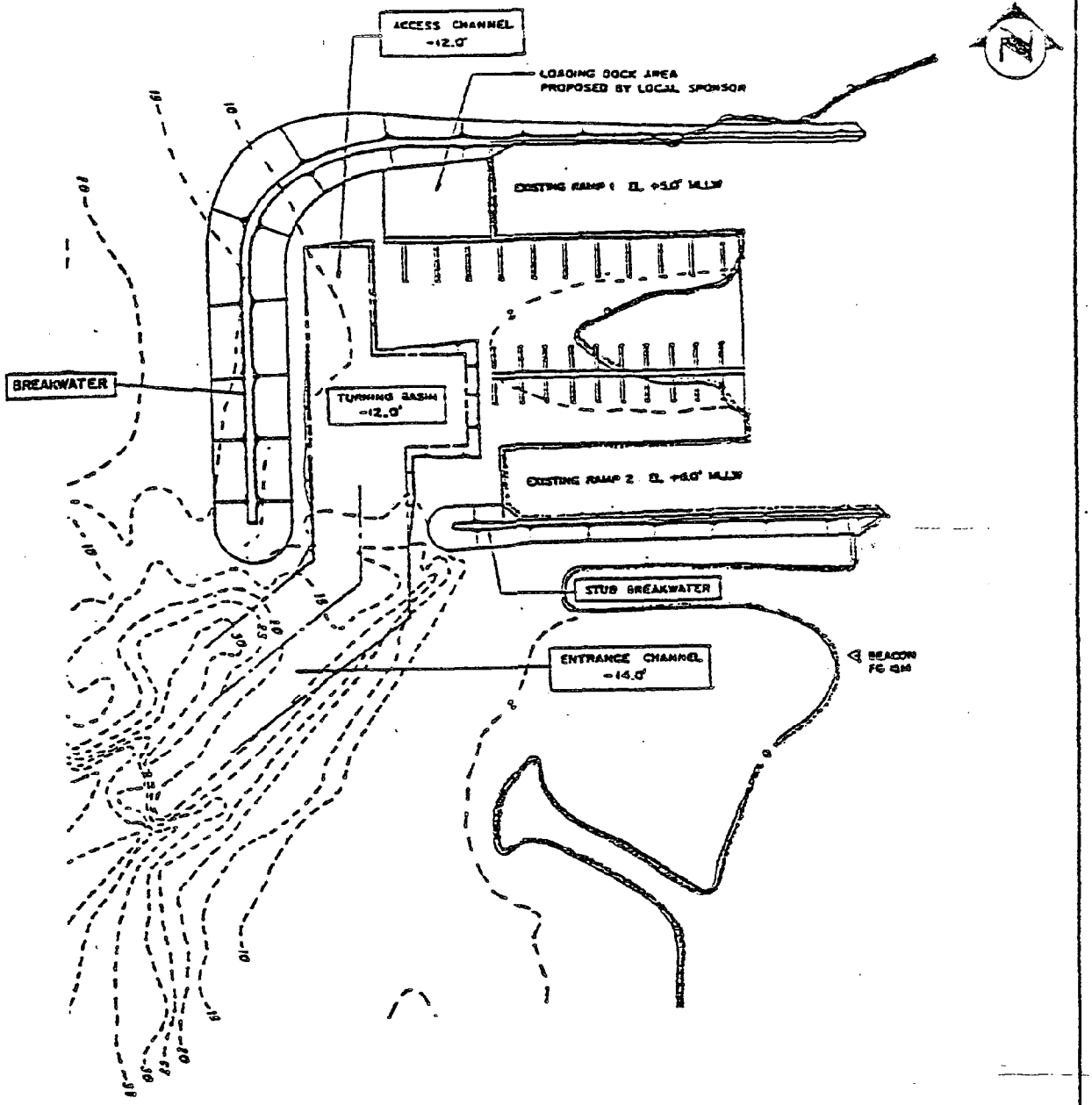
Figure II-4 presents a possible berthing plan for Tanapag Small Boat Harbor. Design and construction funds are now pending an appropriation by the Commonwealth for the local share of the cost. General navigation features would include:

* An entrance channel 240 feet long, 150 feet wide and 14 feet deep.
* A turning basin 250 feet by 150 feet and 12 feet deep.
* A main access channel 175 feet long and 12 feet deep.
* A 1,520 foot long main breakwater and 690 foot long stub breakwater.

c. Port and Shipping

Figure II-5 depicts the shoreline of the Tanapag Harbor Planning Area and its coastal facilities. The following is a description of these facilities starting from the north.

* Seaplane Ramps - These concrete seaplane ramps are the northernmost port facilities. This is the site of the power plant and has been designated as the site for a new Tanapag Small Boat Harbor.
* Range Light Bay - This small bay, about 1-2 feet deep lies between the seaplane ramps to the north and Echo Dock to the south. The lower range light for the harbor entrance is found on shore at this point. The Bay's sediments are coral rubble and sand.
* Echo Pier - This small peninsula is no longer used as a dock, but wood pilings and a concrete seawall still remain. The pier is often used by fishing boats and other small boats. Depth of water is relatively shallow, averaging 9 to 10 feet. Much of the surrounding land mass is littered with abandoned boats and other scrap.



NOTE:
ALL ELEVATIONS REFERENCED TO MLLW.

FIGURE II-4.

TANAPAG SMALL BOAT HARBOR
PLAN.

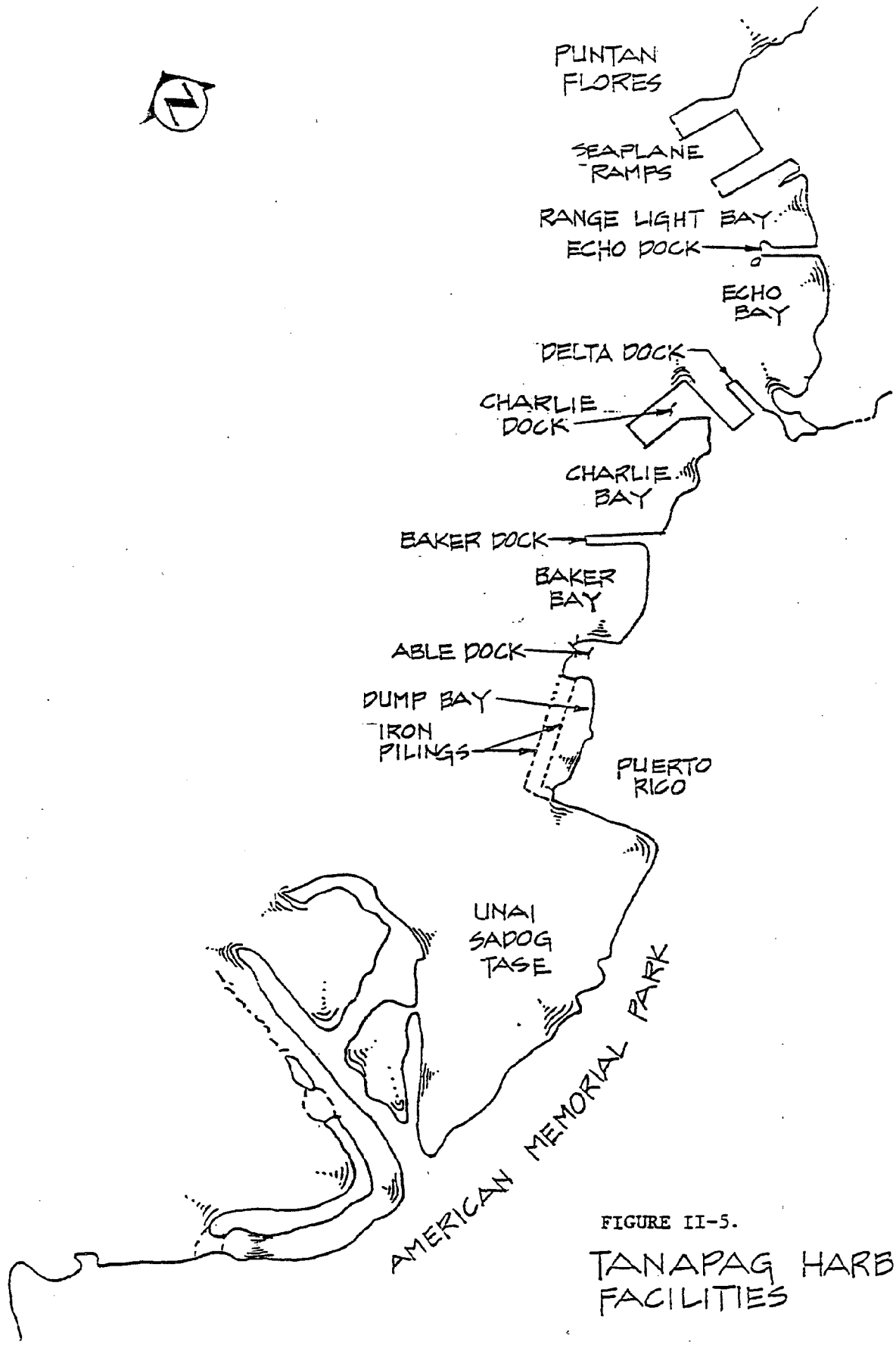


FIGURE II-5.

TANAPAG HARBOR FACILITIES

* Echo Bay - This 6 acre bay lies between Echo Dock to the north and Delta Dock to the south. At the southern end of the Bay an abandoned concrete pipe lies between the shore and the edge of the dredged area. A small stream with associated mangrove community empties into the southern end of this Bay.
* Delta Dock - This is a small dock, just north of Charlie Dock.
* Charlie Dock - This is a Japanese constructed dock that was upgraded by the military serving as the only commercial port docking facility capable of handling container and breakbulk cargo. However, the facility has received very little maintenance over the years. While major damage has been repaired, minor damage has gone unattended and eventually resulted in serious deterioration.

  Inspection of the dock in 1972 indicated that the dock face is a masonry wall of 4'x4'x5' concrete blocks, with a coral-fill core. The dock elevation is 6 feet above the mean lower water mark. The dock has 530 feet of berthing space along the north side, with existing depths reported to be approximately 26 feet below MLLW. Berthing space of 180 feet and 400 feet are available along the west and east sides, respectively, with depths of 20 feet reported on the west side and 10 to 20 feet on the east side. The south side of the pier serves as a small boat quay, with water depths of 6 to 8 feet.

  Freighters utilizing Charlie Dock generally have their own boom system for loading and unloading cargo, both containerized and break bulk. Some of the large cargo vessels also have a stern ramp for roll-on and roll-off cargo, such as automobiles and cargo containers. The Saipan Stevedoring Company has a 25 ton and a 27 ton forklift which handles the 40 foot, 25 gross ton containers. The stevedores also have two 50 ton mobile cranes for loading and unloading. Dockside storage space consists of a 12,000 square foot steel warehouse used for break bulk storage and several acres of adjacent, unpaved container storage space. A second building is for Port operations and maintenance as well as the Marine Resources Division of the Department of Natural Resources. Approximately 12 acres of land are associated with Charlie Dock.

  Charlie Dock is presently in very deteriorated condition. The U.S. Army Corps of Engineers is now designing repairs and improvements to this area as part of its "Saipan Deep Draft Harbor Improvement" project. The plans are scheduled for completion by April 1986. The proposed improvements are further described at the conclusion of this section.

* Charlie Bay - This semi-enclosed Bay occupies about 6 acres between Charlie and Baker Docks and is about 5 - 10 feet deep. Approximately one-half of the Bay is sheltered from wave action by Charlie Dock. The unprotected (southwestern) half receives relatively heavy turbulence due to lagoon waves and the reflection of waves from the northwestern side of Baker Dock. The shoreline is now littered with the remains of old barges.
* Baker Pier - This pier, originally constructed by the Japanese, was reconstructed many years ago. The pier consists of coral fill bounded primarily by iron pilings. The south side has a vertical wall and is useable by the Commonwealth. A sunken barge lies off the northern, seaward end, preventing its use as a dock. A decaying woodpiling dolphin is also situated at the end of the dock.

  The northeastern side of the dock is exposed to direct wave action. The southwestern side of the dock face is made of iron pilings, except for a short section nearshore which is faced with cut limestone. The pilings drop vertically to a narrow bench of coral rubble lying about 1 foot below MLLW. Approximately 4 - 6 feet away from the dock, the bottom has been recently dredged to a depth of 20 to 30 feet, creating a steep coral rubble slope.

  The land behind Baker Pier is leased to Mobil Oil Company for fuel storage.
* Baker Bay - This Bay of 4.2 acres lies between Baker Dock and Able Dock. The bottom has been dredged adjacent to the two docks and consists primarily of fine sand and silt with occasional rocks and metal debris. The sunken remains of a converted minesweeper, the "Four Winds," lies at the outer edge of Baker Bay, near Baker Dock.
* Able Dock - This dock was built by the Japanese as part of their railway system. Previously it had a concrete facing which descended vertically to the coral rubble bottom. Although it is totally unuseable now, it was reconstructed in 1944 and enlarged with 2000 feet of steel piling. Most of the northwest dock has eroded away. The area has many concrete slabs strewn about in various positions and a sloping terrace of boulders, metal debris and coral rubble. The terrace ends in a steep, dredged face.
* Dump Bay - This small bay is south of the iron pilings. The shore is also part of the Puerto Rico Dump.
* Unai Sadog Tase - This is a large shallow bay of about 50 acres and 3 to 6 feet deep.

As a result of in-depth study by the CNMI and the U.S. Army Corps of Engineers extensive improvements have been

recommended for Tanapag (Saipan) Harbor. It was found that the existing harbor facilities are inadequate to serve both the present day needs of Saipan's waterborne commerce as well as the projected growth in both cargo inshipments and container vessel size. The following harbor improvements were determined necessary in order to meet Saipan's present and future needs.

* Widen and deepen the entrance channel and turning basin.
* Construct a new wharf and berth at least 500 feet long in order to accommodate existing vessels during rehabilitation of Charlie Dock.
* Rehabilitate Charlie Dock, including new sheet pile bulkheads and a higher deck elevation.
* Construct a warehouse and container yard which are adequate to handle existing cargo requirements.
* Construct a new 800 foot dock to accommodate large container vessels.

In addition, the following improvements were recommended to be accomplished at a later date.

* Additional warehouse and container yard area, plus improved cargo handling equipment such as a container crane.
* Construction of a passenger terminal and consolidated administration building.

d. Tourism Industry

There are no tourisim facilities in the Tanapag Harbor Planning Area, with the exception of wharves used for embarking and disembarking passengers for occasional passenger liners and for daily commercial Lagoon cruises and sails such as the 80' LOA catamaran, "Star of Saipan" which sails between Saipan and Tinian and within Saipan's Lagoon.

CHAPTER III - MANAGAHA ISLAND PLANNING AREA

Planning Area 3 encompasses Managaha Island, the reefs and patch reefs surrounding the island, Lagoon waters southerly to the main channel to Tanapag Harbor and includes a section of the barrier reef from the channel mouth north to Area 1. This area contains some of the most diverse and richest reefs and fish fauna found in the Saipan Lagoon. Several historic properties including three aircraft are located in Area 3. Because of its offshore position within the lagoon, this Area will be discussed in terms of the lagoon (including patch reefs), reef flat (including the coral area west of Managaha Island) and reef margin and slope of the barrier reef.

A. Natural Resources

1. Living Marine Resources

a. Lagoon and Patch Reefs

The lagoon area around Managaha Island is predominantly a sand and silt bottom with occasional coral/algal rubble areas interspersed with varying sized patch reefs. These path reefs become more sparse and contain less live coral as the Lagoon deepens into the channel and Tanapag Harbor to the south and east of Managaha Island. The richest and most diverse patch reefs are those surrounding the island, including the patch reef situated approximately 600 meters south-southeast of the island in the far southeastern corner of Area 3. For purposes of this report, the reefs west of Managaha to the barrier reef are included in the reef flat zone since they are close to the barrier reef, in shallow water and are truly an extension of the reef flat.

The Lagoon patch reefs are most prolific in areas of shallow water from 2 - 6 m deep and some reach or nearly reach the surface including the patch reef south-southeast of Managaha which is awash at low tide. Corals common to the lagoon patch reefs include Acropora palifera, A. nasuta, Millepora platyphylla, Porites lutea, P. rus, P. (S.) iwayamaensis, Montipora ehrenbergii, M. faveolata, M. verrilli, Stylophora mordax, Heliopora coerulea, Pocillopora eydouxi, P. setchelli, P. damicornis, Sinularia sp. (soft coral), Lobophyllia corymbosa, Favia pallida, Goniastrea retiformis, Leptastrea purpurea, Psammocra nierstraszi, P. digitata and Fungia fungites.

Coral cover on the patch reefs ranges from approximately 10 - 30% with the shallower reefs usually exhibiting higher percent cover. Many of the deeper reefs contain little live coral possibly due to previous Acanthaster damage or other limiting environmental factors such as reduced light penetration from murky water or siltation.

Fishes observed in the Lagoon and around the patch reefs include surgeonfish (Acanthurus triostegus, A. mata, Ctenochaetus striatus and Naso literatus), several species of parrotfish (Scaridae), rabbitfish (Siganus spinus), goatfish

(Parupeneus barberinus), several species of butterflyfish (Chaetodontidae) and several unidentified juvenile fishes. Amesbury, et. al. (1979), describes this habitat as having high species diversity with milkfish (Chanos chanos), large groupers (Epinephelus merra), wrasses (Labridae), surgeonfish and parrotfish being abundant.

The crown-of-thorns starfish, Acanthaster planci, was more commonly seen among the patch reefs in Area 3 than in the rest of the northern lagoon and they were quite numerous in other areas to the south and southwest of Managaha Island. Very few individuals were observed in the rich reef flat/patch reef zone directly west of Managaha at the time of this survey.

Other conspicuous animals observed were the starfish Linckia laevigata and Culcita novaeguineae, the sea cucumbers Holothuria atra, H. edulis, Bohadschia argus, Stichopus chloronotus and Thelenota ananas, the sea urchins Echinothrix diadema and Echinometra mathaei and a few unidentified species of sponges and anenomes.

b. Reef Flat

The reef flat area, including a series of discontinuous shallow water patch reefs due west of Managaha Island represent a rich and diverse area of Saipan Lagoon. These reefs are now heavily utilized by tourists and residents for snorkeling, diving, spearfishing and shell collecting. At the time of this survey, only small numbers of Acanthaster were observed in the reef flat zone of Area 3. The nearby areas and the deeper patch reefs south and southwest of Managaha did have rather high concentrations of the starfish and considerable damage had been done to the corals. In some areas, up to 40 - 50% of the live coral on isolated mounds and patch reefs had been destroyed.

Goreau, et. al. (1969), during a study of the ecology of Saipan's reefs in relation to Acanthaster predation, reported that prevented from causing extensive damage through periodic monitoring coupled with a limited, site specific removal program.

Common corals observed in the reef flat zone of Area 3. include Acropora smithi, A. palifera, A. hebes, A. aspera, A. tenuis, Porites lutea, P. reticulosa, P. (S.) iwayame=aensis, P. cylindrica, P. australiensis, P. rus, Pocillopora damicornis, P. danae, P. setchelli, Acanthastrea echinata, Leptastrea bottae, L. purpurea, Echinopora lamellosa, Favia favus, F. pallida, F. matthaii, Favites sp., Fungia fungites, F. scutaria, Galaxia hexagonalis, Goniastrea retiformis, Heliopora coerulea, Lop=bophyllia costata, Montipora ehrenbergii, M. foveolata, Pavona divaricata, P. venosa, P. varians, Platygyra daedalea, P. pini, Psammocora nierstraszi, P. digitata, Sarcophyton sp. (soft coral), Seriatopora sp., S. aculeata, Stylocoeniella armata and Goniopora sp.

Coral cover varies greatly, ranging from 40 - 60% live coral on the patch reefs west of Managaha Island and 25 - 50% on the reef flat. Coral cover decreases along the reef flat as it

deepens and slopes into the channel entrance in the extreme southwest section of Area 3.

Fish fauna is diverse here with small to medium-sized food fishes and many species of colorful reef fishes visitors like to view including butterflyfishes (Chaetodontidae), damselfish (Pomacentridae), moorish idols (Zanclus cornutus), angelfish (Pomocanthidae), wrasses (Labridae), trumpetfish (Aulostomidae) and a few others. Other fishes observed include parrotfish (Scarus psittacus, S. gobbus, S. sordidus and the hump-headed parrotfish Bolbometapon muricatus), guile (Kyphosus cinerascens), goatfish (Parupeneus barberinus, P. trifasciatus and Mulloidichtys flavolineatus), surgeonfish (Acanthurus lineatus, A. mata, A. triostegus, Ctenochaetus striatus and Naso literatus) and snappers (Lutjanus sp.). Additionally, a blacktip reef shark (Carcharhinus melanopterus) and a green sea turtle (Chelonia mydas) were observed during the present study.

Amesbury, et. al. (1979), reported high abundance and diversity for surgeonfishes, large wrasses, goatfish, juvenile parrotfish, rabbitfish and blue Chromis. A more recent survey of the reef area west of Managaha Island compiled a checklist of 107 species of fish (PBEC, 1985). The checklist is shown in Table III-1.

c. Reef Margin and Slope

The reef margin and slope for Area 3 begins at the north boundary of the channel mouth and extends along the barrier reef to the northeast of Managaha Island. Species diversity and coral cover are good and there are moderate numbers of food fishes present. Coral cover, species diversity and fish fauna generally increase as one moves north along the barrier reef, away from the influence of the harbor and channel, into the more pristine and less accessible portions of the reef. It was also noted that the numbers of Acanthaster decreased dramatically from the southern portion of Area 3, and this trend continued north into Area 1.

Corals observed were very similar to Area 1 with dominant species including Stylophora mordax, Pocillopora eydouxi, Acropora palifera, A. valida, A. diversa, A. quelichi, A. surculosa, A. irregularis, Porites lutea, P. rus, Millepora platyphylla, M. dichotoma, Pavona duerdeni, P. clavus, Leptoria phrygia, Platygyra daedalea, Favia sp. and the soft corals Sinularia sp. and Sarcophyton sp. For additional species common in this area refer to the section describing Area 1, Reef Margin and Slope.

Percent of coral cover varied in the southern portion of Area 2 from 10 - 25%. Acanthaster were abundant in isolated spots with 10 or more visible at one time. Further north, coral cover varied from 10 - 50%, with higher coverage in areas where surge channels (spur and groove system) are better developed. Isolated sections of the reef showed signs of recent coral mortality from Acanthaster and in a few spots as much as

Table III-1. Checklist of fish species observed in the vicinity of Managaha Island.

Carcharhinidae (Sharks)
Triaenodon obesus

Muraenidae (Moray Eels)
Lycodontis meleagris

Synodontidae (Lizardfish)
Saurida gracilis

Holocentridae (Squirrelfish)
Adioryx diadema
Flammeo sammara
Flammeo operecularis
Myripristis murdjan

Aulostomidae (Trumpetfish)
Aulostomus chinensis

Fistulariidae (Coronetfish)
Fistularia commersonii

Syngnathidae (Pipefish)
Corythoichthys sp.

Apogonidae (Cardinalfish)
Apogon novemfasciatus
Apogon sp.
Cheilodipterus quinquelineatus

Serranidae (Groupers)
Epinephelus merra
Cephalopholis sp.

Lutjanidae (Snappers)
Lutjanus fulvus
L. kasmira

Lethrinidae (Emperors)
Gnathodentex aureolineatus
Lethrinus harak
L. ramak
Lethrinus sp.

Nemipteridae (Breams)
Scolopsis cancellatus

Mullidae (Goatfish)
Mulloidichthys flavolineatus
M. vanicolensis
Parupeneus barberinus
P. pleurostigma
P. trifasciatus

Cirrhitidae (Hawkfish)
Paracirrhites arcatus
P. forsteri

Chaetodontidae (Butterflyfish)
Chaetodon auriga
C. bennetti
C. citrinellus
C. ephippium
C. lunula
C. ornatissimus
C. punctatofasciatus
C. reticulatus
C. trifasciatus
C. ulietensis
C. unimaculatus
Heniochus chrysostomus
Megaprotodon trifascialis

Pomacanthidae (Angelfish)
Centropyge flavissimus
Pomacanthus imperator

Pomacentridae (Damselfish)
Abudefduf sexfasciatus
Amphiprion melanopus
Chromis atripectoralis
C. caerulea
C. margaritifer
Dascyllus aruanus
Plectroglyphidodon dickii
P. johnstonianus
P. lachrymatus
Pomocentrus pavo
P. vaiuli
Stegastes albifasciatus
S. fasciolatus
S. nigricans

Labridae (Wrasses)
Anampes twisti
Cheilinus chlorurus
C. oxycephalus
C. trilobatus
Cheilio inermis
C. gaimard
Epibulus insidiator
Gomphosus varius
Halichoeres centriquadrus
H. hortulanus
H. margaritaceus
H. marginatus
H. trimaculatus
Labroides dimidiatus
Stethojulis bandanensis

Table III-1 continue.

Thalassoma fuscum
T. hardwicke
T. lutescens
T. quinquevittata
Xyrichtys taeniourus

Scaridae (Parrotfish)
Calotomus spinidens
Scarus chlorodon
S. ghobban
S. psittacus
juvenile scarids

Acanthuridae (Surgeonfish)
Acanthurus glaucopareius
A. lineatus
A. mata
A. nigricans
A. nigrofuscus
A. olivaceous
A. triostegus
Ctenochaetus striatus
Naso brevirostris
N. literatus
N. unicornis
Zebrasoma flavescens
Z. veliferum

Zanclidae (Moorish Idols)
Zanclus cornutus

Siganidae (Rabbitfish)
Siganus argenteus
S. punctatus
S. spinus

Blenniidae (Blennies)
Salarias fasciatus

Gobidae (Gobies)
Valenciennea strigata

Balistidae (Triggerfish)
Rhinecanthus aculeatus

Monacanthidae (Filefish)
Cantherines pardalis
Oxymonacanthus longirostris

Tetraodontidae (Puffers)
Arothron nigropunctatus
Canthigaster solandri

Total Number Families = 27
Total Number Species = 107

50 - 75% of the coral was dead. This generally improved northward along the barrier reef where individual starfish or small groups of 3 - 5 individuals were infrequently observed.

Fish fauna for this zone are nearly identical to Area 1, and Amesbury, et. al. (1979), classifies the reef margin and slope as one habitat type for its entire length north of Tanapag channel. Abundant food fishes include surgeonfish, parrotfish, groupers, goatfish, squirrelfish, sweetlips, breams, snappers and jacks. Refer to the previous discussion of the Reef Margin and Slope zone of Area 1 for more information on the fishes.

2. Physical Marine Resources

a. Currents

Although currents have not been quantitatively measured near Managaha Island, field observations and aerial photographs indicate the normal flow of water across the Lagoon from the northeast to the southwest splits and bends around the island. This results in variable but somewhat strong currents along the northwest and southeast shores of Managaha. The current is particularly evident in the deeper (6 - 8 m) sand channel between the island and the barrier reef. This water flow continues past Managaha Island and along the inside of the barrier reef until it exits the Lagoon at the mouth of the harbor entrance.

b. Water Quality

Water quality is generally very high in the waters surrounding Managaha Island. The Division of Environmental Quality (DEQ) has numerous sampling stations around the island, including 25 along shore and another 12 situated approximately 150 ft. from the shoreline. Presently, however, the DEQ is collecting samples from 11 stations around the island. Data for these sampling stations are available at the DEQ office. Monitoring station sites and data regarding occurrence and violations of fecal coliform standards are depicted on Figure I-1 of this Volume. Analysis of recent data (October 1984 - March 1985) for fecal coliform shows extremely low readings (less than 10/100 ml) except for one value of 201/100 ml at Station 22 (January 1, 1985).

3. On-shore Resources

a. Rare, Threatened and Endangered Species

Some of the plants used by the Carolinian community for medicinal purposes would be considered rare although none are officially listed as threatened or endangered. Refer to Section A.3.b. for a discussion of the important vegetation on Managaha Island.

Historically the beaches on Managaha Island which almost entirely encircle the island were used by the green sea turtle for nesting. The recent development of the island for a tourist

destination coupled with the wide variety of beach and water related activities which occur every day of the year have resulted in the turtles no longer using the island for nesting. Although it is likely that no turtles have laid their eggs here for many years, personnel on Managaha Island should be made aware that the possibility exists and every effort should be made to protect any nests that might be found.

None of the birds observed on Managaha Island are considered rare, threatened or endangered species. According to the Division of Fish and Wildlife a species of Shearwater (Puffinus sp.) used to nest on the island. If this species is again observed it would be considered rare and the nesting areas should be protected from disturbance.

b. Terrestrial Vegetation

The vegetation on Managaha Island is a unique mix of common plants and trees found elsewhere on Saipan and several species of rare or unique plants that have been planted and utilized for medicinal purposes. The Carolinian community has for many years utilized Managaha Island as a source for many medicinal plants and herbs. A survey conducted for the CRM Office entitled "Carolinian Medicinal Plants on Managaha Island" notes the first documented habitation of the island occurred when Chief Aghurubw (sic) and a group of Yapese immigrants landed there in 1815 (Kastor, Hatnat and V. Tebit, 1981). The 1981 survey compiled a listing of 28 medicinal plants along with descriptions, uses and preparations for use.

During 1985, a survey on Managaha Island listed a total of 39 species of plants and trees (PBEC, 1985). A listing of this vegetation is found in Table III-2.

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

The existing development and public facilities at Managaha Island are described in subsection 2d, Tourism Industry.

b. Public Land Ownership and Access

Managaha Island is Commonwealth owned land and managed by the Marianas Public Land Corporation. Since 1983, a private tour company, PDI, has had a five-year lease from MPLC to develop tourist related facilities on the island and to maintain the island. In 1988 the permit will be reviewed by MPLC to assess the equitability of the permit arrangements.

c. Recreation Sites

The entire Managaha Island is a public recreation site. It is heavily used by tourists and CNMI residents for a variety of water and beach sports.

Table III-2. Checklist of Terrestrial Flora identified along the Nature Trail and elsewhere on Managaha Island. Plant Type: (T) Tree, (Sh) Shrub (S) Sedge, (B) Bush, (F) Fern, (V) Viṅe, (W) Weed, (G) Grass, (H) Herb, (M) Medicinal Plant. (Source: Managaha Island Marine Park Management Plan, PBEC Inc., 1985).

Scientific Name	Common Name	Chamorro Name	Plant Type	Trail
Acrostichum aureum	Fern	Langayao	(F)	x
Annona muricata	Soursop	Laguanaha	(T)	x
Artocarpus sp.	Breadfruit	Lemai	(T)	
Bidens pilosa	Beggar's-Tick		(W)	x
Bougainvillea sp.	Bougainvillea	Putitainobo	(Sh)	
Carica papaya	Papaya	Papaya	(T)	x
Cascuta (campestris)sp.	Parasitic Vine	Dodder	(V)	x
Cassytha filiformis		Mayages	(V) (M)	
Casuarina equisetifolia	Ironwood	Gago	(T) (M)	x
Cocos nucifera	Coconut	Niyog	(T)	x
Colubrina asiatica		Gasoso	(Sh) (M)	x
Corda subcordata		Niyoron	(T) (M)	
Cyperus kyllingia	Cyperus	Chaguan Lemae	(S) (M)	
Ficus prolixa	Banyan	Nunu	(T) (M)	x
Guettarda speciosa		Panao	(T) (M)	
Hernandia nymphaeifolia		Nonak	(T) (M)	x
Hibiscus tiliaceus	Hibiscus	Pago	(B) (M)	x
Hymenocallis littoralis	Spiderlilly	Lirio	(H) (M)	x
Ipomoea pes-caprae	Beach Morning-Glory	Alalag-Tasi	(V) (M)	x
Jatropha integerrima	Rose-flowered	Tuba-Tuba	(Sh)	
Leucaena insularum var. guamense	Tangan-tangan		(T)	x
Leucaena leucocephala	Tangan-tangan		(T)	x
Messerschmidia argentia		Hunig	(T) (M)	
Morinda citrofolia	Indian Mulberry	Lada	(Sh) (M)	
Neisosperma oppositifolia	Fagot		(T) (M)	
Pandanus fragraus	Pandanus	Kafu	(T) (M)	
Passiflora foetida ver. hispida	Love-in-a-mist	Kinahulo' Atdao	(V) (M)	x
Pemphis acidula		Nigas	(Sh) (M)	
Pipturus argenteus		Amahatyan	(T) (M)	
Pithecellobium dulce	Kamachile		(T) (M)	
Plumeria obtusa	Plumeria	Frangipani	(T)	x

Table III-2 continued.

Scientific Name	Common Name	Chamorro Name	Plant Type	Trail
Poinsettia plucherriwa	Poinsettia		(Sh)	
Sesuvium portulacastrum	Seaside purslane	Chara	(H) (M)	
Scaevola taccada		Nanaso	(Sh) (M)	
Sophora tomentosa			(Sh) (M)	
Stachytarpheta indica	False Verbena		(W)	
Terminalia catappa	Tropical Almond	Talisai	(T) (M)	x
Thespesia populnea		Banalo	(T) (M)	
Wedelia biflora	Beach Sunflower		(V) (M)	x

Total Species: 39

d. Historic Sites

Managaha Island contains a grave site which is the burial place for a Carolinean Chief. There are also two Japanese coastal defense guns and a badly deteriorated landing craft and barge on the beach and partially submerged underwater.

There are several historically significant underwater properties located within this Planning Area, many of which are visited by divers and/or glassbottom boat tours. The submerged properties include the wing and other portions of what is believed to be an American aircraft, possibly a PBY-5A Catalina, located in 15 feet of water near the exposed patch reef; an upsidedown but intact Japanese seaplane or "Jake" (Aichi E13A1) in 20 feet of water south of Managaha Island; a coral barge or temporary pier located in 10 feet of water off the east end of the island; and the remains of a small fishing boat and small Japanese airplane located in shallow water just inside the barrier reef near the channel entrance.

e. Beach Erosion and Stormwave Distribution

Beach erosion occurs along the southeastern shoreline for approximately 1000 feet.

f. Stormwater Drainage

There are no stormwater drainage facilities in this Planning Area.

2. Economic Resources

a. Subsistence Fishing and Gathering

A substantial amount of subsistence fishing occurs within the Managaha Island Planning Area. Although boat access is necessary several people have been observed walking the shoreline of the island with a throw-net (Talaya). The near-shore zone and especially the series of rich patch reefs to the west and southwest of the island provide spearfishing, bottom fishing and limited trolling. Information gathered from interviews with fishermen indicates the inner edge of the barrier reef opposite Managaha Island is heavily harvested by villagers from Garapan and Tanapag. Traditionally, this reef area and Managaha Island have been used by Carolinian fishermen who sometimes place gill nets in the area.

b. Commercial and Sport Fishing and Facilities

At this time no facilities for commercial or sport fishing are available at Managaha Island. The concrete pier can be used to pick up and drop off passengers, or to stop for lunch or buy refreshments. No fuel or other supplies are available on the island.

c. Port and Shipping

The only shipping facility within this planning area is a navigation beacon on the southern side of the island. The beacon serves as a range mark for ships entering the Tanapag Harbor channel.

d. Tourism Industry

Managaha Island is synonymous with Saipan's tourism industry. It has become one of the most popular destinations for tourists in Saipan and much of the Island is leased for commercial tourist facility development.

The existing facilities on Managaha Island were recently upgraded (1984) by a private tour company, PDI. Two large pavilions connected in an L-shape were constructed opposite the beach and swimming area. These pavilions have picnic tables and benches and are used by tourists to eat lunch and to get out of the sun. They are also available for residents to use.

In the center of the pavilions is a bar area, office and concession area. There are also restroom facilities and showers in this complex. Another smaller pavilion is located opposite the concrete pier. During 1984 this old Japanese pier was partially repaired and a solar panel powered light was installed to identify the structure at night so it would not become a hazard to navigation. There are plans to eventually increase the size of the pier and to dredge the area on both sides of it to facilitate vessel movements and to allow for use by deeper draft boats.

The swimming area for the Managaha Beach is now buoyed off to increase swimmer safety and to keep boats out of the area. Considerable effort has also been expended in landscaping the area and numerous trees and flowers have been planted.

CHAPTER IV - PUNTAN MUCHOT PLANNING AREA

Planning Area 4 encompasses the shoreline and lagoon from Unai Sadog Tase south to the dock and boat channel in Garapan. A wide variety of marine habitats are represented in Area 4 including the barrier reef, patch reefs, seagrass beds of Enhalus and Halodule, sand and rubble substrate, a rich and extensive thicket of Acropora coral, dredged and filled areas, and one of only two areas in Saipan that contain mangroves. Three of Saipan's largest hotels are found in Area 4: Hyatt Regency (183 rooms), Saipan Beach (175 rooms) and Hafa Adai Beach Hotel (188 rooms). The Hafa Adai Hotel just completed a 68 room expansion and plans to add another 114 rooms starting in 1985. A boat launching site and channel through the outer reef are also located at Garapan.

A. Natural Resources

1. Living Marine Resources

a. Near-shore

The near-shore zone of Area 4 is generally comprised of fine sand and silt with occasional coal/algal rubble and a mixture of seagrasses and algae as the dominant cover. The northern portion of Area 4 contains the embayments south of the dump including Unai Sadog Tase. This bay is lined with the most extensive stand of mangrove found on Saipan (Bruguiera gymnorrhiza). The near-shore zone is comprised of extensive Enhalus beds with 80 - 100% cover. Farther out in the bay, the dominant cover is a mixture of Halodule uninervis and Halophila minor along with Halimeda opuntia and some Padina tenuis. Scattered corals, accounting for less than five percent cover, include Pocillopora damicornis, Porites lutea, Acropora nasuta and A. aspera.

The embayment to the east of Puntan Muchot (outer Smiling Cove) is also characterized by Enhalus beds, but they are more scattered and clumped and account for approximately 20 - 40% cover. Halodule is also very common followed by Halimeda opuntia and Padina tenuis. Scattered corals in the area include Pocillopora damicornis, Porites lutea and some Acropora aspera, and account for 5 - 20% live coral cover. Directly off Puntan Muchot the substrate is covered mostly by Halodule (50 - 75%), Halophila and Padina, with a few scattered small colonies of the coral Pocillopora damicornis.

Fishes observed in the northern near-shore portion of Area 4 were predominately damselfishes (Pomacentridae), particularly those species associated with small coral heads. Common species were Chromis caerulea, Dascyllus aruanus and Pomacentrus pavo. Important food fishes found in the area include mullet (Mugilidae), rabbitfish (Siganus spinus), goatfish (Mullidae), snappers (Lutjanidae) and the Lethrinid Lethrinus harak (Amesbury, et. al., 1979).

West of Puntan Muchot seagrasses thin-out, and extensive stretches of sand predominate with an occasional small coral colony of Pocillopora or Porites. Further south in front of the

Hyatt and Saipan Beach Hotels, sand and sand/rubble substrate contain mixtures of Halodule, Dictyota, Halimeda and Padina with less frequent clumps of Enhalus.

Approximately 300 m south of the Saipan Beach Hotel, a rather dense area of predominantly Halodule (80 - 90%) interspersed with Halimeda, Dictyota, Padina, Caulerpa racemosa and C. sertularoides extends south to the Garapan Dock. This band of seagrass and algae averages 250 m in width. There are a few corals (P. damicornis and P. lutea) scattered about the area. Fishes in this zone of heavy seagrass cover are similar to those observed north of this site including the rabbitfish Siganus spinus, the goatfish Parapeneus barberinus, mullet (Mugilidae), silversides (Atherinidae) and several unidentified species of juvenile fishes. A small pipefish (Syngnathidae) is very abundant among the seagrass and rubble areas throughout the near-shore zone of Areas 4 - 7.

b. Lagoon

The Lagoon zone of Area 4 averages one to two meters deep close to shore and two to four meters in the deeper moat portions of the Lagoon. The floor is relatively flat and comprised mostly of sand with scattered coral/algal rubble. The outer portion is also sandy but with more coral/algal rubble and rocks particularly at the border of the barrier reef where some areas have irregular reef rock exposed at low tides.

Corals are absent to widely scattered along the inner portion of the Lagoon, becoming scattered to patchy within the middle portion and more abundant in the outer Lagoon, particularly where it grades into the barrier reef. The two exceptions to this general pattern are the series of patch reefs located to the west and northwest of Puntan Muchot. These reefs are relatively diverse with good coral cover and are actually a series of isolated patch reefs that are a result of the barrier reef platform being interrupted by irregular channels of various widths and depths.

Another area of abundant coral growth is a band of Acopora formosa located in the outer Lagoon just inside the outer reef flat west of Garapan village. These luxuriant Acropora beds are nearly 1000 m long and represent an important resource within the Lagoon.

Scattered corals found throughout the Lagoon zone include Pocillopora damicornis, P. dane, Porites lutea, Acropora aspera, A. hebes, A. studeri, Psammocora contigua, Pavona divaricata and a few other smaller forms. Coral cover in the sand and rubble areas of the Lagoon rarely exceeds five percent and usually averages only one to two percent cover. The southern portion of Area 4 from the Hafa Adai Hotel to the Garapan Dock and channel is characterized by more seagrass and algae and fewer corals. The lagoon floor here is mostly a mixture of Halodule and Padina tenuis, with some Halimeda opuntia, H. macroloba, Dictyota sp., Caulerpa racemosa and C.

sertularoides. The percent cover of marine plants varies widely, between 20 - 80%.

Fishes observed in the Lagoon areas are similar to those observed in the southern portion of Area 1 (Lagoon). Common fishes are the damselfish (Pomacentridae), the emperor Lethrinus harak, rabbitfish (Siganus spinus), triggerfish (especially Rhinecanthus aculeatus), juvenile parrotfish (Scaridae), mullet (Mugilidae), goatfish (Mullidae), wrasses (Labridae), surgeonfish (Acanthuridae) and cardinalfish (Apogonidae).

Conspicuous invertebrates observed in this habitat include the sea cucumbers Holothuria atra, H. impatiens, H. leucospilota and Bohadschia marmorata, the starfish Linckia laevigata and the sea urchins Echinometra mathaei and Echinothrix diadema.

Patch reefs in the northern portion of the Lagoon in Area 4 border the Tanapag Channel and are geologically part of the barrier reef and reef flat. However, they are discussed here as patch reefs within the Lagoon because of their proximity to the Lagoon.

Two wrecks, a small pontoon-barge used as a pier and a large concrete ship (possibly used to carry water) are located on the northern and northwestern portions of these patch reefs. Surf often breaks along these irregualar reefs providing recreation for surfers and windsurfers.

The Lagoon floor is primarily sand and coral/algal rubble between the patch reefs. Some water movement from surf and swells (surge) or from tidal currents is almost always present in this area and visibility is generally poor.

Corals observed along these patch reefs include Pocillopora damicornis P. setchelli, P. elegans, Montipora ehrenbergii, M. foveolata, M. elschneri, Millepora dichotoma, M. platyphylla, Porites lutea, P. rus, P. convexa, P. cylindrica, Acropora nasuta, A. aspera, A. surculosa, A. humilis, A. palifera, Favia pallida, Heliopora coerulea, Psammocora contigua, P. nierstraszi and Galaxia fascicularis. Coral cover varied from approximately 10 - 50% and averaged 20 - 30%. Many of the patch reefs are comprised of dead Acropora and other species that smaller corals are overgrowing. Some Acanthaster were observed here as were a moderate number of fresh (white) feeding spots.

Fish fauna were moderately diverse among these patch reefs, but most species were small (25 cm) in size. The most abundant fishes were surgeonfishes (Acanthuridae) including Acanthurus lineatus, A. mata, A. nigrofuscus, A. triostegus, Ctenochaetus striatus, Naso literatus, N. brevirostris and N. unicornis, the rabbitfish Siganus argenteus and S. spinus, several species of wrasses (Labridae) and adult and juvenile parrotfish including Scarus chlorodon, S. ghobban, S. sordidus and many unidentified juveniles.

In the sand and rubble areas between these patch reefs are various marine plants including Halodule uninervis, Dictyota bartayresii, Halimeda opuntia and H. macroloba. Less common

were Halophila minor, Caulerpa racemosa, C. sertularoides and floating masses of the filamentous blue-green _____. In selected areas algae and seagrass comprised 10 - 50% of the bottom cover and locally (but uncommon) Halodule and Dictyota together accounted for as much as 75% cover. One green turtle (Chelonia mydas) was observed along the outer seaward edge of these patch reefs.

The Acropora formosa coral beds that are just inside the outer reef flat off Garapan provide excellent habitat for fishes, especially damselfish (Pomacentridae), squirrelfish (Holocentridae) and goatfish (Mullidae). During the field work for this report spearfishermen were frequently observed working these Acropora reefs. Smaller Acropora thickets are found on the edge of the old dredged channel from Garapan Dock and on the south side of the channel midway between shore and the barrier reef. The numerous, smaller beds are generally 90 - 100% live Acropora, while many of the larger extensive patches were 80 - 100% dead on the upper surface, presumably due to exposure at low tides. Below this dead layer and along the perimeter the Acropora is 90 - 100% live. The Acropora thickets rise from depths of 2 - 4 m and nearly reach the surface. The lattice framework provided by this staghorn type coral provides numerous holes for a variety of adult and juvenile fishes, crustaceans, echinoderms, algae and numerous other forms. The Acropora thickets provide hiding places for sources of food, breeding areas and safe havens for juvenile fishes. Large squirrelfish including Flammeo opercularis, F. sammara, Adioryx diadema and Myripristis murdjan were the most obvious fishes seen around these Acropora beds. Amesbury, et. al. (1979), reported that squirrelfish were recorded here at their highest density anywhere in the Lagoon. He also observed high densities of goatfish (especially Mulloidichthys flavolineatus), snappers (Lutjanus kasmira and L. fulvus), juvenile parrotfish and blue Chromis.

c. Reef Flat

The reef flat zone of Area 4 is not a continuous, well defined area of the barrier reef as it is in the northern Lagoon. A true reef flat does not exist south of the Tanapag Channel and west of Puntan Muchot. Here the reef is a series of discontinuous patch reefs and the reef flat platform and barrier reef are not distinct. Even the reef off Garapan is not a typical barrier reef with a distinct inner reef flat and reef margin and slope. The barrier reef system does become more contiguous and well defined south of the Japanese lighthouse (Areas 5 - 7).

The reef flat zone is highly dissected with sand, coral/algal rubble and larger boulders and mounds of dead coral, corals and coralline algae. Species are very similar to those observed on the patch reefs in Area 4 (see Lagoon, above). Dominant corals include Porites lutea, Pocillopora damicornis, P. elegans,

Psammocora nierstraszi, Millepora dichotoma, Montipora elschneri, M. ehrenbergii, M. faveolata, Porites convexa, Psammocora digitata, Favia stelligera, Oulophyllia crispa, Acropora nasuta, A. surculosa and Pavona venosa.

Some of the reef flat rubble areas are overgrown with the coralline algae Porolithon onkodes and Lithophyllum sp. Other algae present in this zone are Lithothamnion asperulum, Padina tenuis, Turbinaria ornata, Cholosodesmis sp., Sargassum cristaefolium and Caulerpa racemosa.

Fishes observed along the reef flat were dominated by surgeonfishs (Acanthuridae), primarily Acanthurus lineatus, A. glaucopareius, A. achilles, A. triostegus and Naso literatus, juvenile and adult parrotfish (Scaridae), groupers (Serranidae), snappers (Lutjanidae), goatfish (Mullidae), wrasses (Labridae) and rabbitfish (Siganidae).

d. Reef Margin and Slope

Much of the reef margin and slope in the southern portion of Area 4 is dominated by coral mounds, large patches of sand, sand channels and low to moderate coverage and diversity of corals. Coral cover averaged 5 - 10% within this zone, and numerous dead corals were observed. During a 20-minute tow approximately 50 - 60 Acanthaster and/or white feeding scars were counted. In many areas blue-green algal forms predominate including Schizothrix mexicana and Microcoleus lyngbyaceus. Other algae include Chlorodesmis sp., Caulerpa sp., and Turbinaria ornata. Visibility is generally reduced or poor due to the outflow of sediment and organic material from the north which exits the Lagoon at the channel and through cuts and other breaks in the barrier reef.

Corals which predominate along the margin and slope include Porites lutea, Pocillopora damicornis, P. eydouxi, Acropora palifera, A. nasuta, A. irregularis, A. hebes, Millepora platyphylla, Porites rus, Platygyra pini and Pavona duerdeni.

2. Physical Marine Resources

a. Currents

The currents in Planning Area 4 have been previously investigated for the Army Corps of Engineers to assist in evaluating flood control needs for the area (M & E Pacific, 1980). Currents were evaluated near-shore, mid-lagoon and outer lagoon at locations just south of the Hafa Adai Hotel and opposite the Saipan Beach Hotel (Figures IV-1 - IV-4).

Some of the findings of the above report are that water circulation patterns are virtually independent of the tidal cycle, and a continuous southwesterly component occurs in the Lagoon in front of the Hyatt - Hafa Adai Hotel area. Except during flood tide conditions when the water transport is parallel to shore towards the south, a nearly continuous southwesterly movement of water is typical of this portion of the Lagoon.

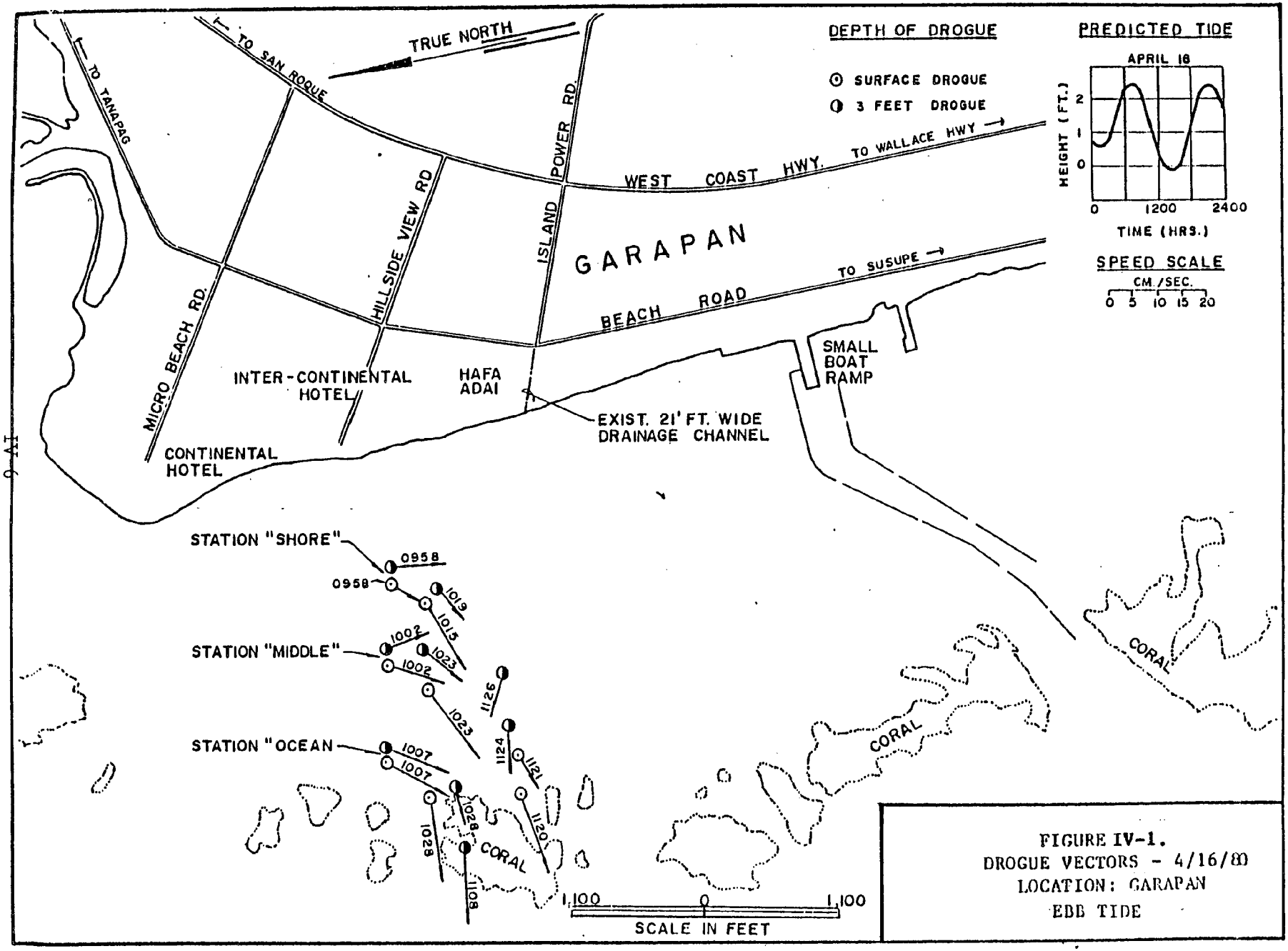


FIGURE IV-1.
DROGUE VECTORS - 4/16/80
LOCATION: GARAPAN
EBB TIDE

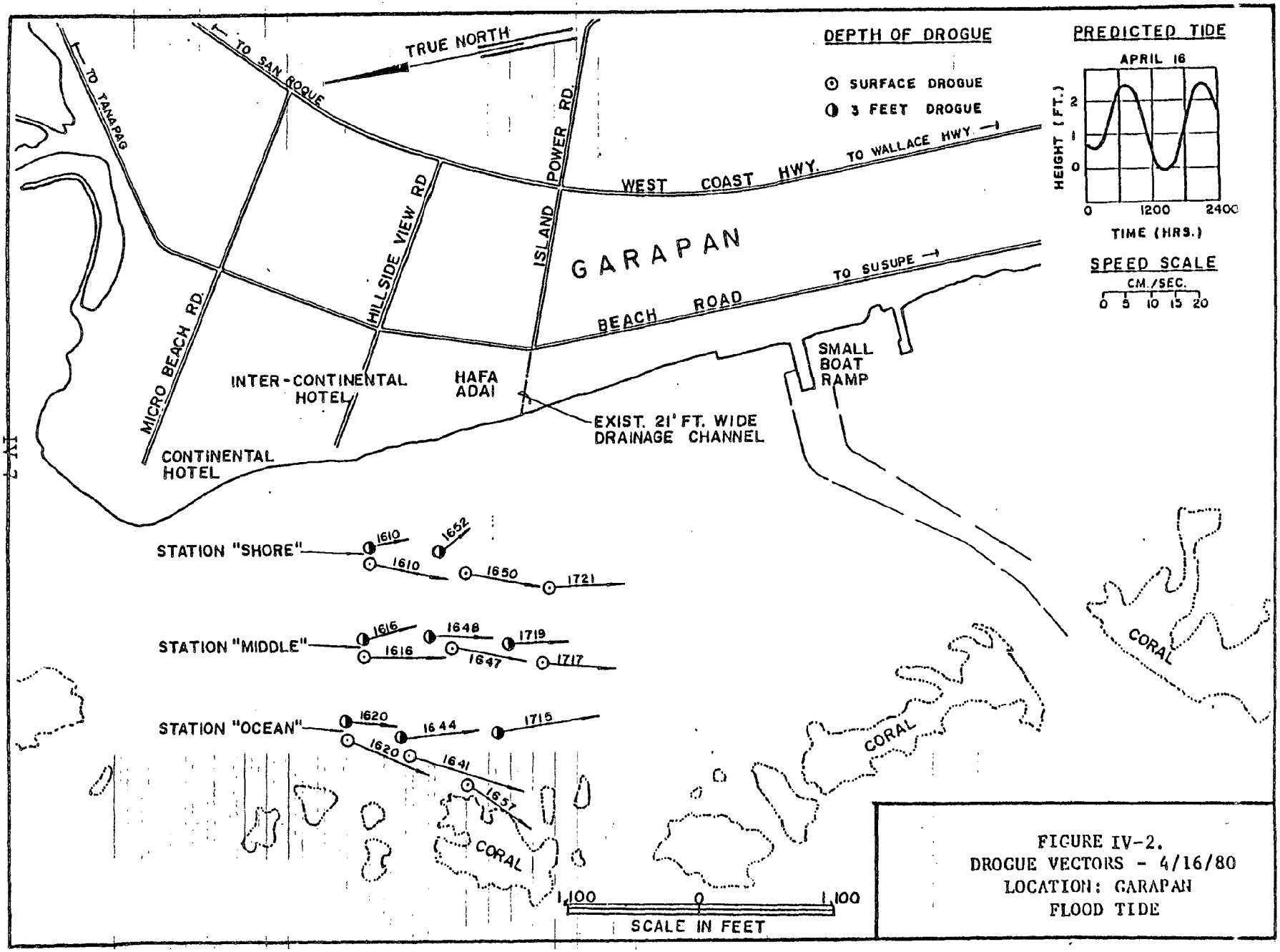


FIGURE IV-2.
DROGUE VECTORS - 4/16/80
LOCATION: GARAPAN
FLOOD TIDE

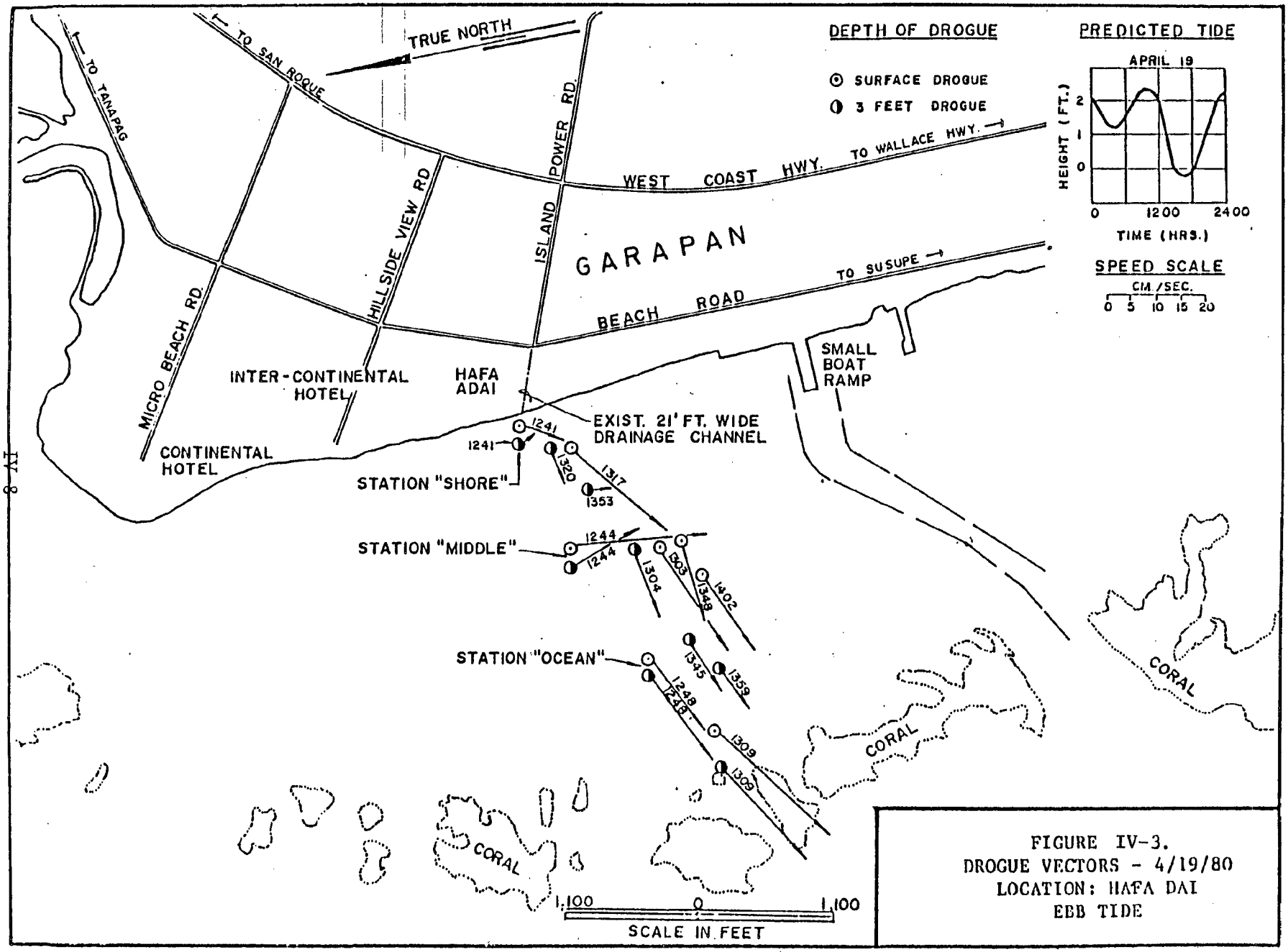


FIGURE IV-3.
DROGUE VECTORS - 4/19/80
LOCATION: HAFA DAI
EBB TIDE

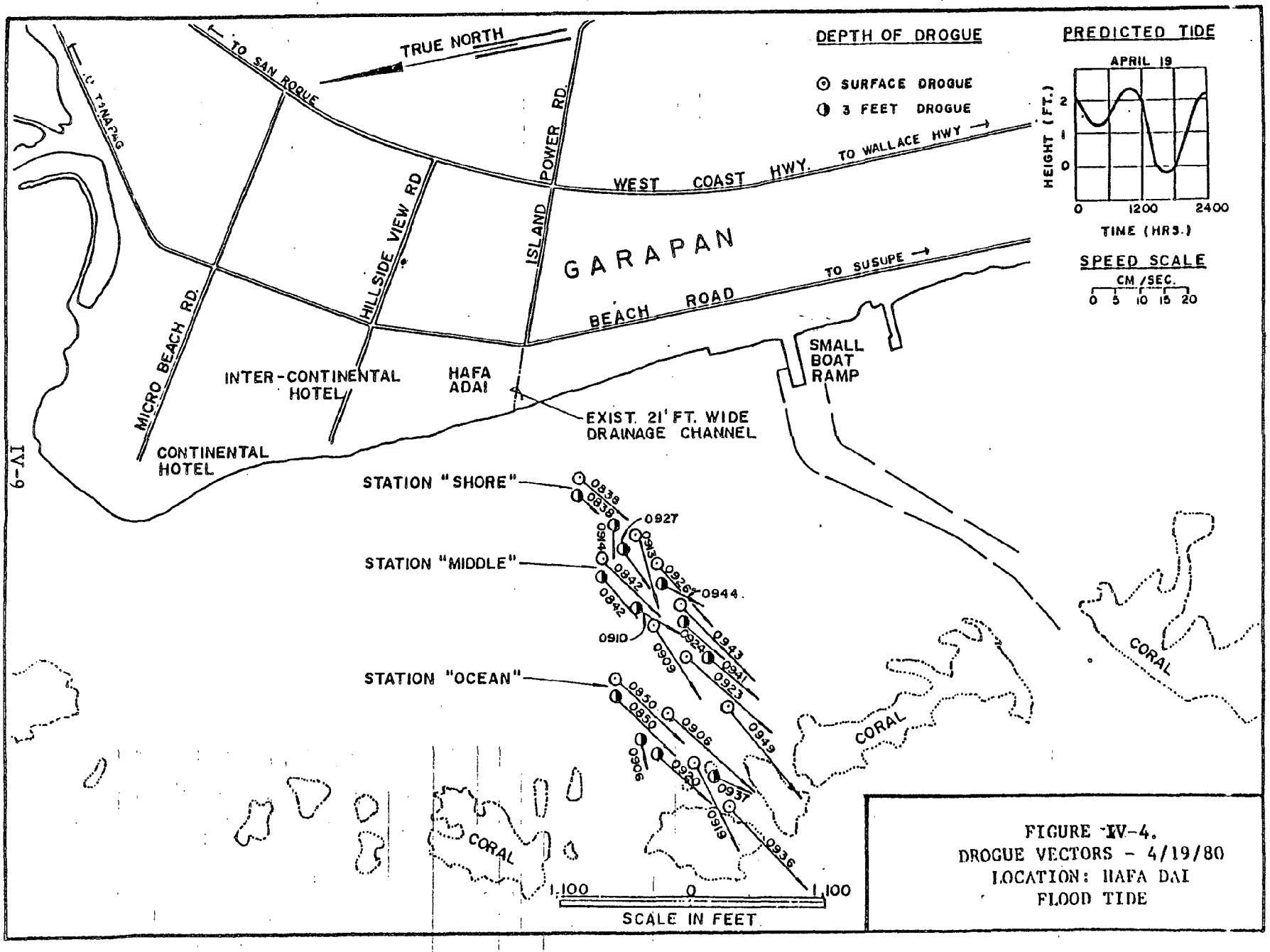


FIGURE IV-4.
DROGUE VECTORS - 4/19/80
LOCATION: HAFA DAI
FLOOD TIDE

Water is transported seaward through the openings in the non-continuous reef structure typical of this area. Water near the Garapan Dock flows towards the small boat channel from both the north and south and exits at the opening in the barrier reef.

Currents in Planning Area 4 were found to average from 3.0 cm/sec (0.06 kts.) to 20.3 cm/sec (0.40 kts.). Figure IV-5 depicts the general circulation pattern for the Garapan area.

b. Water Quality

Water quality in Planning Area 4 is variable and ranges from quite poor in the bay west of he Puerto Rico dump to good in the Lagoon south of Puntan Muchot. The Division of Environmental Quality (DEQ) currently samples water from eight stations within this area including the bay next to the dump, Smiling Cove, Micro Beach, Hyatt and Saipan Beach Hotels, Samoan Housing area, Hafa Adai Hotel and the Garapan Dock. Water quality monitoring station sites and data regarding occurrence and violations of fecal coliform standards are depicted on Figure I-1 of this Volume. Analysis of recent data from the DEQ (October 1984 - March 1985) showed only one sampling station having fecal coliform values over 200/100 ml. The Glass Bottom Boat Dock (Smiling Cove) had one reading for fecal coliform of 201/100 ml but the mean for the sampling period was only 79/100 ml.

The small bays and near-shore waters east of Puntan Muchot are generally quite turbid due to wind generated waves stirring up the fine sand and silt in these shallow (0.5 - 2 m deep) waters. Additionally, leachate material and floating debris blown or washed from the dump are carried to the southwest where they affect water quality and the visual aesthetics of the area.

South of Puntan Muchot three storms drains (south of the Saipan Beach Hotel, south of the Hafa Adai Hotel and in Garapan) empty into the Lagoon. A very large drainage ditch empties into the bay just east of Puntan Muchot. This canal receives all the stormwater runoff from the Civic Center and American Memorial Park areas. Complaints are often lodged against storm drains which plug up with silt and sand and then become stagnant and foul smelling. When the drainage is opened up the resultant outflow of this water causes localized pollution and possible health hazards along the nearby hotel beaches. Additionally, the coliform standard is frequently exceeded in the Micro Beach area. These high levels of coliform are likely caused by overflowing sewage lift stations.

3. On-shore Resources

a. Wetlands

There are two wetland areas within the Puntan Muchot Planning Area. One lies between Beach Road and West Coast Highway just north of the road that runs between the Hyatt

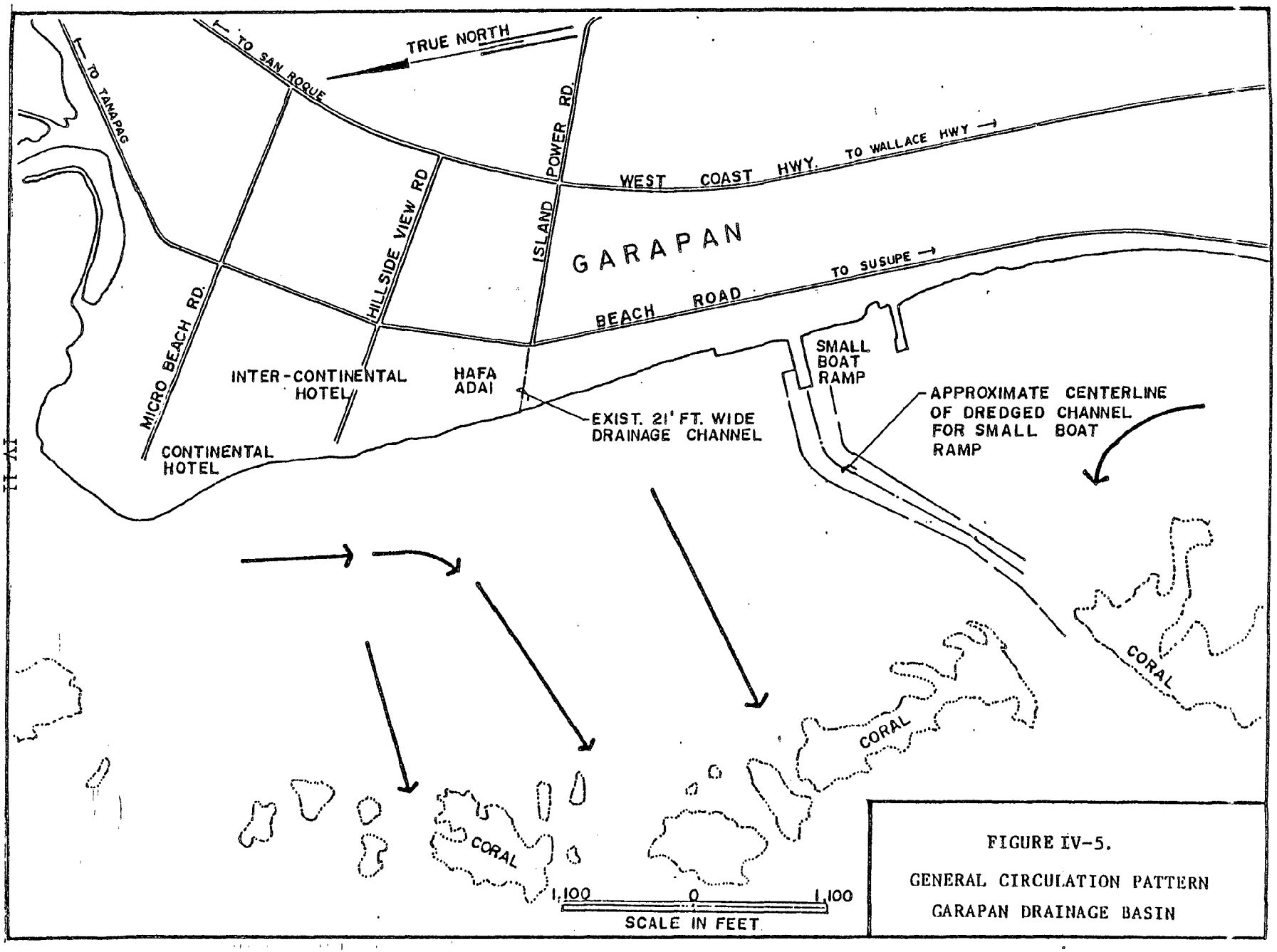


FIGURE IV-5.

GENERAL CIRCULATION PATTERN

GARAPAN DRAINAGE BASIN

and Navy Hill. It is likely that the entire area was once a poorly drained marsh left as a catchment site. The wetland is slowly filling in, a process which is helped along by its use as an illegal dumping site.

This wetland site is approximately 8.4 acres in size. The dominant vegetation consists of grasses such as Panicum maximum, the fern Acrostichum aureum, Tangan-tangan (Leucaena leucocephala), Pago (Hibiscus tiliaceus), Elephant grass (Pennisetum purpureum) and Ironwood (Casuarina equisetifolia). The fern A. aureum is by far the most common plant in open areas and provides important nesting cover for the Marianas Gallinule (Gallinula chloropus), an endangered species that frequents this wetland.

The second wetland is a small ponding basin used for the housing subdivision just west of West Coast Highway and south of its junction with Navy Hill Road. It is directly across the highway from the new Commonwealth Health Center. This site was previously a wetland marsh before the housing area was constructed (Moore, et. al., 1977). At that time the wetland occupied approximately 12 acres. Today the ponding basin area is only about 3.2 acres. The main vegetation includes grasses such as Panicum maximum and Pennisetum purpureum and the reed Phragmites karka.

b. Mangroves

Another small mangrove habitat on Saipan is found just south of the Puerto Rico Dump along a short segment of coastline. The extent of the mangrove area is approximately 600 m long by 10 m wide. Brugiera gymnorrhiza is the only mangrove species in this area. This site if fed by freshwater along the shoreline from a small wetland directly across Beach Road and to the south 100 m. Data suggest that the area was likely a poorly drained marsh at one time. The area is now filling in, a process which is facilitated by the expanding dump site.

c. Rare, Threatened and Endangered Species

The wetland between Beach Road and West Coast Highway (see Section a, above) provides habitat for two endangered species of birds, the Marianas Gallinule (Gallinula chloropus) and the Nightengale Reed Warbler (Acrocephalus luscinia). Significant numbers of the Reed Warbler have been observed or heard in this wetland site.

The mangroves (Brugiera gymnorrhiza) found along the coastline south of the Puerto Rico Dump and, to a lesser extent, in the wetland east of the American Memorial Park should be protected. Although not officially listed as threatened or endangered they should be considered rare as they are found in very limited numbers in Planning Areas II and IV. To ensure the viability of the Brugiera they should be given protection from pollution, filling and dredging activities and other environmentally detrimental actions.

Historically, it is likely that the Green Sea Turtle (Chelonia mydas) nested on the beaches along the shoreline of the Smiling Cove area, American Memorial Park and Micro Beach. In recent years, development and heavy use by local residents and tourists has kept the turtles away. Development, particularly hotel and resort complexes, is not compatible with nesting of the turtles. Consideration for preserving some coastline/beach areas should be given before all suitable nesting sites on the west coast of Saipan are developed or altered, precluding their use by the turtles.

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

Garapan, being Saipan's most urban community, represents a cross section of single-family and multi-family residences, commercial and tourist commercial businesses and public use areas.

The major public facilities within this Planning Area include the American Memorial Park, several Commonwealth beach parks, the CNMI Museum, Garapan Park, Saipan Fishing Center and supporting infrastructure with appurtenances. Just south of the Hafa Adai Hotel is a community service complex with the Dispensary, Head Start, YMCA and the Carolinian Affairs Office (now under construction).

Recently completed improvement plans for the Saipan Fishing Center include additional on-shore facilities, upgrading the launching ramp, more trailer parking, fueling facilities, and a boat berthing area for approximately 15 boats, up to 20 feet in length.

b. Public Land Ownership and Access

Public land in this Planning Area is limited to four sites. The first is a large contiguous tract including Micro Beach, the American Memorial Park and the Smiling Cove and DPW Beach area. Second is the Garapan Dock and launching ramp. Third is a parcel next to Beach Road where the sewage pumping station is located. Fourth is the Samoan Housing Area, north of the Hafa Adai Hotel, being used as government housing.

c. Recreation Sites

The recreation sites are listed and described in Table IV-1.

d. Historic Sites

Eight historic sites are found within the project area as shown in Figure IV-6. Located within the American Memorial Park these properties include Japanese pillboxes, storage tanks, barracks site, a bathhouse, garden complex, bunker and anti-aircraft gun.

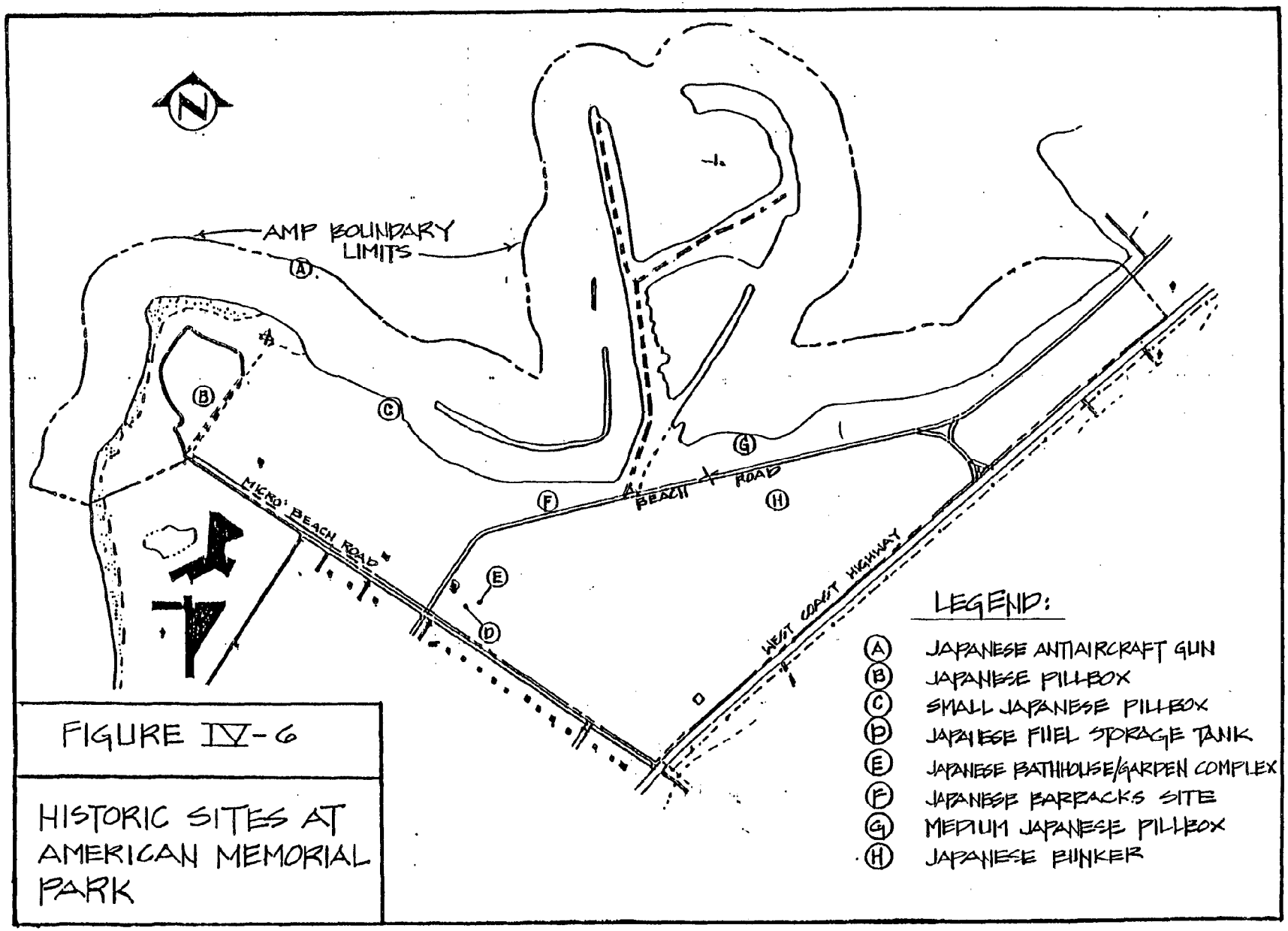


FIGURE IV-6

HISTORIC SITES AT AMERICAN MEMORIAL PARK

Table IV-1
RECREATION SITES AT PUNTAN MUCHOT PLANNING AREA

Park or Recreation Area	Existing Facilities
American Memorial Park	Picnic Tables - 8 Launching Ramp Parking at Smiling Beach - 30 vehicles Boat Trailers Parking - 5 trailers Pavillion
Micro Beach	Access road, paved and compacted coral 1600 lf Public restroom Pavillion Picnic tables - 5 Volleyball court Playground, Hobie cat sailboat rental Windsurfer rental

e. Beach Erosion and Storm Surge Zones

Shoreline erosion has occurred at four locations in this Planning Area, as depicted in Figure IV-7. Additionally, interacting and convergent longshore currents deplete the Micro Beach area.

Doan and Siegrist also point out a special concern around Micro Beach. They note that the present configuration of Muchot Point is the result of several thousands of years of interaction among winds, waves, tides, currents and sea level changes and represents an equilibrium of these forces which is perhaps easily disturbed but, in all probability, self-restoring. At Puntan Muchot the persistent longshore currents, resulting from a combination of winds and daily tides, are intermittently eroding and transporting sands from the low promontory and adjacent beaches, and subsequently depositing them as bars on the reef flat. This on-going process occurs at the rate of five feet per year from Puntan Muchot.

f. Stormwater Drainage

1. Existing Development and Public Facilities

In June 1984 the U.S. Army Corps of Engineers released its "Draft Detailed Project Report and Environmental Statement for the Garapan Flood Control Project." The objective of this project is to alleviate recurring and severe flooding in the lower Garapan area.

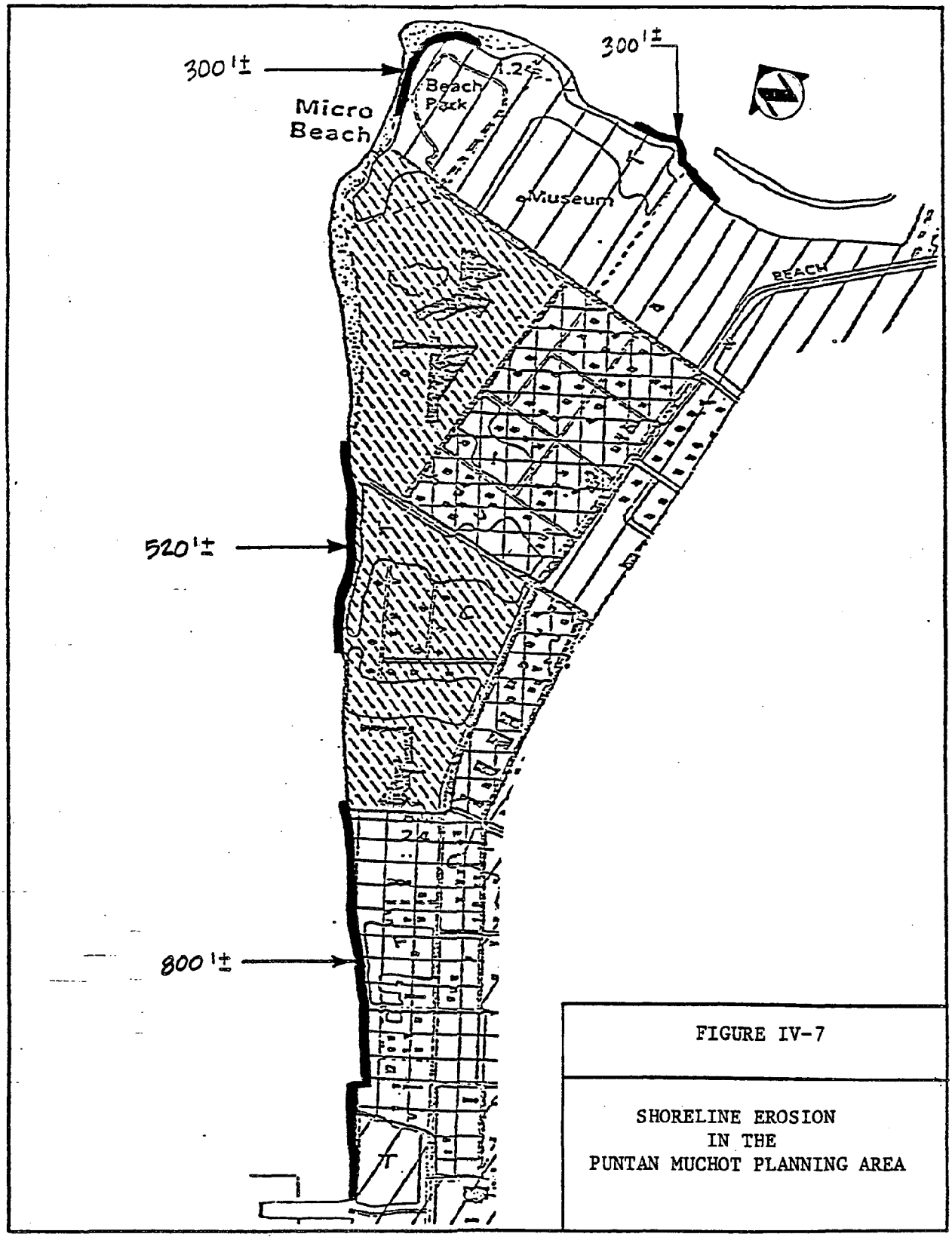


FIGURE IV-7

SHORELINE EROSION
IN THE
PUNTAN MUCHOT PLANNING AREA

Residences as well as small and moderate size commercial structures are affected by floodwaters. In August 1978 Tropical Storm Carmen caused an estimated $200,000 worth of damage to buildings over a 90-acre area in the village of Garapan, which was inundated by up to 1½ feet of low to no-velocity flood waters.

The primary causes of Garapan's flood problems are the lack of a suitable outlet channel to effectively convey runoff to the ocean and the relatively flat topography of the area which compounds the drainage problem. Related problems are reduced water quality of the Lagoon as a result of stormwater discharge and an interim stormwater drainage system.

Seven possible measures were studied to alleviate Garapan's flood control problem. These measures are listed in Table IV-2. The only three preliminary alternative plans which are given serious consideration involve structural improvements consisting of a diversion channel to convey floodwaters to an outlet channel which would discharge the flow into the Saipan Lagoon.

The diversion channel at each of these structural measures is 15 to 20 feet wide at its base. The outlet channel base widths vary from 40 to 50 feet. Utility relocations, new culvert crossings and (for one alternative) relocation of four residences are also required.

The presently recommended flood control plan is depicted in Figure IV-8. The channel is 5,720 feet long and discharges into Tanapag Harbor. It's typical sections are presented in Figure IV-9.

The recommended alternative is preferable over the other two structural alternatives, especially because its discharge point is Tanapag Harbor rather than in shallow Lagoon waters farther south within the Puntan Muchot and Garapan Lagoon Planning Areas. Nonetheless, the recommended plan has several inherent problems, now being studies in the U.S. Army Corps of Engineers. These include:

- The potential for disturbing unknown subsurface historic sites
- Potentially altering the existing wetland sites
- Strong opposition from the National Park Service for construction of the outlet channel through a portion of the American Memorial Park
- Opposition from the CNMI Department of Natural Resources because the channel traverses a wetland and may endanger some birds in the area

While the inevitable impacts and obstacles of the plan's overland portion of the project do not appear particularly difficult to mitigate, additional study and attention must be given to the Lagoon's water quality as it is affected by a large volume of stormwater discharge. All the alternatives will create temporary as well as intermittent, long-term

TABLE IV-2

MEASURES FOR ALLEVIATING
GARAPAN FLOODING

Measures	Preliminary Findings
Flood Warnings/Temporary Evacuation	Predictions untimely and un reliable for small drainage areas.
Flood Proofing	Not practical. Adverse socio-economic impact.
Permanent Evacuation and Relocation	High cost and adverse housing and social impact, but being considered further.
Floodplain Regulation	Does not alleviate the existing flood problems in developed areas.
Ponding Basins	Less favorable than other structural measures.
Channel-Levee Improvements	Has merit, should consider further.
Combination Nonstructural and Structural	Less desirable than structural measures from the equity standpoint.

Source: Draft Detailed Project Report and Environmental Statement Garapan Flood Central. U.S. Army Corps of Engineer. June 1984.

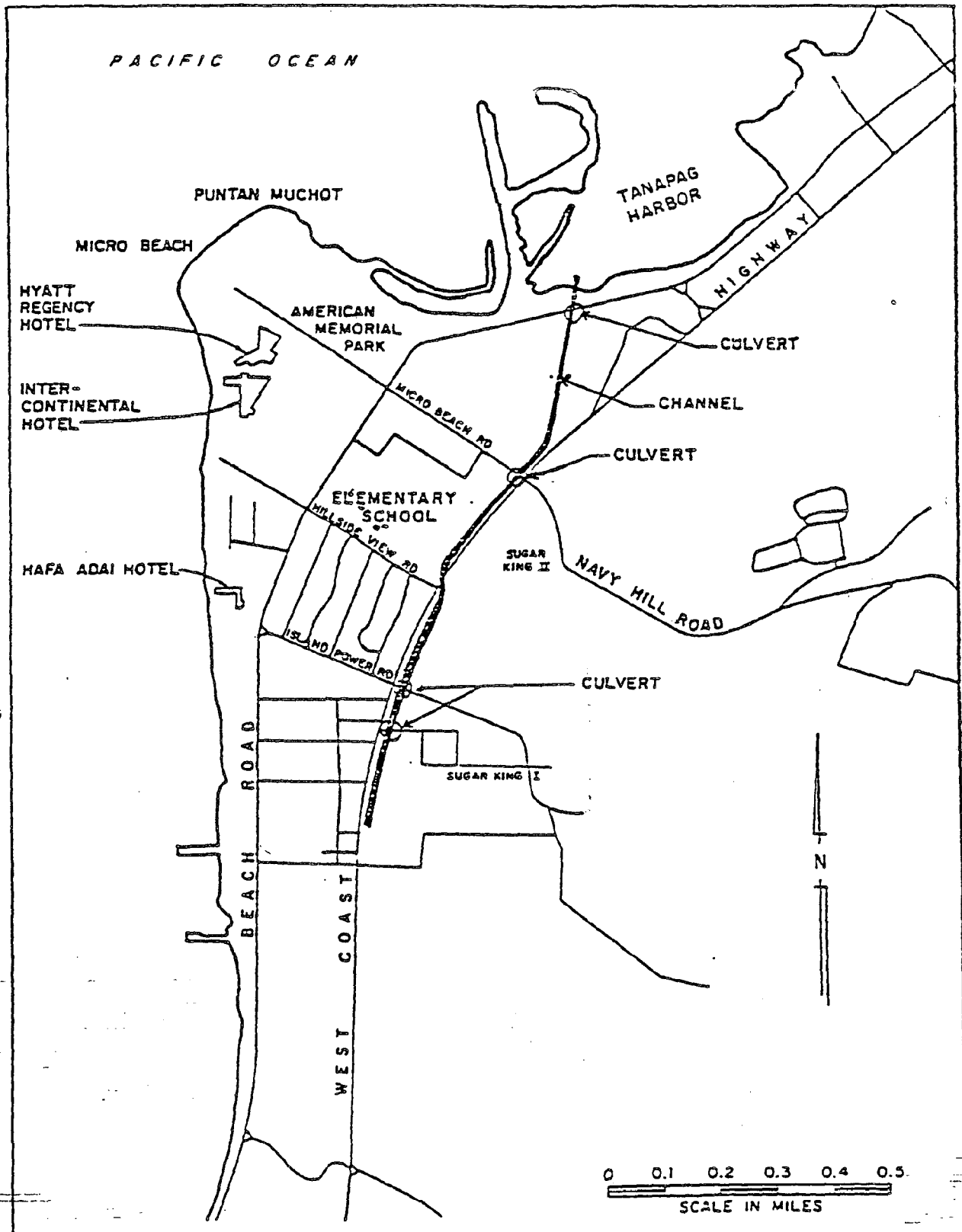
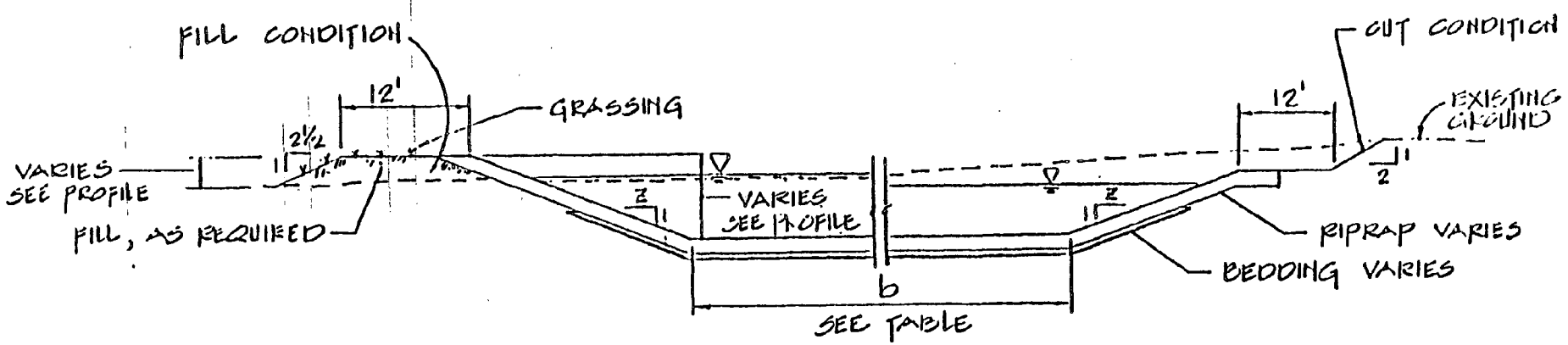


Figure IV-8. Recommended Plan for Garapan Flood Control.

Source: Draft Detailed Project Report and Environmental Statement, U.S. Army Corps of Engineers, 1984.



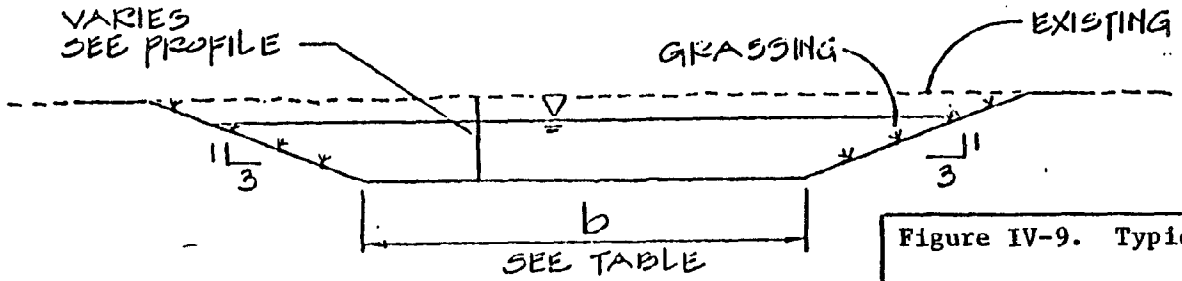
TYPICAL RIPRAP LINED SECTION

STATION TO STATION	Z	b_{10}	b_{50}	b_{500}	TYPE LINING
0+00 TO 2+00	3	20'	20'	40'	UNLINED
5+00 TO 18+00	3	20'	20'	40'	RIPRAP
21+50 TO 30+50	3	20'	40'	60'	RIPRAP
34+70 TO 43+00	2.5	20'	20'	20'	RIPRAP
47+00 TO 48+20	2.5	15'	15'	15'	RIPRAP
50+00 TO 57+22	2.5	15'	15'	15'	CONC RIPRAP

NOTE:

1. STATIONS NOT LISTED INDICATE LOCATIONS OF CULVERTS AND TRANSITIONS AT ROADWAYS. ALL TRANSITIONS SHALL BE WARPED TYPE AND RIPRAPPED.

2. SECTIONS NOT TO SCALE



TYPICAL GRASSED SECTION

STA. 0+00 TO STA. 2+00

Figure IV-9. Typical Section, Garapan Flood Control.

Source: Draft Detailed Project Report and Environmental Statement, U.S. Army Corps of Engineers, 1984.

effects on coastal water quality. In addition, the outlet channel would require dredging of the reef flat for a distance of about 100 feet off-shore. Localized turbidity would continue for the duration of dredging activities.

During the discharge of relatively large volumes of stormwater runoff through the channel outlet into the Lagoon, long-term water quality impacts can be anticipated. A temporary zone of mixing would result with higher than ambient turbidity and depressed salinity. Other pollutants from terrestrial sources can also be expected. These impacts must be more closely studies in order to understand their consequences so that appropriate measures can be provided within the final project analysis.

2. Economic Resources

a. Subsistence Fishing and Gathering

Subsistence fishing occurs to a lesser extent along the shoreline of Planning Area 4 than in other shoreline zones due to the development of hotels and other commercial facilities. There is considerable boat traffic utilizing the Smiling Cove Harbor and many small fishing boats enter the Lagoon and Philippine Sea from this launch site. Throw-net (Talaya) fishermen can be seen along the beach areas but are more frequent along Micro Beach, the American Memorial Park and south of the Hafa Adai Hotel (to Garapan Dock). Tourist related activities in the vicinity of the three hotels tend to preclude shoreline fishing except during the very early morning hours.

b. Commercial and Sport Fishing and Facilities

Garapan Wharf (Garapan Dock) was originally constructed by the Japanese and later modified by the U.S. after World War II. The dock consists of a 485 foot concrete pier, a dredged channel and docking area and a concrete landing ramp. Dredged depth ranges from 5 to 10 feet. A boat launch ramp and trailer parking area are also available here (also see Section B-1, this chapter).

The Smiling Harbor dock and boat launching ramps are located along the north central portion of the American Memorial Park. The Saipan Fishing Center is located just south of the Garapan Wharf.

Small boat launching ramps are being constructed for Smiling Beach and Garapan Fishing Center.

c. Ports and Shipping

No ports and shipping facilities exist in this planning area.

d. Tourism Industry

The Puntan Muchot Planning Area is the heart of Saipan's tourist facilities, including the large hotels and the majority of Saipan's tourist-oriented businesses. Both the tourist accommodations as well as direct and indirect economic tourism

industry businesses are presently expanding in response to the steady flow of tourists to Saipan. Many of Garapan's former residences have been converted to small shops and nightclubs catering to local and tourist markets.

The off-shore Lagoon waters are well used by tourists for snorkeling, wading, swimming, surfboarding and sailing. The PDI boat shuttles tourists between the Hafa Adai Hotel and Managaha Island.

CHAPTER V - GARAPAN LAGOON PLANNING AREA

Planning Area 5 encompasses the small cove opposite the fisheries complex in Garapan south to San Jose Beach (just north of the intersection of Beach Road and Chalan Msgr. Guerrero Road). The shoreline is mostly a continuous sandy beach with some gravel and widely scattered coral/algal rubble. The shoreline is relatively undisturbed except for the cove opposite the fisheries complex which was dredged and filled on-shore in order to create a mooring area and two piers.

A. Natural Resources

1. Living Marine Resources

a. Near-shore

The near-shore zone of Planning Area 5 is generally comprised of a sand and sand/silt/rubble substrate covered by thick stands of seagrass with only an occasional coral head scattered among the seagrass and algae. Because of the heavy runoff of fresh water into the near-shore environment, dense Enhalus acoroides beds are found in a narrow band (approximately 10 - 50 m wide) along the shoreline throughout most of this Planning Area. Enhalus accounts for 60 - 100% coverage and very few if any corals exist where the seagrass forms such dense stands. Freshwater runoff and nutrients are known to enhance the growth of Enhalus, and it would also tend to stress any corals in the vicinity of a storm drain or outlet. Very little, if any, Enhalus is found south of Area 5, although the seagrass Halodule uninervis becomes very common.

Intermixed with and sometimes seaward of the Enhalus is the very common Halodule uninervis. Halodule is the major marine plant (70 - 90% of the algae and seagrass) throughout all of the near-shore zone of Area 5 (seaward of the Enhalus zone). The percent cover varies from approximately 20 - 75%, with higher coverage along Unai Chalan Laulau and Unai Garapan. Other species common in this zone include Halimeda macroloba, H. opuntia, Padina tenuis and Dictyota bartayresii, although none of these algae comprise more than one to five percent of the total bottom cover. In the southern portion of Area 5 some growth of the green algae Enteromorpha clathrata was present along the shoreline. This algae only grows in the intertidal zone and sometimes washes up on the beach.

Corals in the near-shore zone are very sparse and are characterized by scattered, small colonites of Porites lutea and Pocillopora damicornis. Areawide, live coral cover is less than one percent except in spots such as the area below the fisheries complex and opposite Unai Garapan where Porites and Pocillopora comprise as much as 5% cover.

Conspicuous invertebrates in the near-shore zone include the common sea cucumbers Holothuria atra, Actinopyga echinites, Bohadschia argus, B. marmorata and Holothuria edulis, and the starfish Linckia laevigata. The clam "Amsun" is

found in abundance near-shore in the Enhalus and Halodule seagrass beds. Frequently people are observed digging in the substrate within the seagrass beds all along the Garapan Lagoon south to San Jose Beach for this clam, locally known as "Amsun." Although this is likely an important resource at the subsistence level, a quantitative evaluation of the actual and potential harvest cannot be determined at this time.

Subsistence fishing occurs along the shoreline of the Garapan Lagoon, and fishermen using talayas (throw-nets) and spears are often observed searching for schools of juvenile to medium-size fishes as well as occasionally larger fish (such as Mullet) which feed and hide among the dense seagrass beds and occasional coral heads. Common fishes observed in the near-shore zone include juvenile and adult rabbitfish (Siganus spinus and S. argentus), mullet (Mugilidae), goatfish (Mullidae), snappers (Lutjanidae) and the emperor Lethrinus harak. Amesbury, et. al. (1979) reports that this near-shore area contains abundant populations of rabbitfish, goatfish (primarily Parupeneus barberinus) and silversides (Atherinidae). Other fishes observed include groupers (Serranidae), jacks (Carangidae), wrasses (Labridae), juvenile and adult parrotfish (Scaridae), surgeonfish (Acanthuridae) and cardinalfish (Apogonidae).

Common juvenile fishes harvested along the shore with cast nets include goatfish (Tiao), jacks (Ee), rabbitfish (Manahac and Dagi) and mullet (Aguas). Occasionally, small wrasses, halfbeaks, silversides and needlefish are also harvested by net fishermen.

b. Lagoon

The Lagoon zone in Area 5 varies from approximately two to four meters in depth and is mostly sand and coral/rubble substrate. Several species of algae, some seagrass and scattered to patchy corals are found in this area, with a few patches of staghorn Acropora coral also present.

Some portions of the Lagoon floor are covered with a fine mat of the seagrasses Halodule uninervis and Halophila minor. These are most common where the substrate is sand or fine rubble. Percent cover varies greatly from approximately 25 - 75%. Where the rubble is more prominent and larger in size, other marine plants such as Padina tenuis, Halimeda macroloba, Dictyota bartayresii, Turbinaria ornata and Sargassum polycystum are present.

Scattered among the rubble substrate are small patches of coral and solitary coral colonies, predominately Pocillopora damicornis, Porites lutea, Acropora nasuta and A. formosa. Live coral coverage in the Lagoon varies from less than one percent to approximately five percent, exclusive of the Acropora patch reefs. A few patch reefs are found in the middle to outer lagoon opposite Unai Garapan and Unai Chalan Laulau, the largest being in the southern section of Area 5. These patch reefs are comprised almost entirely of Acropora

formosa, with some A. aspera, Pocillopora damicornis, P. setchelli and P. danae. Some of these patch reefs are 60 - 80% dead A. formosa, with other species of coral growing on the dead branches. In addition, the algae Turbinaria ornata and Schizothrix calcicola were found attached to the dead coral network. The larger zone of Acropora to the south near an opening in the reef is more alive and varies from 5 - 40% live cover. Additional corals found in this area include Psammocora contigua, P. obtusangula and Millepora dichotoma.

Fishes observed in the lagoon zone varied in species composition and density with the greater numbers in the vicinity of the patch reefs. Common species include the surgeonfish Ctenochoetus striatus, Zebrasoma flavescens, Acanthurus xanthopterus and Naso literatus; the damselfish Dascyllus aruanus, Chromis caerulea, Stegastes nigricans and S. lividus; juvenile and adult parrotfish including Scarus sordidus and S. ghobban; the goatfish Parupeneus barberinus and Mulloidichthys flavolineatus; and in the Acropora thickets the squirrelfish Adioryx spinifer, Flammeo opercularis, F. sammara and Myripristis violaceus. Amesbury, et. al. (1979) reports that this zone contained the highest density of goatfish (Mullidae) and the second highest density of juvenile parrotfish (Scaridae) and cardinalfish (Apogonidae). Other common fishes observed in this habitat were jacks (Carangidae), wrasses (Labridae), surgeonfish (Acanthuridae), rabbitfish (Siganidae) and snappers (Lutjanidae).

c. Reef Flat

The reef flat within this Planning Area contains a diverse coral community which averages 25 - 40% live cover. The reef flat and margin are better defined and more continuous than that further north in Area 4. Predominant corals include Acropora formosa and A. aspera which form patch reefs and thickets that approach 75 - 80% cover in a few spots. Other common corals observed are Acropora smithi, A. nasuta, A. palifera, Porites lutea, P. cylindrica, Pocillopora damicornis, P. danae, P. setchelli, Montipora ehrenbergii, Goniastrea retiformis, Psammocora obtusangula, Stylophora mordax, Pachyseris speciosa, Favia matthaii, Platygyra daedalea and Leptoria phrygia.

Marine plants were less common in the reef flat zone than in the Lagoon zone and most species were those which attach to dead coral and coral/algal rubble. Species observed include Padina tenuis, Halimeda opuntia, Caulerpa cupressoides, Turbinaria ornata and Acanthophora spicifera. Only a very small amount of the seagrasses Halophila minor and Halodule uninervis are present, mostly in the small sandy patches along the reef flat.

Fishes are rather abundant and diverse in this area. All the species observed in the Lagoon are present on the reef flat as well. Schools of goatfish (Mullidae), juvenile and adult parrotfish (primarily Scarus sordidus and S. psittacus),

surgeonfish (mostly Acanthurus triostegus and A. mata) and rabbitfish (Siganus spinus) were observed here. Wrasses (Labridae) are more abundant in this zone including Gomphosus varius, Halichoeres hortulanus, H. trimaculatus and Thalassoma quinquevittata. Fishes such as squirrelfish (Holocentridae), moorish idols (Zanclus cornutus) and butterflyfishes (Chaetodontidae) are most abundant in the areas of rich coral growth and among the Acropora patch reefs.

d. Reef Margin and Slope

The reef margin and slope along Area 5 begin to form a more defined and continuous barrier reef, unlike the discontinuous reef pattern north of the lighthouse. Water visibility near the lighthouse and channel is generally poor, as this is the one of the major exit points for water from Areas 2 and 4. Visibility improves to approximately 60 - 80 feet as one moves south from the lighthouse area. Lagoon water also exits at the small cut in the reef near the southern boundary of this Planning Area. However, this exiting water does not seem to adversely affect water clarity.

Percent of live coral cover along the barrier reef margin and slope averages 10 - 15% and approaches 25 - 30% in a few areas. There are large sections of mostly dead coral, likely the result of past and present infestations of Acanthaster planci. Approximately 12 individual starfish were sighted during the tows, but an additional 50 - 60 recent feeding spots were observed. At the time of this survey the majority of the Acanthaster was sighted in the southern portion of Area 5.

The most dominant corals observed were Porites rus, Pocillopora eydouxi, Acropora palifera, Millepora platyphylla and M. dichotoma. Other common corals observed along the reef margin and slope include Pocillopora damicornis, P. verrucosa, P. elegans, Acropora irregularis, A. gravida, A. nasuta, A. surrculosa, A. smithi, A. humulis, Porites lutea, P. australiensis, Stylophora mordax, Montipora sp., Pavona duerdeni, Favia stelligera, F. pallida, F. matthaii, Diploastrea heliopora, Platygyra daedalea, Lobophyllia corymbosa and Heliopora coerulea.

Fish diversity is good along the barrier reef margin and slope although most fishes are small forms, generally less than 12" in length. The sand and rubble bottom areas contain good populations of jacks (Carangidae), parrotfish (Scaridae) and goatfish (Mullidae). The coral heads and the many holes within the reef network provide habitats for such forms as squirrelfish (Holocentridae), surgeonfish (Acanthuridae), damselfish (Pomacentridae), groupers (Serranidae) and others.

Amesbury, et. al. (1979) found that this zone was one of two habitats of highest surgeonfish abundance (primarily Acanthurus lineatus) and was the area highest in abundance for adult parrotfish, large wrasses and large groupers. Some very large needlefish were also observed, as were rudderfish (Kyphosus cinerascens) and fusilers (Caesio sp.).

Some of the more common species observed in this zone are the squirrelfish Adioryx spinifer, the snappers Lutjanus bohar, L. fulvus, L. monostigmus, the beams Monotaxis grandoculus and Scolopsis cancellatus, the jacks Caranx melampygus and Decapterus pinnulatus, the goatfish Mulloidichtys flavolineatus, Parapeneus barberinus, P. bifasciatus, P. cyclostomus, and P. trifasciatus, several species of butterflyfish (Chaetodon sp.), the wrasses Cheilinus chlorurus, C. trilobatus, C. undulatus, Gomphosus varius, Thalassoma fuscum, T. hardwicke and T. lutescens, the parrotfish Cetoscarus bicolor, Scarus chlorodon, S. ghobban, S. rubroviolaceus and S. sordidus, and the surgeonfish Acanthurus glaucopareius, A. guttatus, A. mata, A. nigrofuscus, A. triostegus, Naso literatus and N. unicornis.

Other marine life observed in this zone include one green sea turtle (Chelonia mydas), the starfish Linckia laevigata and Culcita novaeguineae, the sea cucumbers Thelenota ananas and Holothuria edulis and Trochus (Trochus niloticus).

2. Physical Marine Resources

a. Currents

No evaluations of the currents in Planning Area 5 have been conducted. It is assumed that the general circulation pattern would be an along-shore transport moving south to southwest exiting the Lagoon in low areas and cuts and channels in the barrier reef. One small opening is located in the outer reef opposite Unai Chalan Laulau and water likely exits the Lagoon here. Water in the northernmost section of this area may move northwest and exit through the Garapan channel as suggested by M & E Pacific (1980). This would likely hold true for ebbing tides, during periods of weak northeasterly winds and during southerly winds (unusual). Much of the Lagoon water would move south and exit the Lagoon through the channel and lower reef system at Susupe.

b. Water Quality

The water quality in this portion of the Saipan Lagoon is good but heavily influenced by freshwater runoff and associated sediments and nutrients. There are a total of 10 storm drains that empty into this portion of the Garapan Lagoon.

The extensive seagrass beds of Enhalus and the occurrance of the algae Enteromorpha are indicators that freshwater and increased levels of nutrients are entering the near-shore environment.

The Division of Environmental Quality (DEQ) collects and analyzes water samples from only two locations in this Planning Area; Dave Sablan Beach and Chalan Laulau Beach. Data on various water quality parameters are available at the DEQ office. Monitoring station sites and data regarding occurrence and violations of fecal coliform standards are depicted on Figure I-1 of this Volume. Analysis of recent data from the DEQ (October 1984 - March 1985) revealed all fecal coliform concentrations to be less than 200/100 ml.

3. On-shore Resources

a. Rare, Threatened and Endangered Species

No wetlands, mangroves or other critical habitat sites are located in this planning area. The extensive sand beach shoreline was likely used by the Green Sea Turtle (Chelonia mydas) for nesting in the past. There are no recent records of any nesting activities within this area.

No threatened or endangered species of birds would likely be found in this area as the vegetation is not extensive and there are no densely forested or wetland sites.

The large patch reef of the branching coral Acropora formosa found both to the south (this planning area) and north (Planning Area IV) of the lighthouse channel should be protected from any activities that might adversely impact the corals. A portion of the barrier reef south of the lighthouse has been designated as a Trochus (Trochus niloticus) preserve. The Trochus sanctuary encompasses the barrier reef from the lighthouse to one mile south, with the inshore boundary extending 50 yards in-shore of the edge of the reef and the 40 foot depth contour as the offshore boundary. No taking of Trochus is allowed within this sanctuary and one at Tank Beach (Kagman).

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

There is no major existing development with this Planning Area with the exception of beach park facilities at Unai Garapan and at Unai Chalan Laulau.

b. Public Land Ownership and Access

The full extent of this linear, beach-oriented Planning Area is in public ownership.

c. Recreation Sites

The following park and recreation facilities now exist within Planning Area V.

Table V-1

RECREATION SITES AT GARAPAN LAGOON PLANNING AREA

Park or Recreation Area	Existing Facilities
Unai Garapan	Access Road, Compacted Coral, 300 linear feet (lf) Launching Ramp Fishing Dock Parking for 6 vehicles and boat trailers Playfield
Unai Chalan Laulau	Picnic Tables - 4

d. Historic Sites

A WWII Japanese bunker is located at the intersection of Chalan Laulau and Beach Road.

Most of the beach in this area was the site of the invasion by American forces in 1944 and is now designated as a National Historic Landmark.

e. Beach Erosion and Stormwave Redistribution

Beach erosion occurs along the southernmost 2000 feet of shoreline within this Planning Area. Also, beach depletion occurs along the entire shoreline as a result of long-shore drift which within a 15 - 20 foot zone in-shore of the surf zone.

f. Stormwater Drainage

Ten storm drainage culverts empty into the Saipan Lagoon along this Planning Area. They discharge runoff from the Beach Road area as well as from upstream areas, inland of Beach Road.

2. Economic Resources

a. Subsistence Fishing and Gathering

A good deal of subsistence fishing and gathering occurs in the Garpan Lagoon. The shoreline is largely sandy beach which is easily accessible by foot or vehicle. It is very common to observe several Talaya fishermen and spearfishermen along the shoreline and near-shore zones. Frequently people are observed digging for clams (Ansum) in among the dense seagrass (Enhalus) beds. Small boats are sometimes moored along shore or pulled up on the beach in this area. The deeper areas of the Lagoon and reef flat provide good reefs for spearfishing and hook and line fishing.

b. Commercial and Sport Fishing and Facilities
None in this area

c. Port and Shipping
None in this area

d. Tourism Industry
The only tourism industry facilities within this Planning Area are the Saipan Lady Floating Restaurant, a 100' long, former sailing vessel converted into a 50-seat floating restaurant and bar, and a WWII tank and bunker site which is a popular site for picture taking.

CHAPTER VI - PUNTAN SUSUPE PLANNING AREA

The beach strand and near-shore zones of the Puntan Susupe Planning Area (Area 6) are heavily used for fishing and gathering, recreational uses and water-oriented activities of many kinds by residents and tourists. Several sandy beaches stretch nearly the entire length of Area 6. The Diamond Hotel, formerly the Royal Taga, proposed for renovation into a ten story, 329 room Diamond Hotel and the Grand Hotel, to expand by 34 rooms, are also found here. Sugar Dock in Susupe provides good access to the Lagoon for boaters, and a channel allows relatively safe passage through the barrier reef.

A. Natural Resources

1. Living Marine Resources

a. Near-shore

The near-shore zone of Planning Area 6 contains rather extensive beds of the seagrass Halodule uninervis with widely scattered and isolated coral heads. The substrate is primarily sand with some coral/algal rubble in the northern section of this area from the Royal Taga Hotel Beach. North along the shoreline is a fringing dense stand of approximately 75 - 90% Halodule which varies from about 100 - 200 m in width.

Along the shoreline and fringing the Civic Center and Royal Taga Beaches is the filamentous green alga Enteromorpha clathrata. This algae is somewhat seasonal and a favorite food of the juvenile rabbitfish manahac (Siganus spinus). This plant is usually considered bothersome and unattractive by tourists, hotel owners and other beach users. It is sometimes removed by hand (rakes) to make the beaches more attractive. It is known that growth of Enteromorpha is greatly enhanced by increased nutrient levels which enter the near-shore environment via runoff from the land or from underground streams (seeps). Other factors which are known to enhance growth of this alga include shorelines which are sheltered from severe wave action and water movement, existence of rubble and other types of substrate which provide a holdfast for the plant and (to a lesser degree) slightly lower salinity than normal seawater (25 - 30 parts per thousand).

Opposite Puntan Susupe and south to Unai Chalan Kanoa the seagrass and algae zone is somewhat wider, extending approximately 300 - 400 m from shore. Species composition is mostly Halodule uninervis which accounts for 70 - 90% of the cover, followed by Dictyota bartayressii, Turbinaria ornata and Halimeda opuntia. Scattered among these dense Halodule seagrass beds are a few corals including Pocillopora damicornis, Porites lutea and a little Acropora formosa. Coral cover in this zone varies from about one to five percent.

Fish fauna in this near-shore zone predominated by extensive Halodule beds includes a number of juvenile forms, especially snappers (Lutjanidae), rabbitfish (Siganidae), parrot-

fish (Scaridae) and goatfish (Mullidae). Other common fish observed include the goatfish Parupeneus barberinus and Mulloidichtys flavolineatus, mullet (Mugilidae), the surgeonfish Acanthurus triostegus and A. olivaceous, the emperor Lethrinus harak, the rabbitfish Siganus argenteus and S. spinus and the squirrelfish Adioryx diadema, A. spinifer and Flammeo sammara.

b. Lagoon

The Lagoon zone of Area 6 is comprised mostly of sand and coral rubble substrate with scattered corals, algae and seagrass. North of Puntan Susupe the Lagoon contains some seagrass (Halodule) in scattered patches and as a light cover on sandy substrate, but this seagrass does not occur in dense mats. Dictyota bartayresii, Sargassum polycystum, Padina tenuis and Halimeda opuntia are also present in varying but small amounts. Corals are also widely scattered and account for less than five percent cover. Species include Pocillopora damicornis, Porites lutea and Acropora formosa. There exist a few intermittent "fingers" of corals that extend from the barrier reef flat shoreward into the Lagoon that are composed primarily of Acropora formosa and A. teres. These patches of coral account for 70 - 80% live cover, but the total area covered by corals is small.

South of Puntan Susupe the Lagoon narrows and is dominated by the seagrass Halodule (50 - 80%) and the algae Dictyota, Turbinaria, Halimeda and Padina. Corals are sparse and scattered, with Porites lutea and Pocillopora damicornis, dominating but accounting for less than five percent cover. South of the Sugar Dock in the boat channel and just south of this channel coral cover increases to approximately 5 - 10%. Besides P. lutea and P. damicornis, species observed here include Pocillopora danae, Acropora aspera, A. nasuta, Montipora verrucosa, Pavona duerdeni, Porites cylindrica, Psammocora sp. and Favia matthaii.

Fish fauna for the lagoon zone of Area 6 is very similar to that found in Area 5. Fish diversity and density are both rather low as the habitat is predominated by extensive patches of loose sand and rubble with only occasional, small patches of Halodule and scattered corals. Mullet (Mugilidae) are fairly common, and other fishes observed include the milkfish Chanos chanos, cardinalfish (Apogonidae), the emperor Lethrinus spinus, and some unidentified juvenile fishes. Amesbury, et. al. (1979) describes this habitat as containing few fishes of any kind except for the milkfish and silversides (Atherinidae).

c. Reef Flat

The reef flat zone in Area 6 varies considerably in percent cover and diversity of corals, ranging from less than 5% to approximately 15 - 20% in spots. Areas of highest coral cover and diversity are opposite the intersection of Beach Road and Chalan Msgr. Guerrero, Unai Susupe and the channel and reef flat south of Sugar Dock. Localized small patch reefs of

Acropora provide as much as 70 - 80% live cover, but the overall area of these reefs is small. Dominant corals along the reef flat include Acropora formosa, A. aspera, A. teres, Pocillopora damicornis, P. danae, Pavona divaricata, Montipora foveolata, M. ehrenbergii, Psammocora contigua, Goniastrea retiformis, G. edwardsi, Favia pallida, Favites sp. and Millepora dichotoma.

The most common marine plants in this zone include Halimeda opuntia, Dictyota bartayresii, Padina tenuis, Turbinaria ornata and a little Halodule and Halophila in isolated sandy areas. Some coralline algae is also present where the reef flat nears the margin (Porolithon onkoides and Lithophyllum moluccense).

Fishes observed in the reef flat zone of Area 6 are similar to those which occur in Area 5. Overall, the fish fauna is rich and diverse and several schools of juvenile and adult fishes were observed, including parrotfish (primarily Scarus sordidus), surgeonfish (Acanthurus triostegus, A. mata and Ctenochaetus striatus), rabbitfish (Signaus spinus), goatfish (Mulloidichtys flavolineatus and Parupeneus barberinus) and the snapper Lutjanus kasmira. Healthy populations of other food fishes are also present, including squirrelfish (Holocentridae), wrasses (Labridae), jacks (Carangidae) and groupers (Serranidae).

d. Reef Margin and Slope

The reef margin and slope in the Puntan Susupe Planning Area are characterized by a well defined barrier reef system with good coral and fish diversity and a well developed spur and grove system. The reef slope features sand channels and high relief coral spits and mounds, some of which rise as much as two to ten meters from the bottom. At the time of this survey, extensive amounts of coral were dead, presumably from recent Acanthaster planci predation. In some areas live coral cover is only 5 - 10%, and it reaches a maximum of only 15 - 25% in very few areas. During one 25 minute tow in this area approximately 60 Acanthaster (or fresh feeding sites) were counted.

The most dominant coral observed was Porites rus which formes huge colonies in some areas. Also very common is Porites lutea, Acropora nasuta, A. irregularis, A. palifera, Stylophora mordax, Pocillopora eydouxi, Millepora dichotoma, M. latifolia, Heliopora coerulea, Stylaster gracilis, Montipora verrucosa, Favia favus, Platygyra daedalea, Leptoria phrygia and Pavona duerdeni. A few areas contain large patches of the soft corals Sarcophyton sp. and Sinularia sp.

Diverse fish populations were observed along the margin and slope zone although it is possible that the large amount of dead coral has been detrimental to their overall diversity and biomass. Amesbury, et. al. (1979) reports that this habitat contains the greatest overall fish diversity with highest abundances of surgeonfish (especially Acanthurus lineatus), adult

parrotfish (Scaridae), large wrasses (Labridae), large groupers (Epinephelus merra), rudderfish (Kyphosus cinerascens) and fusilers (Caesio caerulaureus).

Other fishes observed in abundance include squirrelfish (Adioryx spinifer and A. caudimaculatus), emperors (Gnathodentex aureolineatus and Lethrinus harak), snappers (Lutjanus kasmira and L. fulvus), breams (Scolopsis cancellatus), jacks (Caranx melampygus and Decapterus pinnulatus) and surgeonfish (Acanthurus triostegus, A. glaucopareius, Ctenochaetus striatus and Naso literatus).

2. Physical Marine Resources

a. Currents

The general current pattern in Planning Area 6 is primarily an along-shore movement of the near-shore water and a south to southwesterly movement in the mid-lagoon and reef flat zones towards a channel or reef opening. There is well-defined movement of water away from shore and out through an opening in the barrier reef near the Sugar Dock Channel.

The currents near the Saipan Grand Hotel and near Chalan Kanoa approximately 1500 m south of the Sugar Dock were investigated by M & E Pacific (1980). The point where the drogues were released is actually located in the northern portion of Planning Area 7. However, the drogue paths entered Area 6 as the water moved towards the reef opening of Sugar Dock Channel so these results are discussed in this section.

Figures VI-1 and VI-2 show the paths of the drogues released in front of the Grand Hotel during both ebb and flood tide conditions. Current velocity averaged from 2.8 cm/sec (0.05 kts.) to 20.3 cm/sec (0.39 kts.) with higher velocities during ebb tides. Speeds reached as high as 35 cm/sec (0.68 kts.) near the Sugar Dock Channel. Drogue movement was predominantly southerly and towards the reef opening, becoming westerly as water exits the Lagoon through the boat channel opposite Sugar Dock.

Figures VI-3 and VI-4 depict drogue movements at the Chalan Kanoa site. Here water transport is in a northerly direction exiting the Lagoon at a shoal (approximately 1000 m south of Sugar Dock) and at the channel opening. Current velocities were found to be generally greater during ebb tide conditions than during flood tides. Velocities averaged from 8.0 cm/sec (0.15 kts.) to 14.0 cm/sec (0.27 kts.). Figure VI-5 shows the generalized circulation pattern for this portion of the Saipan Lagoon.

b. Water Quality

Water quality in Planning Area 6 is variable but generally good. Although only a couple of stormwater outlets empty into the Lagoon, the rather extensive along-shore occurrence of the alga Enteromorpha clathrata indicates that there is likely an

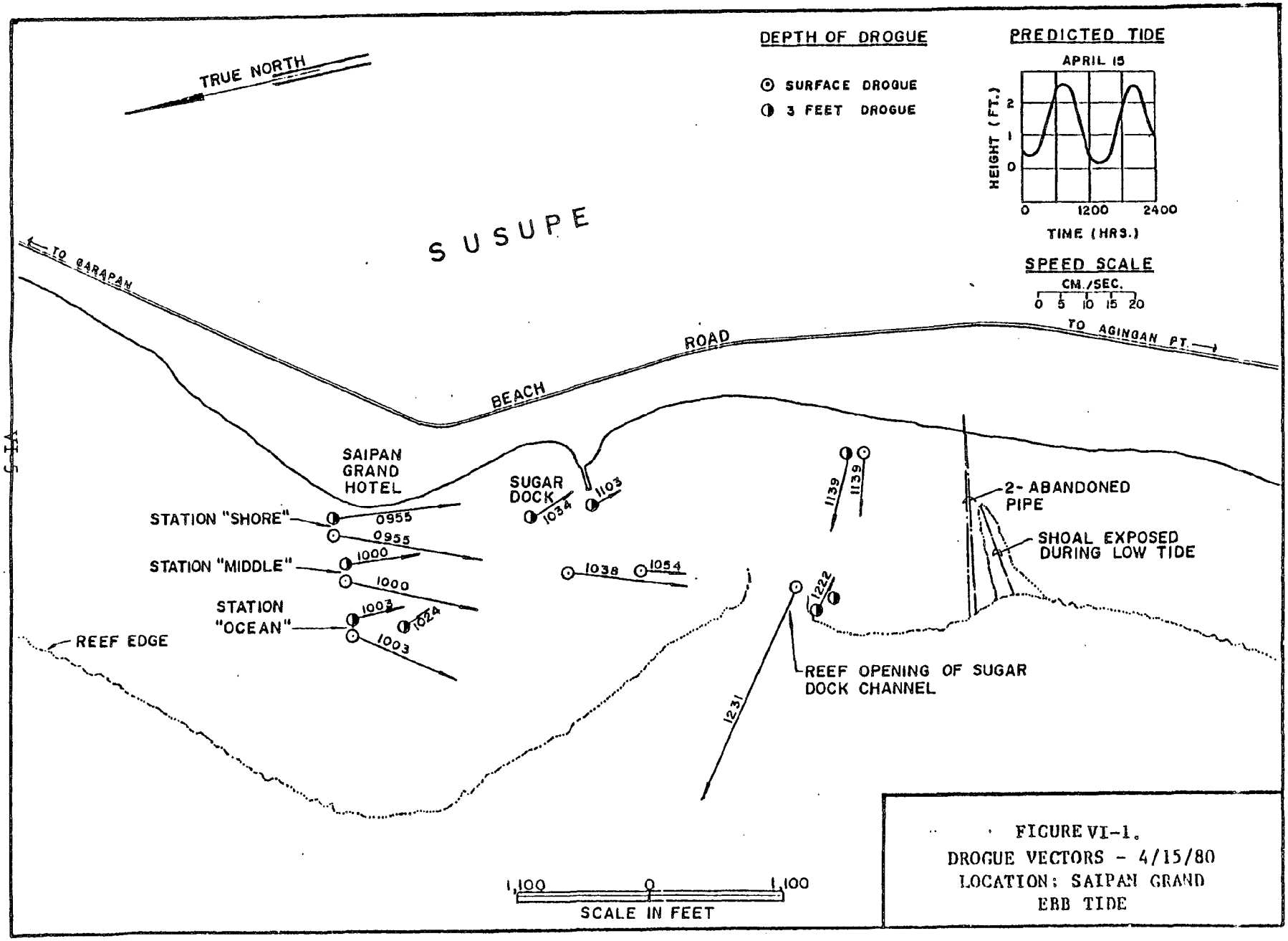


FIGURE VI-1.
DROGUE VECTORS - 4/15/80
LOCATION: SAIPAN GRAND
EBB TIDE

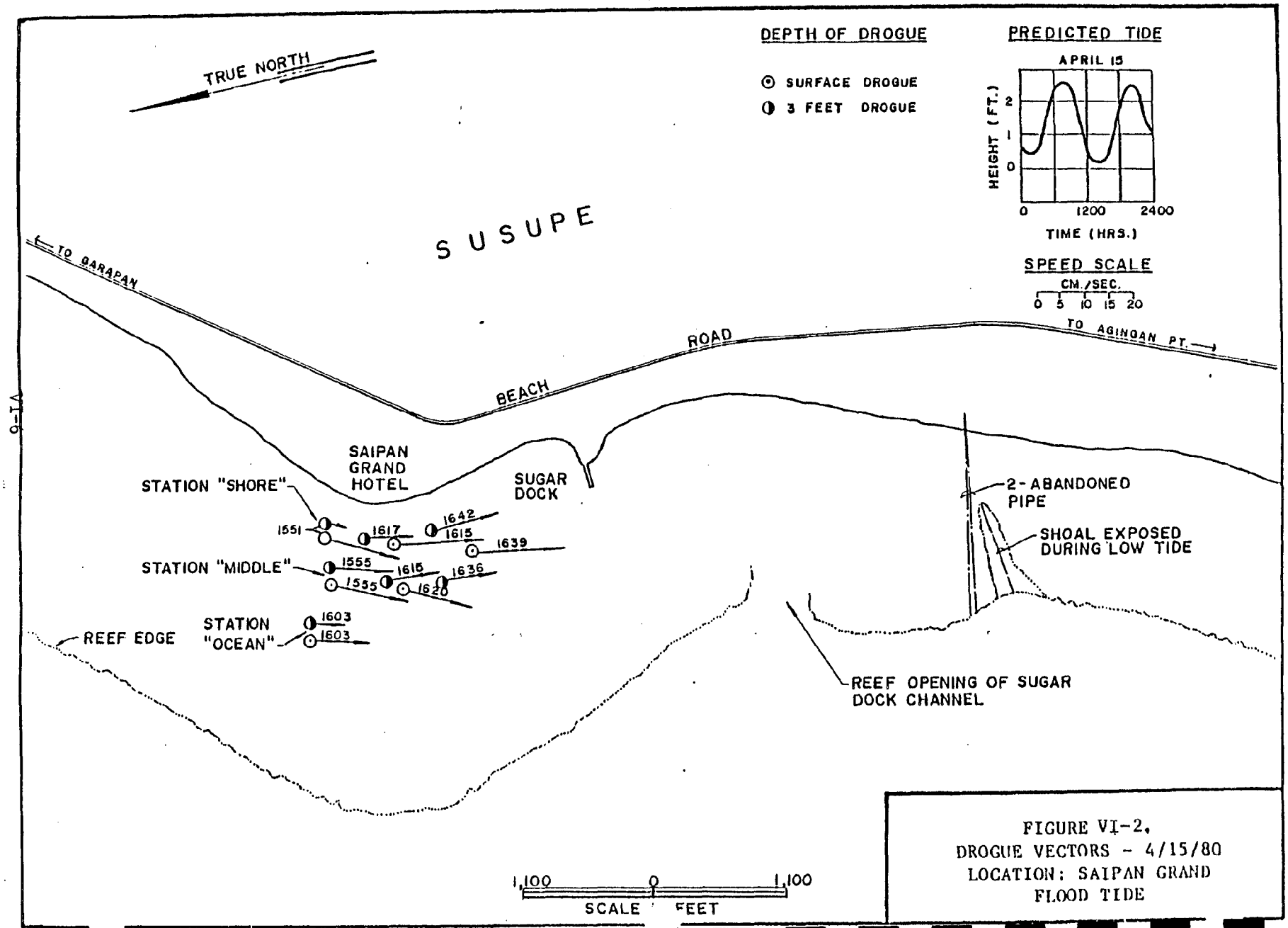


FIGURE VI-2.
DROGUE VECTORS - 4/15/80
LOCATION: SAIPAN GRAND
FLOOD TIDE

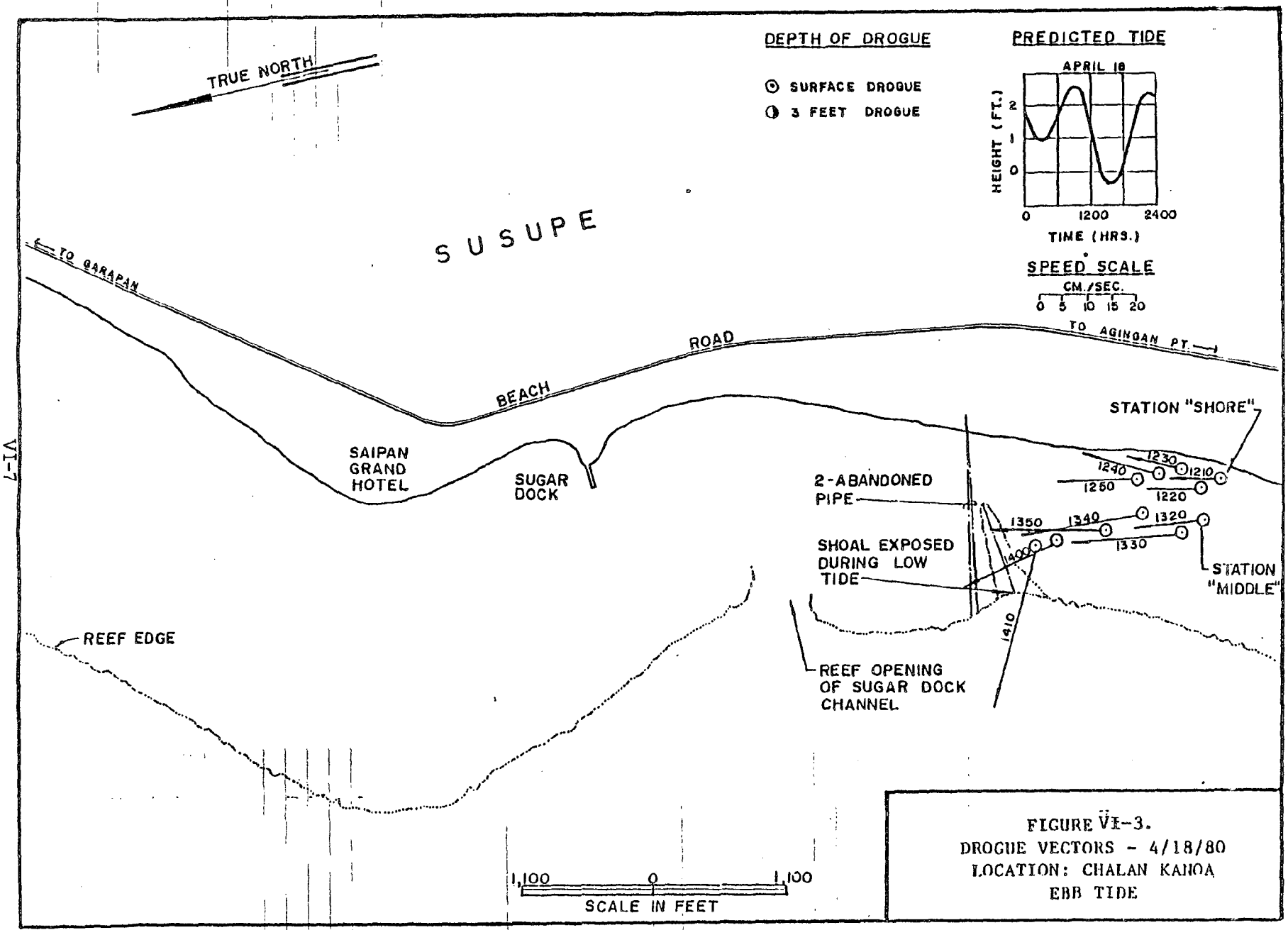


FIGURE VI-3.
DROGUE VECTORS - 4/18/80
LOCATION: CHALAN KANOA
EBB TIDE

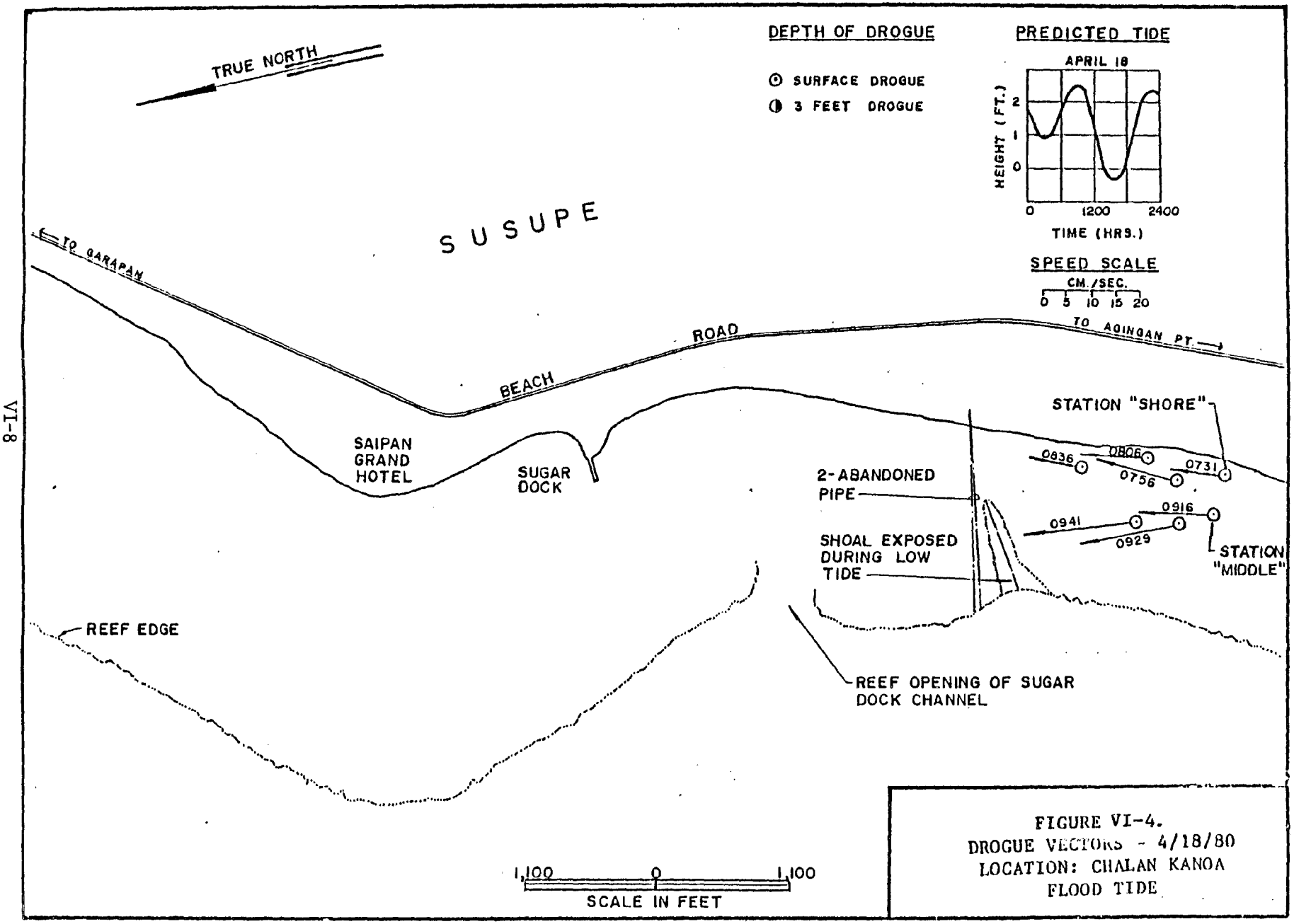


FIGURE VI-4.
DROGUE VECTORS - 4/18/80
LOCATION: CHALAN KANOA
FLOOD TIDE

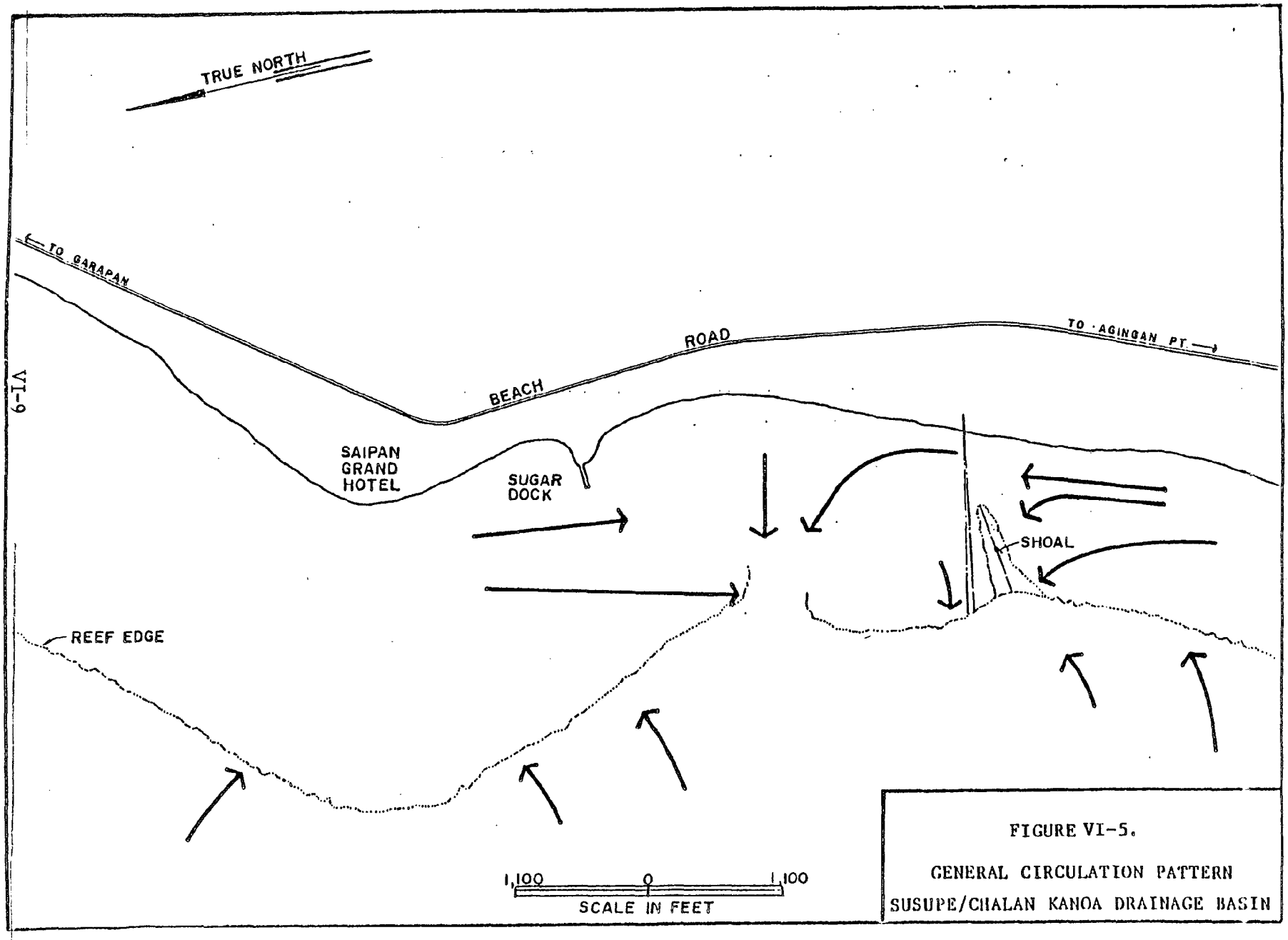


FIGURE VI-5.

GENERAL CIRCULATION PATTERN

SUSUPE/CHALAN KANOA DRAINAGE BASIN

influx of fresh water and nutrients via run-off or underwater seeps along the shoreline. The Division of Environmental Quality (DEQ) collects water quality data from six sampling locations. These stations are located at San Jose Beach, Civic Center Beach, Royal Taga Hotel, Grand Hotel, Community School Beach and Sugar Dock. Data for various water quality data are available from the DEQ office. Monitoring station sites and data regarding fecal coliform occurrence and violations are depicted on Figure I-1 of Volume I. Recent data (October 1984 - March 1985) showed no fecal coliform readings greater than 200/100 ml for all the sampling locations.

3. On-shore Resources

a. Wetlands

No wetlands exist in this Planning Area.

b. Rare, Threatened and Endangered Species

No threatened or endangered species of birds or marine life were observed in Planning Area VI. The beaches along this portion of the coastline were likely used as nesting sites in the past by Green Sea Turtles (Chelonia mydas). Hotel, recreational and residential development has kept the turtles from utilizing this area in recent years. However, turtles may frequent this portion of the lagoon since the channel at Sugar Dock provides an easy access point. Adequate enforcement is needed to ensure the safety of any turtles that may enter the lagoon and/or nest on any of the beach.

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

The Lake Susupe drainage area is 2,755 acres and includes Chalan Laulau, Chalan Kiya, Oleai, Susupe, Chalan Kanoa, Fina Sisu, Chalan Piao, As Perdido and San Antonio. Lake Susupe is the center of the drainage basin. Principal land uses affected by floods in this area are single-family residences and wetlands around Lake Susupe (not in the Puntan Susupe Planning Area).

The preliminary plan for flood control improvements include a low levee aligned along the eastern periphery of residential development within the project area and an outlet channel to release flood waters to the Lagoon. A control structure may be required at the inlet end of the wetland is not lowered. The estimated first cost of the project is 2.1 million dollars.

The preliminary plan is still under review by local and federal authorities. The ACOE is examining different alternatives before deciding to proceed into the next phase, the Detailed Project Report. The environmental effects of the flood water discharge into the Lagoon as a result of this preliminary

plan have not yet been fully assessed. However, it is likely that any such facility would substantially impact the Lagoon's water quality.

b. Public Land Ownership Access

Five parcels of public land exist in this Planning Area between the beach and Beach Road. They are, from north to south, San Jose Beach; Civic Center Beach and the Civic Center/Government of the Northern Mariana Islands facilities together with the site of the Diamond Hotel (under lease); The Unai Susupe parcel (Susupe Beach Park) adjacent to the southern property boundary of the Grand Hotel; and a smaller parcel to the south of beachside Chalan Kanoa. All except the last parcel provide for access between Beach Road and the Saipan Lagoon Coastline.

c. Recreation Sites

The following park and recreation facilities now exist within Planning Area VI.

Table VI-1
RECREATION SITES AT PUNTAN SUSUPE PLANNING AREA

Park or Recreation Area	Existing Facilities
San Jose	Picnic Tables - 3 Beach Volleyball Court
Civic Center	Access Road, Coral, Beach Park 50 linear feet (lf) Parking for 15 vehicles at north end and for 15 vehicles at south end Picnic Tables - 6 Public Restrooms Tennis Court - 2 Volleyball Court
Susupe Beach Park	NONE
Unai Chalan Kanoa	Access Road, Paved 150lf Fishing Dock Launching Ramp

d. Historic Sites

The beach along this Planning Area is part of the Saipan Invasion Beach, a National Historic Landmark. WWII tanks are located at Civic Center Beach and at the intersection of Beach Road and Chalan Msgr. Guerrero, in Oleai.

e. Beach Erosion and Stormwave Redistribution

No beach erosion and stormwave redistribution sites exist in this Planning Area. However, gradual beach depletion occurs due to a longshore drift which results in a continuous transport of beach materials within a 15 - 20 foot wide inshore surf zone.

f. Stormwater Drainage

Two drainage culverts discharge stormwater in the Lagoon within this Planning Area. One is at San Jose Beach and handles roadside drainage flows from the San Jose areas. The second is a channel approximately 1200 feet south of the San Jose intersection. That culvert accommodates stormwater flow from both Beach Road as well as some of the San Jose/Susupe vicinity.

Naturally, Lake Susupe technically qualifies as a stormwater drainage facility. During storms with high intensity and duration of rainfall, Lake Susupe overflows and floods downstream areas in Chalan Kanoa. Flooding of highways and lower fringing areas occurs at least once each year.

2. Economic Resources

a. Subsistence Fishing and Gathering

Subsistence fishing and gathering occurs along the shoreline and in the Lagoon waters of Planning Area VI. Talaya fishermen and snorkelers with spears are often seen along the near-shore zone and in among the seagrass beds that lie just offshore. Some harvesting of clams also occurs here.

Boaters frequently use the beach just south of the Grand Hotel as a landing spot and for temporary mooring of vessels. The Sugar Dock is the only improved boat launching ramp and channel out through the barrier reef in the southern portion of Saipan Lagoon. Many boats, both those heading offshore for trolling and bottomfishing as well as smaller craft that fish within the Lagoon, use this launching facility.

b. Commercial and Sport Fishing and Facilities

Sugar Dock, also known as Chalan Kanoa Dock, is a remnant of a small Japanese dock designed for boats hauling sugar. It is a 276 ft long pier with a small concrete launching ramp on the northside. A culvert beneath the dock permits near-shore currents to pass. There are no navigational aids at the dock, and the water depth is less than six feet at low tide. The entrance channel is approximately 30 feet wide. Adjacent lands are privately owned.

c. Port and Shipping

None in this area.

d. Tourism Industry

In this Planning Area, the two primary tourist facilities are the Diamond Hotel (formerly the Royal Taga) and the Grand Hotel, both located at Puntan Susupe. The adjacent Unai Susupe and Royal Taga Beaches are, naturally, well used by tourists. The MPLC has designated this site for a proposed aquarium as a tourist attraction. Windsurfing, sailing and snorkeling around underwater wreck sites are popular tourist activities here.

CHAPTER VII - PUNTAN AFETNA PLANNING AREA

The Puntan Afetna Planning Area (Area 7) is the smallest Planning Area and represents the southern extreme of the Saipan lagoon and barrier reef. The entire shoreline is fronted by a sandy beach. The Lagoon area here is rather narrow, averaging approximately 400 m wide with a maximum depth of about 1.5 - 2 m. The shoreline becomes rocky at Puntan Agingan where the barrier reef and lagoon meet steep slopes and cliffs along low limestone terraces. The former White Sands Hotel was re-opened in 1984 as the Surf Hotel, with 36 hotel and 5 lodge rooms in service; a 3 story, 71 room extension is also planned.

A. Natural Resources

1. Living Marine Resources

a. Near-shore

The near-shore environment consists primarily of a sand and occasional coral/algal rubble substrate covered by the seagrass Halodule uninervis. In the northern portion of Area 7 this Halodule mat provides approximately 80 - 90% coverage. Opposite Unai Afetna the seagrass and algae band becomes wider (up to 300 m) and is still dominated by Halodule, but the percent coverage varies greatly as much of the seagrass occurs in clumps with sandy areas in between. Other algae which comprise less than five percent of the overall cover include Halimeda opuntia, Caulerpa sertularioides, Dictyota bartayresii and Schizothrix sp.

Corals are almost totally absent from the near-shore environment in Area 7. A few small and very widely scattered colonies of Pocillopora damicornis and Porites lutea were the only species noted here, and they accounted for much less than one percent cover.

Other organisms observed include the starfish Linckia laevigata and the sea cucumbers Holothuria atra and H. edulis.

Few fishes were observed in the near-shore zone. Small forms and some unidentified juvenile fishes were seen among the clumps of seagrass. Other fishes observed include mullet (Mugilidae), rabbitfish (Siganus spinus), the emperor Lethrinus harak, unidentified goatfish (Mullidae), juvenile snappers (Lutjanidae) and silversides (Atherinidae).

b. Lagoon

The lagoon zone in Area 7 consists primarily of a sand and rubble substrate with a lot of seagrass and algae and limited coral development. The dominant marine form is once again the seagrass Halodule uninervis, although it occurs here in scattered clumps and thin mats. Also present, although in much less quantity, is the seagrass Halophila minor. Other frequently observed marine plants include Halimeda opuntia, Dictyota bartayresii, Padina tenuis, Halimeda macroloba, Schizothrix mexicana, Caulerpa cupressoides and Boodlia

composita. Occurrence of many of these algae is patchy, and locally one or more species many contribute from 5 - 40% of bottom cover. However, when analyzed over the entire Planning Area these numbers are much smaller. Generally, the algae are more prominent north of Unai Afetna (especially Dictyota , Boodlia, Padina and Schizothrix) and in some small areas they can comprise as much as 30 - 50% of the substrate cover. This occurs primarily in the northern sector of Area 7.

Corals become more abundant within the Lagoon as it approaches the barrier reef. In the outer Lagoon, the substrate is characterized by more rock/rubble substrate, less sand and a harder substrate providing points of attachment for corals. Lagoon species include Pocillopora damicornis, Porites lutea, Psammocora contigua, Acropora formosa, A. aspera, A. hebes, and Heliopora coerulea. North of Unai Afetna, coral cover varies from one to five percent with occasional higher values where patches of Acropora occur.

Coral cover in the lagoon increases south of Puntan Afetna and reaches 20 - 40% near Puntan Agingan. This increase is primarily due to an increase in abundance of species of Acropora as well as Heliopora, Favia matthaii, Platygyra pini and the appearance of the soft coral Sinularia sp. In the middle of the Lagoon, off-shore and just south of the former Coast Guard Station an area containing mats of an unidentified zooanthid (an anenome like organism) was observed.

Fishes observed in the Lagoon are very similar to those species reported for Area 6. Common groups include the goatfish (Mullidae), snappers (Lutjanidae), wrasses (Labridae), juvenile parrotfish (Scaridae), surgeonfish (Acanthuridae), rabbitfish (Siganidae), silversides (Atherinidae) and cardinalfish (Apogonidae).

c. Reef Flat

The reef flat zone of Area 7 is well defined until it ends by merging with the limestone terrace and cliffs along Puntan Agingan. Coral diversity and percent cover are fairly good, and the species are similar to those further north in Area 6. Most all the corals observed in the outer lagoon zone in this Area were also found in the reef flat zone. Percent cover ranged from approximately 10 - 30% with higher values found in the reef flat areas opposite Puntan Afetna and south to the small cut in the reef some 1500 m north of where the reef ends. Dominant species are Acropora aspera, A. nasuta, A. smithi, Pocillopora eydouxi, P. damicornis, Porites lutea, Pavona divaricata and P. venosa. Common species include Pocillopora elegans, P. setchelli, Acropora surculosa, A. palifera, Montipora tuberculosa, M. sp., Heliopora coerulea, Platygyra daedalea, Favia matthaii, Psammocora contigua and Porites annae.

Fishes observed in the reef flat zone were nearly identical to those seen in the reef flat in Area 6. However, densities of surgeonfish (Acanthuridae), squirrelfish (Holocentridae) and

goatfish (Mullidae) were greater in this Planning Area. Amesbury, et. al. (1979) reports that this habitat contains moderately abundant populations of juvenile parrotfish, rabbitfish, surgeonfish, goatfish, large wrasses and Blue Chromis. Some common species observed include the snapper Lutjanus fulvus, the emperor Lethrinus harak, the goatfish Mulloidichtys flavolineatus, Parupeneus barberinus, P. bifasciatus, P. cyclostomus, P. pleurostigma and P. trifasciatus, the parrotfish Scarus ghobban, S. sordidus and S. sp., the surgeonfish Acanthurus glaucopareius, A. olivaceous, A. triostegus, A. xanthopterus, Naso brevirostris and N. literatus.

d. Reef Margin and Slope

The reef margin and slope zone in Area 7 is a well developed barrier reef system with numerous spur and grove channels and coral mounds which provide excellent relief for corals, fishes and other marine life. Overall, coral coverage averages 20 - 25%, higher (40%) in localized areas and lower (5 - 10%) in limited areas.

Of the entire barrier reef surveyed, the reef in this Planning Area showed the most recent signs of damage by the starfish Acanthaster planci. During a 25 minute tow approximately 300 individuals were counted, with over 100 fresh feeding sites observed.

The most dominant corals observed were Pocillopora eydouxi, P. verrucosa, P. setchelli, Stylophora mordax, Acropora nasuta, A. surculosa, A. irregularis, A. palifera and Heliopora coerulea. Other species common to this zone include two large areas of the soft coral Sinularia sp., Acropora tenuis, A. smithi, A. valida, Pavona varians, P. duerdeni, Montipora ehrenbergii, M. sp., Goniopora sp., Porites rus, Favia favus, F. pallida, Goniastrea edwardsi, Diploastrea heliopora, Platygyra daedalea, P. pini, Leptoria phrygia, Leptastrea purpurea and Lobophyllia corymbosa.

Fish fauna was rather diverse and some large grouper (Serranidae), rudderfish (Kyphosus cinerascens) and parrotfish (Scaridae) were observed. Also seen were two rather large schools of parrotfish, a spotted eagle ray (Aetobatis narinari) and a 1.5 m long reef whitetip shark (Triaenodon obesus). As this section of the barrier reef is very similar to the margin and slope in Area 6, Amesbury, et. al. (1979) classified them as similar habitats. He reports that this habitat was where the greatest overall fish diversity was recorded. It contained the highest abundance of surgeonfish (primarily Acanthurus lineatus), adult parrotfish (Scaridae), large wrasses (Labridae) and large groupers (Serranidae).

Some of the more common species observed in this zone include the groupers Epinephelus merra, E. fasciatus and Cephalopholis argus, the emperor Gnathodentex aureolineatus, the parrotfish Scarus gibbus, S. psittacus and S. sordidus, the surgeonfish Acanthurus olivaceus, A. pyroferus, A. triostegus, A. mata, Ctenochaetus striatus and Naso lituratus, the bream

Scolopsis cancellatus, and the snappers Macolor niger, Lutjanus kasmira and L. bohar.

2. Physical Marine Resources

a. Currents

Water movement in the southern end of the Saipan Lagoon is not well known and no specific studies have been conducted in this Planning Area concerning the currents. The M & E Pacific Study (1980) did release a series of drogues in the extreme northern portion of Planning Area 7, and the results are shown in the Puntan Susupe chapter (Figure VI-1, VI-2, and VI-3). Water movement here was to the north, as the Sugar Dock channel and shoal area to the south of the channel are major exit points for water leaving the Lagoon.

Water moving south likely exits partially at Puntan Afetna as the force of the normal northeasterly tradewinds would tend to push some of the water over the reef at this point. Other Lagoon water would tend to build up at Puntan Agingan and likely exits the Lagoon near the point where the barrier reef meets the limestone cliff of the point. At this location there are large rocks and boulders and the barrier reef is more variable with small openings and depressions.

b. Water Quality

Water quality at the southern end of the Saipan Lagoon is highly variable. There are no developed stormwater drains that empty into the Lagoon in Planning Area 7. The sewage outfall at Puntan Agingan is far enough around the point that the normal ocean waves and oceanic current almost always provides for good mixing of the effluent which is carried offshore to the south or southeast. Only under unusual wind and sea conditions would the effluent possibly be transported north of Puntan Agingan and influence the water quality of the barrier reef and/or Lagoon.

The wastewater system sewage lift station "A-1", located just south of San Antonio overflows when its electrical power is interrupted. This causes raw sewage to exit via a bypass line to the adjacent beach, causing severe pollution (see Chapter VIII, Section B.1. b.4). This condition is responsible for excessive violations of the coliform standard at nearby beaches.

The Division of Environmental Quality (DEQ) samples for water quality monitoring at five locations in this Planning Area. The stations are located at Chalan Piao Beach, Coast Guard Beach, San Antonio Beach, Hopwood School and at the Agingan STP Lift Station. Water quality data are available at the DEQ office. Monitoring station sites and data regarding fecal coliform occurrence and violations are depicted on Figure I-1 of this Volume.

Recent data from the DEQ (October 1984 - March 1985) showed only two individual samples with fecal coliform values of 201/100 ml, at Coast Guard Beach and the Agingan lift station

Area Beach. The DEQ also has eight monitoring stations near the Agingan Outfall. The following locations had fecal coliform content means exceeding 200/100 ml; 100' south of outfall (33,610); 600 ft. north of outfall (4,859); and 500 ft. offshore of outfall (367).

3. On-Shore Resources

a. Rare, Threatened and Endangered Species

The Green Sea Turtle (Chelonia mydas) could be found within the lagoon on occasion in this planning area but there is no evidence that nesting is presently occurring. However, according to the Fish and Wildlife Division, Green Turtles have nested along the beaches in this planning area in the past. It is possible that the endangered Nightengale Reed Warbler (Acrocephalus luscinia) might be found within the vegetated areas near Hopwood High School and the former Coast Guard Station. However, these areas would not be considered as prime or critical habitat for this species.

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

This is a rural and generally isolated coastline area with the San Antonio village itself as the primary center of development. The secondary activity center is Hopwood Junior High School, except when school is not in session. The area is served by primary infrastructure; other major public facilities are the elementary and junior high schools.

The reopening of the former White Sands Hotel (now the Surf Hotel) will place additional wasteload from 46 rooms into Saipan's southern wastewater system. This wasteload amounts to approximately 9,200 gallons per day. This additional waste load will not tax the existing primary treatment plant; however it will add to the pollution which occurs when sewage lift Station "A-1" fails during power disruption.

Traffic activity is recently increased through San Antonio due to the recent re-opening of the Surf Hotel and the increased residential development of the Koblerville area. This trend can be expected to continue.

Perhaps the "public facility" with the most potential for development is the former U.S. Coast Grand Station property, now under the management of the Marianas Public Land Corporation. Both the existing structures as well as the large size and ideal location of the property contributes to this site's overall development potential.

b. Public Land Ownership and Access

Four parcels of public land exist in the Puntan Afetna Planning Area. They are at the Hopwood Junior High School, San Antonio Elementary School, former U.S. Coast Guard

Station and the San Antonio sewage pumping station. Public access to the beach is possible at all four sites.

c. Recreation Sites

The following park and recreation facilities are found within Planning Area VII.

Table VII-1
RECREATION SITES AT PUNTAN AFETNA PLANNING AREA

Park or Recreation Area	Existing Facilities
Afetna Beach Park	Picnic Shelter - 2 Picnic Tables - 3

d. Historic Sites

Part of this beach is the site of the American Invasion during WWII. Saipan Invasion Beach has been designated a National Historic Landmark.

e. Beach Erosion and Stormwave Redistribution

No beach erosion or stormwave redistribution exist in this Planning Area.

f. Stormwater Drainage

No drainage culverts carry stormwater discharge to the Lagoon in this Planning Area.

2. Economic Resources

a. Subsistence Fishing and Gathering

A moderate amount of subsistence fishing and gathering occurs in Planning Area VII. Talaya fishermen and people harvesting clams utilize the shoreline and extensive seagrass beds found in the near-shore zone. Coral development is good, especially south of Puntan Afetna, and spearfishermen and surround netters regularly harvest fish from the Lagoon and reef flat areas.

b. Commercial and Sport Fishing Facilities

None in this area.

c. Ports and Shipping

None in this area.

d. Tourism Industry

One tourist facility exists here, the recently re-opened Surf Hotel in San Antonio. It has 41 rooms, and a major expansion is planned.

Area Beach. The DEQ also has eight monitoring stations near the Agingan Outfall. The following locations had fecal coliform content means exceeding 200/100 ml; 100' south of outfall (33,610); 600 ft. north of outfall (4,859); and 500 ft. offshore of outfall (367).

3. On-Shore Resources

a. Rare, Threatened and Endangered Species

The Green Sea Turtle (Chelonia mydas) could be found within the lagoon on occasion in this planning area but there is no evidence that nesting has occurred on the beach areas. It is possible that the endangered Nightengale Reed Warbler (Acrocephalus luscinia) might be found within the vegetated areas near Hopwood High School and the former Coast Guard Station. However, these areas would not be considered as prime or critical habitat for this species.

B. Man-made Resources and Human Uses

1. Land Uses

a. Existing Development and Public Facilities

This is a rural and generally isolated coastline area with the San Antonio village itself as the primary center of development. The secondary activity center is Hopwood Junior High School, except when school is not in session. The area is served by primary infrastructure; other major public facilities are the elementary and junior high schools.

The reopening of the former White Sands Hotel (now the Surf Hotel) will place additional wasteload from 46 rooms into Saipan's southern wastewater system. This wasteload amounts to approximately 9,200 gallons per day. This additional waste load will not tax the existing primary treatment plant; however it will add to the pollution which occurs when sewage lift Station "A-1" fails during power disruption.

Traffic activity is recently increased through San Antonio due to the recent re-opening of the Surf Hotel and the increased residential development of the Koblerville area. This trend can be expected to continue.

Perhaps the "public facility" with the most potential for development is the former U.S. Coast Grand Station property, now under the management of the Marianas Public Land Corporation. Both the existing structures as well as the large size and ideal location of the property contributes to this site's overall development potential.

b. Public Land Ownership and Access

Four parcels of public land exist in the Puntan Afetna Planning Area. They are at the Hopwood Junior High School, San Antonio Elementary School, former U.S. Coast Guard Station and the San Antonio sewage pumping station. Public access to the beach is possible at all four sites.

c. Recreation Sites

The following park and recreation facilities are found within Planning Area VII.

Table VII-1
RECREATION SITES AT PUNTAN AFETNA PLANNING AREA

Park or Recreation Area	Existing Facilities
Afetna Beach Park	Picnic Shelter - 2 Picnic Tables - 3

d. Historic Sites

Part of this beach is the site of the American Invasion during WWII. In the opinion of the CNMI Historic Preservation Officer, the Saipan Invasion Beach is eligible as a National Historic Landmark.

e. Beach Erosion and Stormwave Redistribution

No beach erosion or stormwave redistribution exist in this Planning Area.

f. Stormwater Drainage

No drainage culverts carry stormwater discharge to the Lagoon in this Planning Area.

2. Economic Resources

a. Subsistence Fishing and Gathering

A moderate amount of subsistence fishing and gathering occurs in Planning Area VII. Talaya fishermen and people harvesting clams utilize the shoreline and extensive seagrass beds found in the near-shore zone. Coral development is good, especially south of Puntan Afetna, and spearfishermen and surround netters regularly harvest fish from the Lagoon and reef flat areas.

b. Commercial and Sport Fishing Facilities

None in this area.

c. Ports and Shipping

None in this area.

d. Tourism Industry

One tourist facility exists here, the recently re-opened Surf Hotel in San Antonio. It has 41 rooms, and a major expansion is planned.

CHAPTER VIII - PROJECT AREAWIDE

A. Natural Resources

1. Currents

Saipan lies in the belt of seasonal northeast trade winds. Its narrow north end points obliquely into the north equatorial drift current. The local currents run from north-northeast to south-southeast on both sides of the island, and ordinarily southeast through Saipan channel at the south end (Cloud, 1959). The current system of the Saipan Lagoon is affected by the inflow of water across the barrier reef, wind conditions, water depth and location and size of channels, cuts and depressions in the reef.

Currents have been investigated at specific locations within the Lagoon by Doty and Marsh (1977) and M & E Pacific (1980). Current patterns are discussed in detail in the chapters dealing with the seven Planning Areas.

2. Tides

Saipan's tides are mixed semidiurnal with two different high and low tides during each day. Cloud (1959) states that the tidal range averages 2 - 2.5 ft. The U.S. Army Corps of Engineers (1981) gives the following information on tides for Saipan.

	Feet
Mean Higher High Water, MHHW	1.90
Mean High Water, MHW	1.85
Mean Tide Level, MTL	1.20
Mean Low Water, MLW	0.55
Mean Lower Low Water, MLLW	0.00

B. Man-made Resources and Human Uses

1. Land Uses and Infrastructure

a. Water Facilities

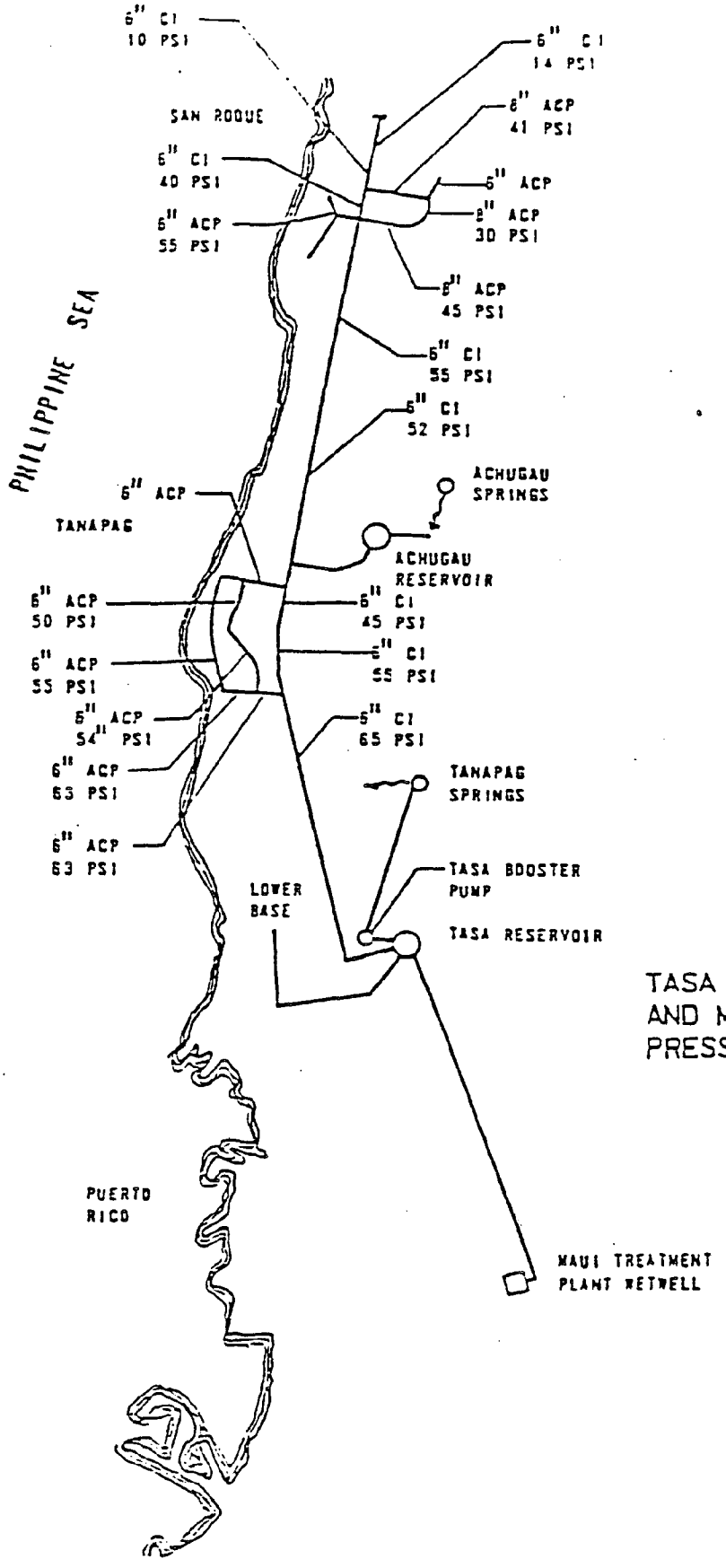
1. The Existing System

Due to the interdependent nature of Saipan's islandwide water facilities, it is not practical to isolate production, storage, treatment and distribution components. The entire system is described in the "Saipan Water System Study", prepared for the Commonwealth of the Northern Mariana Islands by GK²/Maguire Group.

The system which serves this PLAN'S project area is depicted in the following figures taken from the "Saipan Water System Study."

Figure VIII-1 Puntan Magpi Planning Area;
Figure VIII-2 Tanapag Harbor and Puntan Muchot Planning Areas; and
Figure VIII-3 Garapan Lagoon, Puntan Susupe, and Puntan Afetna Planning Areas.

The water system's demands and flows as of February 1982, are presented in Figure VIII-4. Of course, only the



NOTES:

1. DEVIATIONS IN LINE PRESSURES MONITORED ARE A RESULT OF WATER SERVICE HOUR VARIATIONS

2. PRESSURES WERE MEASURED AT AREA RESIDENCES USING A BOURDON TUBE PRESSURE GAUGE.

TASA SYSTEM: DISTRIBUTION SCHEMATIC AND MEASURED HOUSE SERVICE LINE PRESSURES

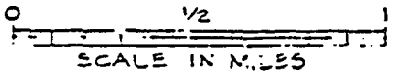


Figure VIII-1

Puntan Magpi Planning Area Water System.

Source: Saipan Water System Study, 1982.

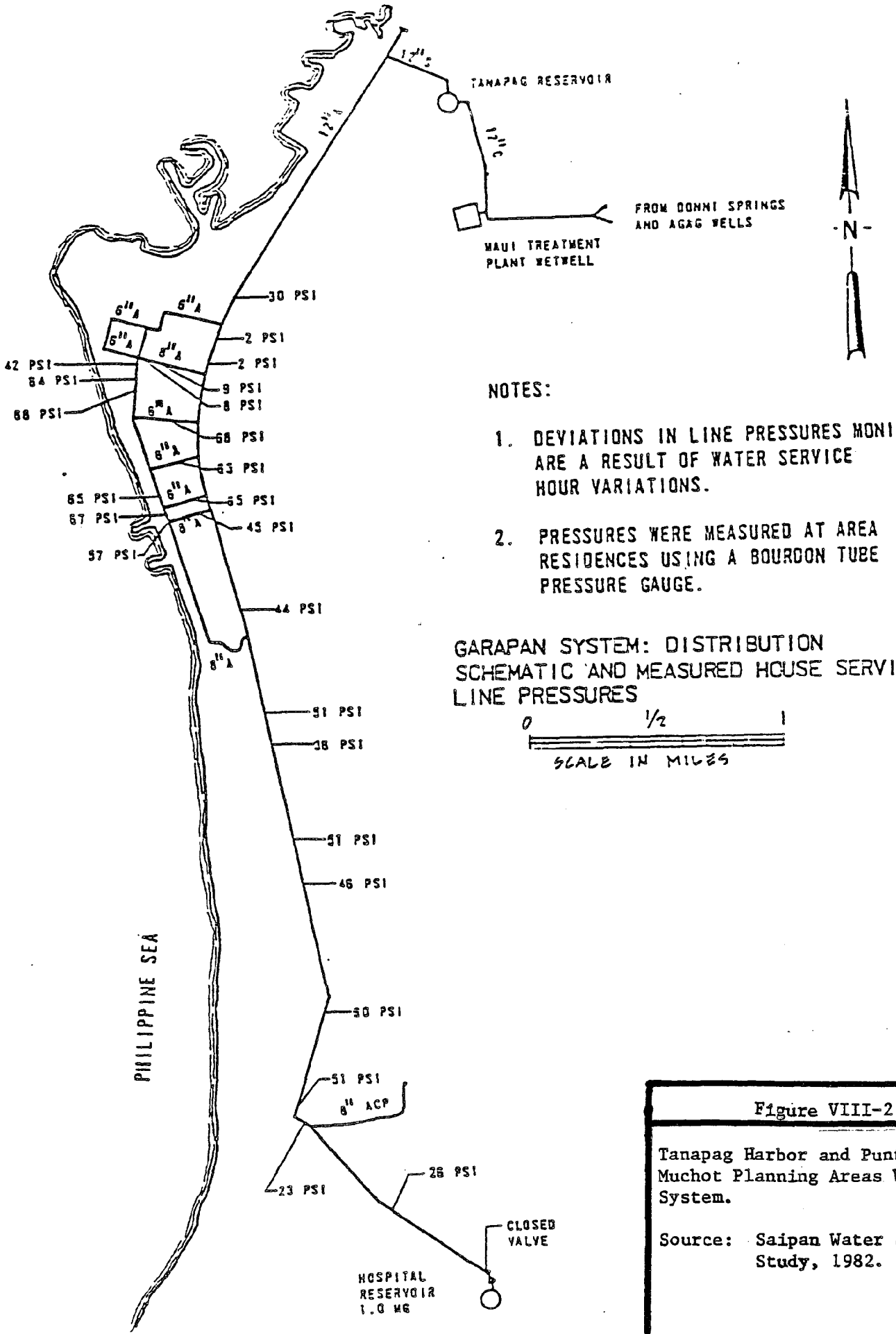
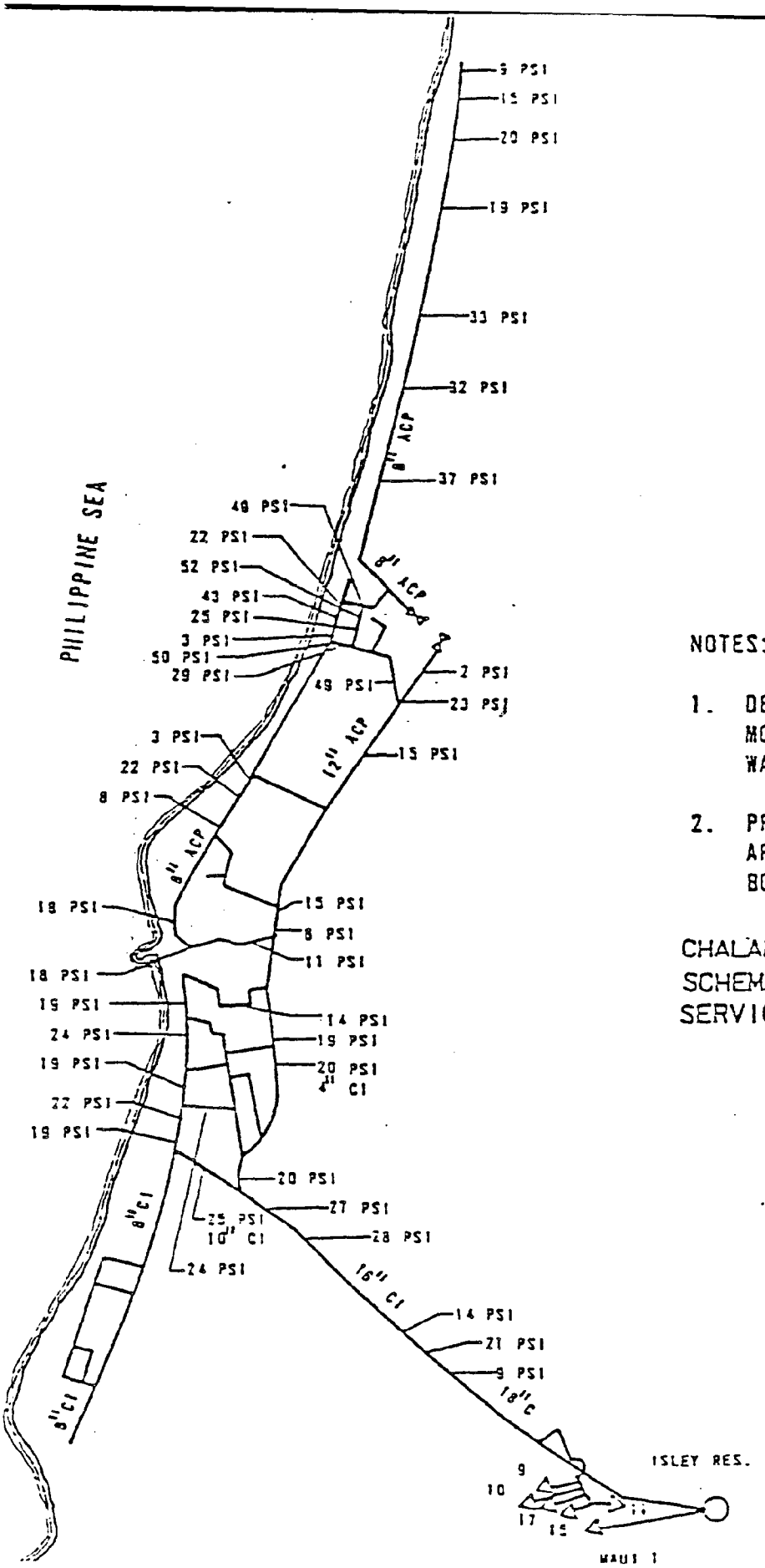


Figure VIII-2

Tanapag Harbor and Puntan Muchot Planning Areas Water System.

Source: Saipan Water System Study, 1982.



N

NOTES:

1. DEVIATIONS IN LINE PRESSURES MONITORED ARE A RESULT OF WATER SERVICE HOUR VARIATIONS.

2. PRESSURES WERE MEASURED AT AREA RESIDENCES USING A BOURDON TUBE PRESSURE GAUGE.

CHALAN KANOA: DISTRIBUTION SCHEMATIC AND MEASURED HOUSE SERVICE LINE PRESSURES

0 1/2 1
SCALE IN MILES

Figure VIII-3

Garapan Lagoon, Puntan Susupe and Puntan Afetna Planning Areas Water System.

Source: Saipan Water System Study, 1982.

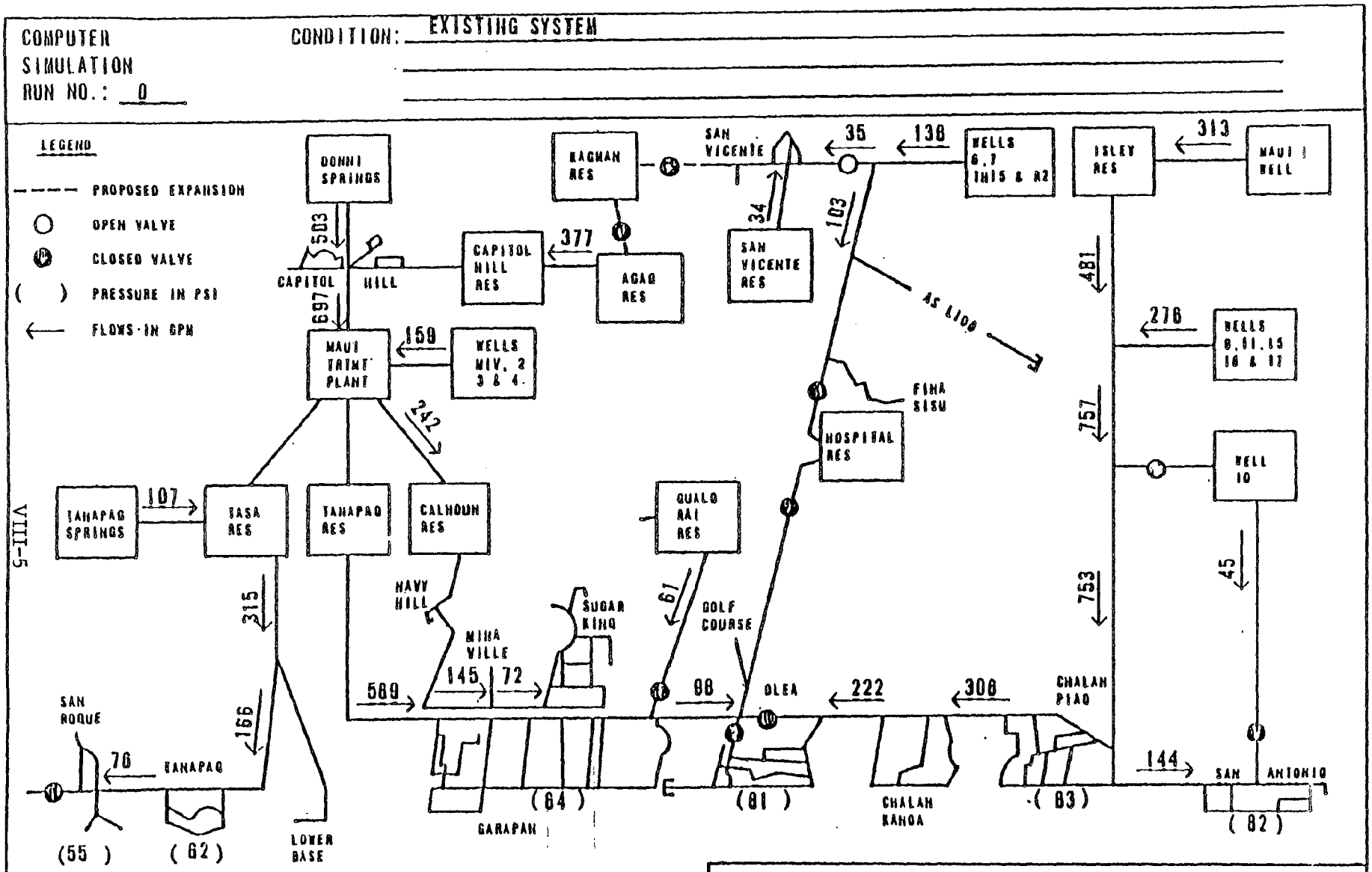


Figure VIII-4. Saipan Water System Demands and Flows.
Source: Saipan Water System Study, 1982.

Table VIII-1

PROJECTED RESIDENTIAL EDUCATIONAL, COMMERCIAL AND INDUSTRIAL WATER CONSUMPTION DEMANDS

SYSTEM	PROJECTED POPULATION YEAR 2000	DAILY DEMAND (gal)	AVERAGE FLOW (gpm)
Tanapag Residential	1,625	214,500	149
San Roque Residential	1,373	181,236	126
Garapan Residential	5,333	703,956	489
Chalan Kanoa Residential	12,247	1,616,604	1,123
Total for Residential	21,557	2,716,296	1,887
Tanapag Elementary School		3,520	
San Roque Elementary School		4,430	
Department of Public Works		30,880	
Department of Education		2,330	
Community of Cultural Affairs		750	
Coca Cola Bottling Plant		8,000	
Concrete Batch Plant		80,500	
Sablan Quarry Plant		8,000	
Hafa Adai Hotel		73,920	
Intercontinental Hotel		96,000	
Hyatt Hotel		88,320	
Arriola Laundromat (typical)		1,950	
Personnel Office		1,240	
Community and Cultural Affairs		750	

SYSTEM	DAILY DEMAND (gal)
Saipan Community School	1,890
Garapan Elementary School	11,860
Headstart	6,840
Department of Revenue	830
Land and Survey	520
Public Health	1,400
Public Safety and Fire	1,020
Criminal Justice	150
Civic Center	1,940
As Perdido Ag. Station	710
Private Offices	2,680
Marianas High School	15,600
Hopwood Junior High School	14,600
San Antonio Elementary School	4,530
Chalan Kanoa Elementary School	12,920
Oleai Elementary School	7,930
Mt. Carmel School	15,950
Marianas Private School	3,590
Oleai Laundromat	1,950
Chalan Kanoa Laundromats (3)	5,850
Susupe Laundromat	1,950
San Antonio Laundromat	1,950

SYSTEM	DAILY DEMAND (gal)
Hotels	192,000
Industries	80,000
Offices/Businesses	52,500
Total for Educational, Commerical and Industrial	841,750

figure's lower section, which represents the Saipan Lagoon coastline, is relevant for the the project area's analysis.

2. Existing Plans for Saipan's Water Facilities

The projected residential, educational, commercial and industrial facilities water demands for the PLAN's project area and coastline water service areas, as presented in the "Saipan Water System Study," are presented in Table VIII-1.

These projections presume that water leakage will be reduced to acceptable amounts and that residential consumption, in gallons per capita per day (gpcd) is:

110 gpcd usage
10 gpcd for leakage in household fixtures
10 gpcd for leakage in transmission lines and tanks
130 gpcd

Further assumptions for projecting the water consumption demands are listed in Table VIII-2.

Table VIII-2
ASSUMPTIONS FOR PROJECTING WATER CONSUMPTION DEMAND

1. Government offices: The present government employee to total population ratio is approximately 11.5%. Historically, the ratio of government employees to total population rises; hence an increase to 12% is projected. Estimated water usage is 10.5 gallon per day per employee.
2. Elementary Schools: A 99.8% increase in the 0 to 14 age group is projected. The same rate of increase was applied to the present student population. Estimated water usage is 17.5 gallons per day per student.
3. Industries and Hospital: 50% of the rate of total projected population increase equating to a 47.4% employee increase is projected. Estimated water usage is 17.5 gallons per day per employee.
4. The present usage for the Coca Cola Bottling Plant is estimated at 4,000 gallon per day. This usage is projected to double. (Defective meter, unable to ascertain present consumption.)
5. Hotels: A 20% increase in usage based on bed capacity is projected.
6. Private Businesses: A 50% usage increase is projected.
7. Private Offices: 50% of the rate of total projected population increase (94.7%), equating to a 47.4% employee increase, is projected. Estimated water usage is 10.5 gallons per employee per day.
8. Senior and Junior High Schools: An increase of 97.8% was projected for the 15 to 19 age group. The same rate increase was applied to the present student population. Estimated water usage is 10.5 gallons per day per student.
9. Laundromats: Increase of 50% based on Arriola Laundromat as a typical unit of measurement.

10. New Developments: Hotels, two with 200 room capacity, using 480 gallons per room per day. Industries, four major facilities using 20,000 gpd. Office and businesses employing 5,000 persons using 10.5 gallons per day.

From: Saipan Water System Study, 1982.

Fire flow capacities are further calculated by population of communities as presented in Table VIII-3:

TABLE VIII-3
FIRE FLOW CAPACITIES ARE FURTHER CALCULATED BY POPULATION

Community Population	Fire Flow (gpm)	Duration (hr's)
1,000	1,000	4
1,500	1,500	6
3,000	1,750	7
5,000	2,250	9
10,000	3,000	10
20,000	4,350	10
40,000	6,000	10

These fire flows are generally necessary for business districts or urban centers within the community. Recommended fire flows for residential areas are based on the population density and vary from 500 to 3,000 gpm. Table VIII-4 presents the resultant, estimated maximum future flow rates.

The projected islandwide consumption for the year 2000 is 4.7 mgd. Based on the February 1982 production level of 3.3 mgd, new production sources must be explored. Also, repairs to the existing system are necessary in order to reduce leakage and production costs and to improve capacity.

Recommendations for improvements to the existing system are excerpted below, in Table VIII-5, from the "Saipan Water System Study." Because the islandwide system was evaluated en toto and planned improvements reflect the interdependency of production sites, reservoirs, treatment plants, and distribution lines, it is inappropriate to insulate only those recommendations for upgrading the system which lie in the PLAN'S project area. However, the improvements relating wholly or in part to the Planning Areas are denoted with an asterisk.

Table VIII-4

ESTIMATED MAXIMUM FUTURE FLOW RATES

SYSTEM	ESTIMATED MAXIMUM FLOW (gpm)*
Calhoun	1,100
Mihaville & Sugar King	600
Navy Hill	500
Capitol Hill	1,100
Tasa	1,800
Tanapag	1,000
San Roque	800
Kobler Field	450
Garapan	2,000
Gualo Rai	550
Kagman	450
San Vicente	1,200
Isley/DanDan	600
Airport	1,000
Hospital	1,000
Chalan Kanoa	4,100

* Includes Fire Flows

Source: Saipan Water System Study, 1982.

Table VIII-5
RECOMMENDED IMPROVEMENTS TO THE SAIPAN WATER SYSTEM

1. Repair leaks determined in field surveys:
   * - Valve along West Coast Highway in Garapan System across from Mihaville
   - Transmission lines from Donni Springs to MTP/ww
   - Transmission line from production wells to MTP/ww
   - Valve below Capitol Hill Reservoir adjacent to 1200 block housing
   - Leak at the base of Capitol Hill Reservoir
   - Transmission line from MTP/ww to Calhoun Reservoir

   Estimated total construction cost = $1,392,000.
2. Repair or replace pumps operating below 60 percent of the manufacture's rating.
   - Well No. 17 (Isley)
   - Well No. 11 (Isley)
   - Hospital Well
   - Deep Well No. 3 (MTP)
   - Agag Booster No. 1
   - Agag Well 72

   Estimated total construction cost = $91,000.
3. The installation of new distribution lines is proposed for the Calhoun system. These new lines would connect the Calhoun Reservoir with the Navy Hill, Mihaville, and Sugar King Systems. Pressure regulating valves (PRV's) would be installed throughout the system in order to reduce the pressure in the Sugar King and Mihaville areas.
   - These three service areas (Navy Hill, Mihaville, and Sugar King) would therefore be split into three separate pressure zones. Navy Hill and Maturana Convent would be serviced directly from the Calhoun Reservoir. Pressure regulating valves would separately regulate the pressure to the Mihaville and Sugar King area. These changes would eliminate the water pressure problems presently experienced in the distribution lines.

   Estimated total construction cost = $288,000.
* 4. Repair or replace broken and inaccurate water meters and complete installation of meters on all service lines. The high priority assigned to this item is based on the fact that meter readings can be used to determine whether if leakage is occurring within or outside the user residence. Also, proper billing for water consumption can be initiated with accurate meters in place.
   Estimated total construction cost = $621,000.
5. Replace deteriorated lines in the 1300 block housing area served by the Capitol Hill System.
   Estimated total construction cost = $427,000.
* 6. Replace various inoperative or malfunctioning gate valves throughout the system. Very few valves of four inches and larger were found to be in proper working order and many contribute to the leakage problems.
   Estimated total construction cost = $700,000.

7. Repair or replace pumps operating at between 60 to 80 percent of the manufacturer's rating (Table 6, second column):
   - Well No. 9 (Isley)
   - Well No. 10 (Isley)
   - Well No. 1 (Isley)
   - Well No. 76 (Kagman)
   - Deep Well No. 2 (MTP)
   - Deep Well No. 4 (MTP)

   Also, provide needed improvements to Achugau Springs in order to bring the facility back into operation. The extent of typhoon damage will have to be assessed and repairs made accordingly.
   Estimated total construction cost = $151,000.
8. Upgrade 18,700 feet of access roads to various wells and springs. All access roads are poorly maintained coral roads. Upgrading and continued maintenance of these roads is essential.
   Estimated total construction cost = $1,047,000.
9. Replacement of various water supply lines throughout the system is recommended. In order to reduce construction costs for total line replacement, sections of the existing water lines could be salvaged. Verification of the adequacy of existing water line sections would be completed by the construction contractor as part of the line replacement contract. In this way, savings from these distribution system replacement costs can be achieved.
   The areas recommended for pressure testing and/or pipeline replacement are listed below in order of priority. Costs reflect worse-case situations, i.e. total line replacement.
   a. The line along As Lito Road between Monsignor Guerrero Highway and As Perdido Road. This line is a combination of 6 inch, 4 inch and 2.5 inch pipes of various materials. Pressure testing is recommended since some portions, such as the 6 inch line, may be acceptable for continued use. Replacements shall be with 6 inch line.
      Estimated total construction cost = $335,000.
   b. Transmission lines from Donni Springs, Agag and Tasa booster pumps. These lines were found to have low "C" values and should be replaced to reduce power requirements, thereby reducing power cost.
      Estimated total construction cost = $709,000.
   * c. The 3 inch galvanized steel line along Beach Road and the 4 inch galvanized steel line along Monsignor Guerrero Highway in Chalan Kanoa. The small 3 inch line along Beach Road has a high friction loss and, consequently, customers along this line have low service pressures. Replace with new 6 inch line.
      Estimated total construction cost = $257,000.
   d. Other lines to be tested and possibly replaced are as follows.
      - The distribution line from the Calhoun Reservoir servicing Navy Hill, Mihaville and Sugar King.
      * - The 8 inch main along Beach Road servicing San Antonio.
      * - The 12 inch cast iron transmission line between the Tanapag Reservoir and service area.

- The 8 inch cast iron line between Tasa Reservoir and the MTP/ww.
* - The 6 inch cast iron line between Tasa Reservoir and the villages of Tanapag and San Roque.
* - The 4 inch cast iron distribution line in Lower Base.
- The 6 inch cast iron transmission lines in San Vicente.
- The 10 inch cast iron transmission line on As Perdido Road.
* - The 12 and 14 inch cast iron transmission line in Chalan Kanoa.
- The 18 inch cast iron transmission line between Isley reservoir and Chalan Kanoa.

Estimated total construction cost = $2,442,000.

The islandwide water system needs expansion as well as repairs. New production resources and new water storage facilities are enumerated in the "Saipan Water System Study"; however, none are recommended for site specific placement within the PLAN'S project area.

3. Problems Associated with the Water System

The following water system problems have a direct impact on Lagoon and shoreline uses of the PLAN'S Project Area.

* The high chloride content (500 ppm) adversely affects the taste and palatability of the drinking water. With the recommended improvements of the "Saipan Water System Study," however, the chloride content is expected to be lowered to an acceptable amount.
* Limited hours of water service restrain new development and restricts existing commercial and tourism establishment from reaching their full economic potential. Furthermore, the interruption of water pressure allows infiltration from groundwater into the potable water system and increases the risk of contamination. Again, the full development of Saipan water resources, including production, storage, treatment and transmission as recommended in the "Saipan Water System Study", will restore full service to the island.
* Assumption #10 for projecting water consumption demand (see Table VIII-2) projects that two additional hotels at 200 rooms each will be accommodated by the 1982 Saipan Water System Facilities Plan. However, Table VIII-15 (this chapter) forecasts that 992 rooms will be constructed by 1988. This indicates a need to re-size the water system planned in the 1982 plan so that it accurately reflects current planning data.

b. Wastewater Facilities

Because the PLAN'S on-shore project area represents the majority of Saipan's developed area, it is understandable that the majority of the island's wastewater system is located within this ecological zone.

Saipan's wastewater facilities are divided into two systems:

* The central system, serving Capital Hill, Tanapag industrial area, Navy Hill and Garapan (represented by the Tanapag Harbor and Puntan Muchot Planning Areas)
* The southern system, serving San Vicente, San Jose, Susupe, Chalan Kanoa and San Antonio (represented by the Puntan Susupe and Puntan Afetna Planning Areas)

Both systems, along with their pump stations, interceptors, treatment plants and outfalls, are depicted in Figure VIII-5.

1. Central Wastewater System

The Central Wastewater System consists of collection and interceptor lines, seven pump stations, the Garapan Wastewater Treatment Plant and an outfall at Charlie Dock in Tanapag Harbor. The system is divided into a northern portion which receives flows from Navy Hill and the Tanapag industrial area and the southern portion which receives flows from the Garapan industrial and commercial areas. Both portions lead to the wastewater treatment plant, east of the Port, across Beach Road (Figure VIII-6).

The treatment plant has a capacity of 3 mgd (.6 mgd peak flow) and provides primary treatment. The plant does not have a flow metering device. The wastewater effluent discharges through a 12" diameter outfall pipe mid-way between Baker Dock and Charlie Dock. There it lies in a westerly direction on the Harbor bottom for approximately 1200 feet. Then the outfall reduces to an 8" diameter diffuser pipeline which is 50 feet long, with a 6" diameter port on each end of the 50 feet long diffuser. The diffuser end has been damaged for some time now. The outfall is fractured at a point about 900' from the shoreline. The Garapan outfall is depicted in Figure VIII-7. This problem is being addressed by the Government's "Assessment of Wastewater Facilities Project" and a solution will be recommended.

The Central System residential sewer service connections, as of June 1984, are presented in Table VIII-6. Historical and 1984 residential and hotel room connections are presented in Table VIII-7. Average sewage flows from 1977, 1984 and projected for 1991 and 1998 are depicted in Table VIII-8. Newly projected wastewater flows for the Central System are being developed for the Department of Public Works through the "Saipan Wastewater Facilities Plan Update," available in early 1985.

2. Southern Wastewater System

The Southern Wastewater System consists of collection and interceptor lines, 15 pump stations, Agingan Wastewater Treatment Plant and an outfall on the coastline at Agingan Point. This collection system begins at the Joeten housing area and flows westward along Chalan Pale Arnold to San Jose. The main portion of the system, aided by eight pump stations, follows Beach Road to the Agingan Plant (Figure VIII-8).

The Agingan Wastewater Treatment Plant has a capacity of 1.0 mgd and provides for primary treatment. The effluent is

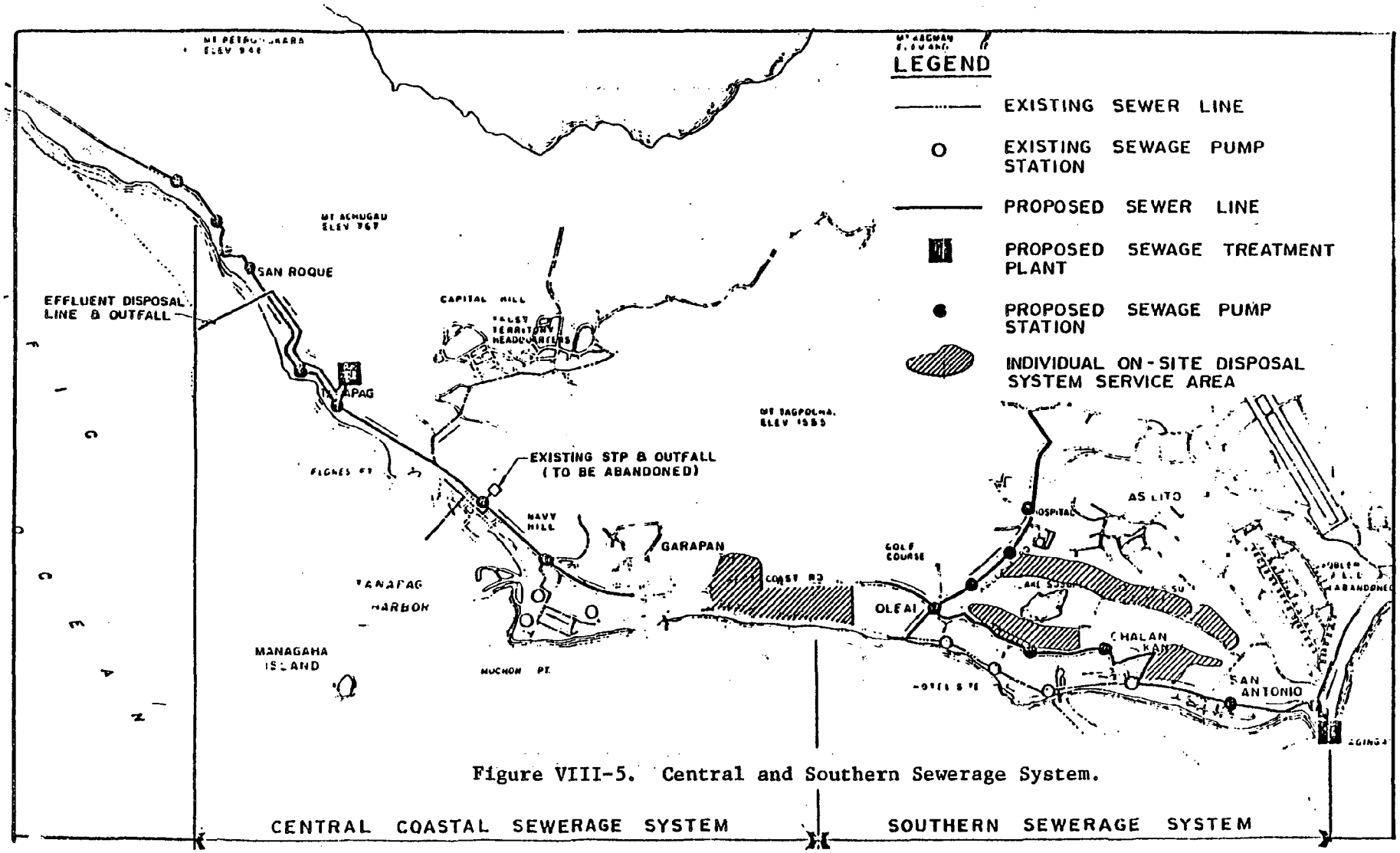


Figure VIII-5. Central and Southern Sewerage System.

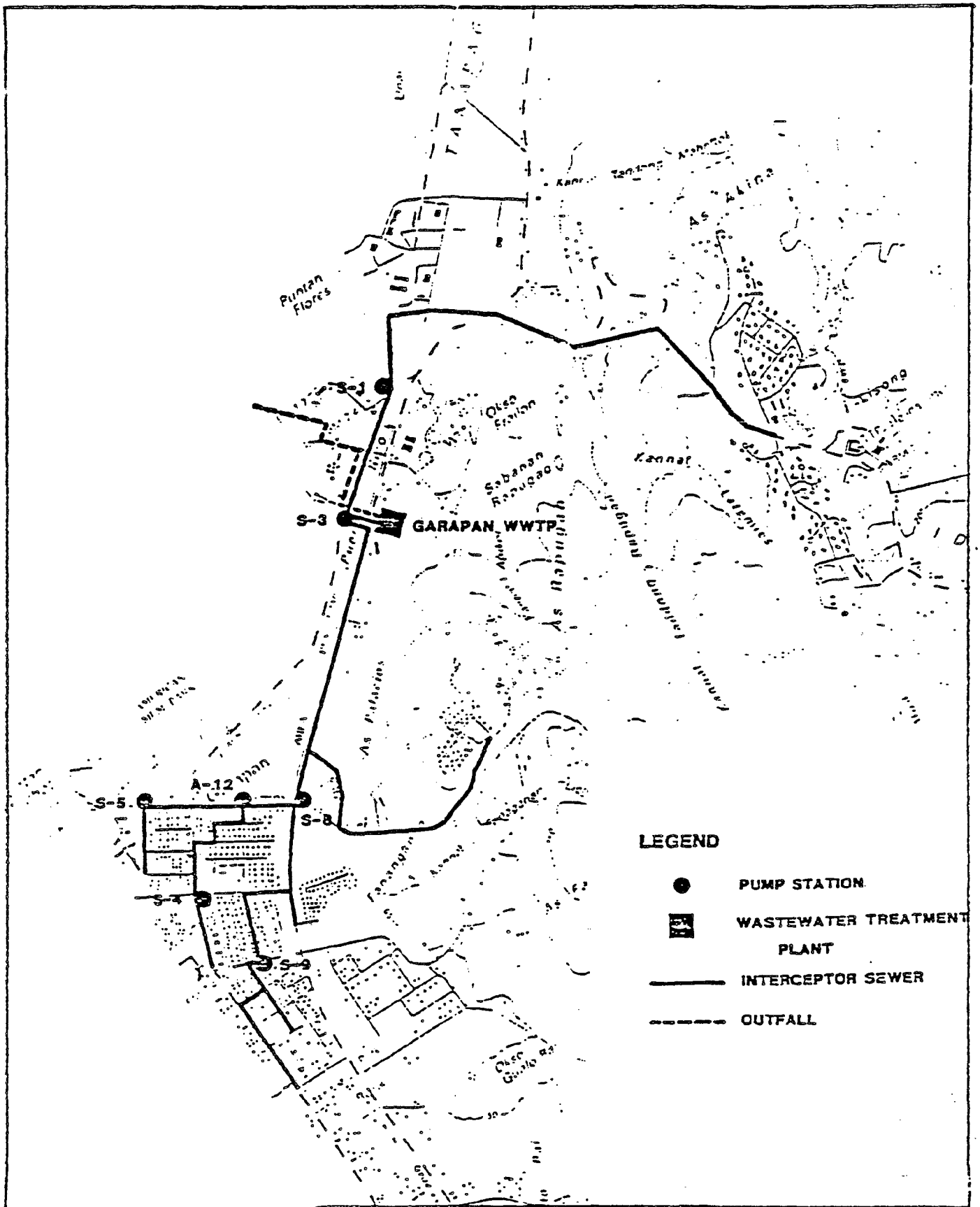
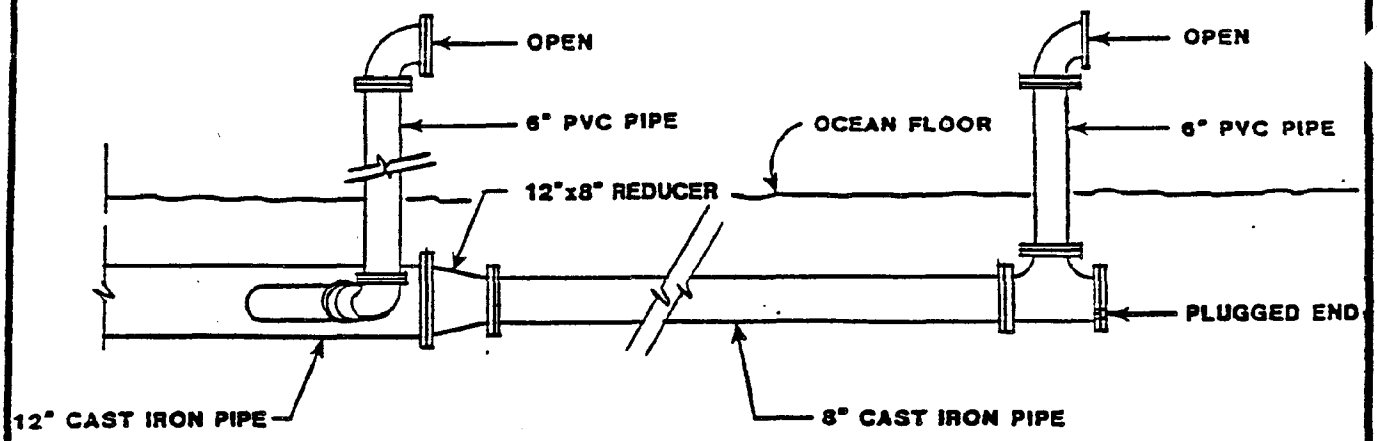
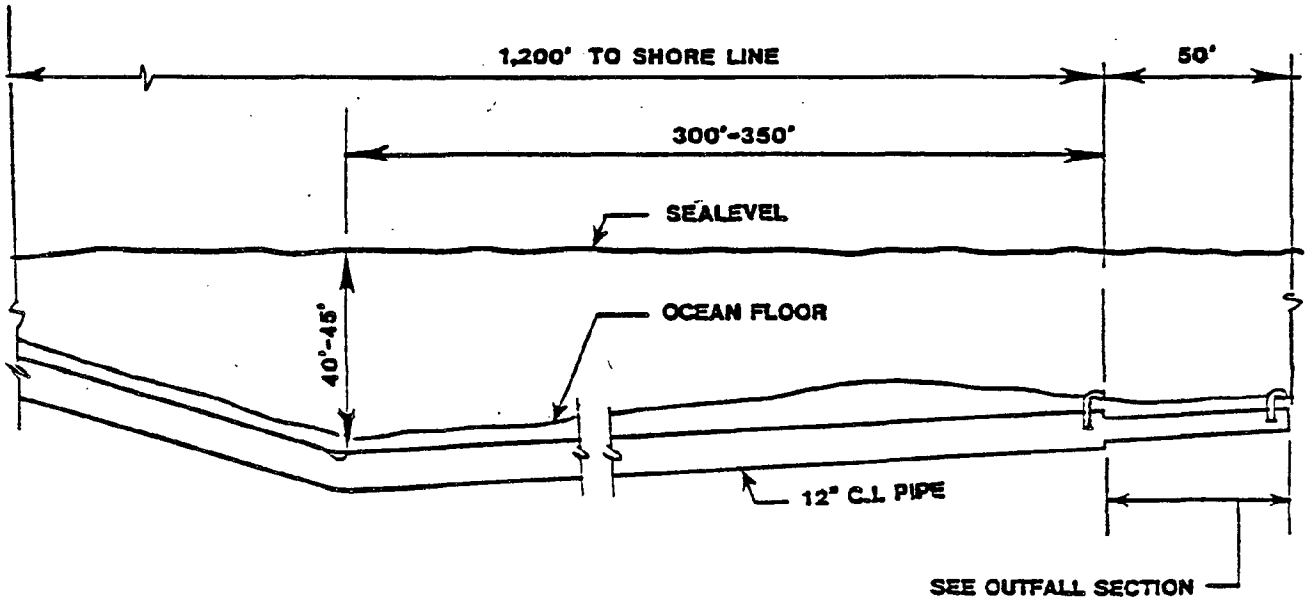


Figure VIII-6. Central Sewerage System; Existing Facilities
Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.



OUTFALL SECTION



SECTION

Figure VIII-7. Garapan Outfall Plan.
Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.

Table VIII-6

CENTRAL SYSTEM RESIDENTIAL SEWER SERVICE CONNECTIONS

	Number of Homes	Number of Homes Connected	Percent Connected
Capital Hill	130	130	100
Navy Hill	40	40	100
Lower Base	3	3	100
Garapan	678	137	16
Subtotal Central System	851	330	39

Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.

Table VIII-7

CENTRAL SYSTEM NUMBER AND TYPE OF WASTEWATER CONNECTIONS

	1977 (1)	1984 (2)
Number of Residential Connections	187	330
Total Number of Residences	540	851
Number of Percentage of Residences Connected	35	39
Number of Hotel Rooms	504	504

(1) From "1979 Facilities Plan."
(2) Based on flow analysis performed in June of 1984.

Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984

Table VIII-8

WASTEWATER FLOWS, CENTRAL SYSTEM

	Average Flow in MGD Per Year			
	1977 (1)	1984 (2)	1991	1998
Residential Wastewater Flow	0.10	0.17	0.60	0.85
Hotel and Commercial Flow	0.04	0.24	0.60	1.20
Infiltration	0.30	0.12	0.20	0.30
Total Wastewater Flow, MGD Central System	0.44	0.53	1.40	2.35

(1) From "1979 Facilities Plan."
(2) Based on flow analysis performed in June of 1984.

Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.

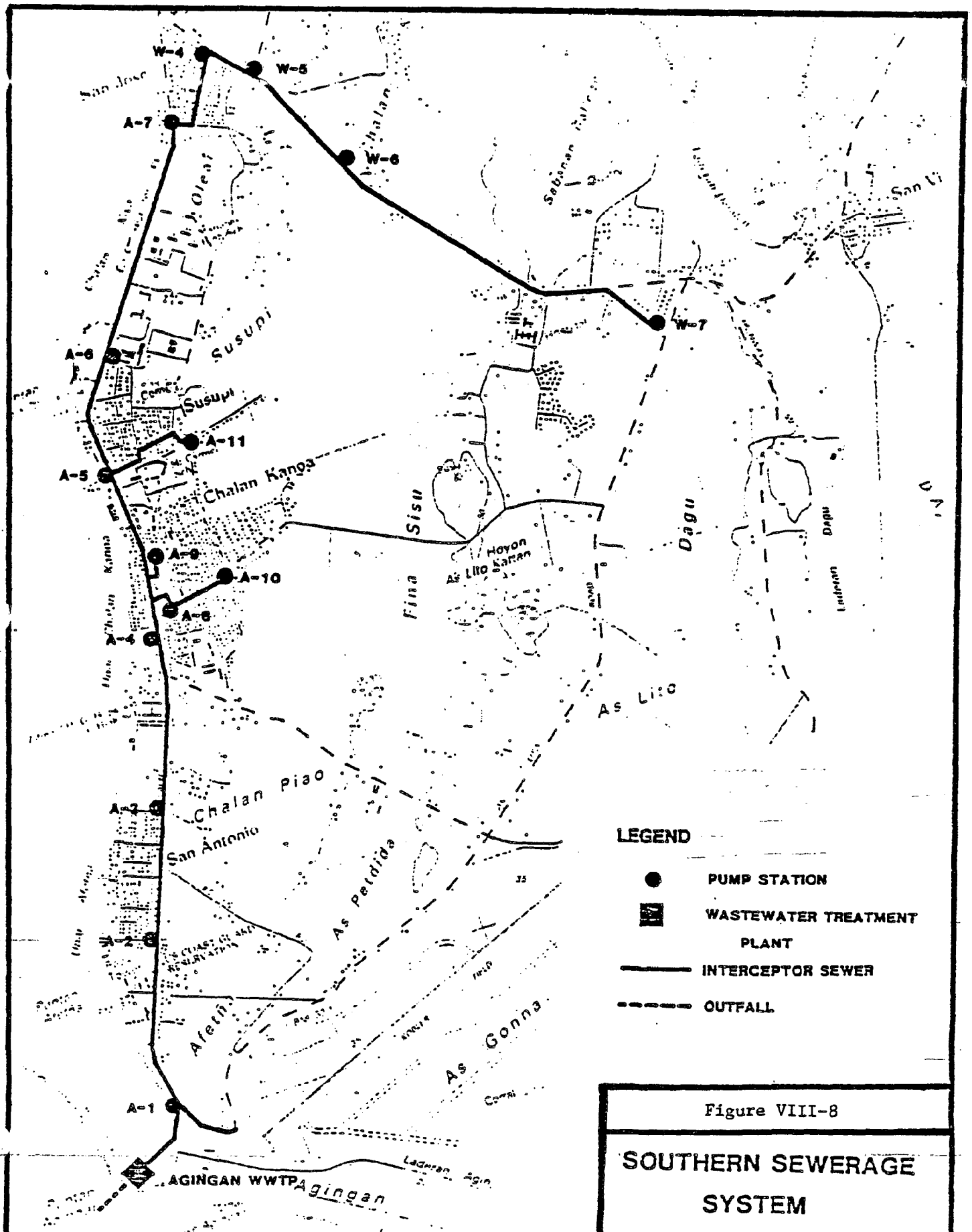


Figure VIII-8

SOUTHERN SEWERAGE SYSTEM
EXISTING FACILITIES

Source: Assessment of Wastewater Facilities

discharged at the ocean's edge in 10 feet deep water through a 12" diameter outfall (Figure VIII-9). One end of the diffuser is plugged and reserved for a future outfall extension.

The Southern System residential sewer service connections, as of June 1984, are presented in Table VIII-9. Historical and 1984 residential and hotel room sewer connections are presented in Table VIII-10. Average sewage flows from 1977, 1984 and projected for 1991 and 1998 are depicted in Table VIII-11. Newly projected wastewater flows for the Southern System are being developed for the Department of Public Works through the "Saipan Wastewater Facilities Plan Update," available in early 1985.

3. Existing Plans for Saipan's Wastewater Facilities

The June 1979 "Facilities Plan for the Island of Saipan" now serves as the island's master plan for sewage infrastructure. The plan was prepared for the Department of Public Works by M&E Pacific, Inc. The plan is now being updated for the Department of Public Works by Barrett, Harris and Associates, Inc.

The following description of proposed facilities is taken, verbatim, from the 1979 plan. In summary, the recommended system consists of implementing the following four actions:

- Expanding and/or replacing portions of the existing sewage collection and transmission system.
- Constructing two new sewage treatment facilities to provide secondary treatment to incoming sewage flows.
- Constructing an ocean outfall for the Tanapag treatment facility and extending the existing outfall at Agingan Point.
- Constructing individual on-site disposal systems in areas that have been zoned as agricultural or rural-residential.

The proposed sewerage systems are designed to serve the northern and southern districts independently. Each system essentially involves the construction of new sewer lines and pump stations designed to accommodate projected sewage flows for a 20-year design period.

The proposed secondary treatment action calls for the construction of two treatment facilities, each rated at 2.3 mgd. The practice of disposing digested-dewatered sludge at a sanitary landfill is proposed. As an interim measure, a proposed less-than-secondary treatment system (primary treatment facility) is recommended.

The recommendation of implementing a primary treatment facility as an interim measure is based on the following reasons:

- Cost factors, both capital and operational, favor primary treatment.
- Operational expertise is less stringent for a primary treatment facility.
- Public Law 95-217 permits a waiver to the secondary treatment requirement for discharges from publicly

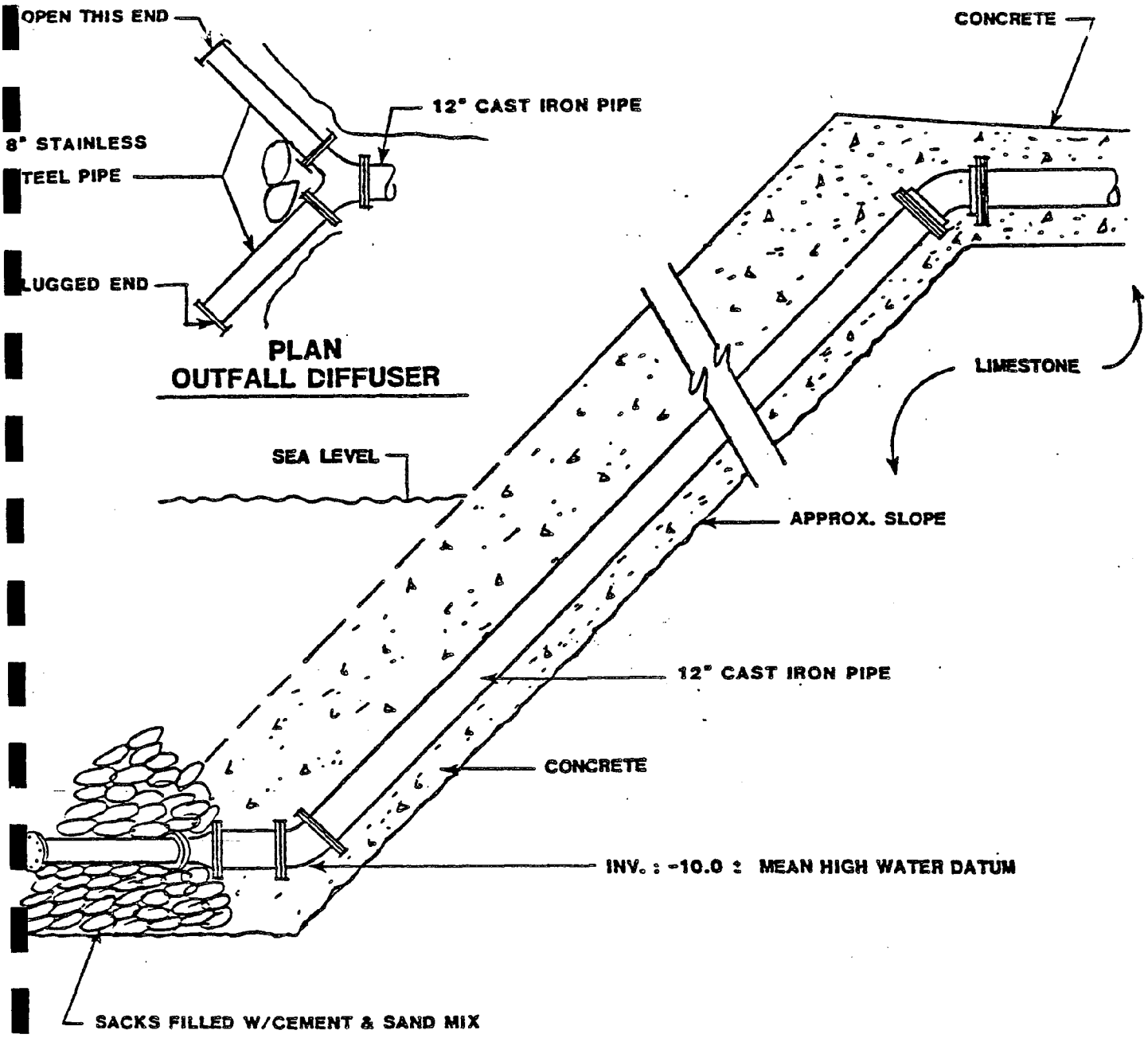


Figure VIII-9. AGINGAN OUTFALL PLAN

Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.

Table VIII-9

SOUTHERN SYSTEM RESIDENTIAL SEWER SERVICE CONNECTIONS

	Number of Homes	Number of Homes Connected	Percent Connected
San Antonio	319	35	11
Chalan Kanoa	585	159	27
Susupe	171	41	24
San Jose	299	23	8
Hospital	72	72	100
Subtotal Southern System	1446	330	23

Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.

Table VIII-10

NUMBER AND TYPE OF WASTEWATER CONNECTIONS FOR THE SOUTHERN SYSTEM

	1977 (1)	1984 (2)
Number of Residential Connections	91	330
Total Number of Residences	1580	1446
Number of Percentage of Total Residences Connected	6	23
Number of Hotel Rooms	60	202

(1) From "1979 Facilities Plan."
(2) Based on flow analysis performed in June of 1984.

Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.

Table VIII-11

WASTEWATER FLOWS FOR THE SOUTHERN SYSTEM

	Average Flow In MGD Per Year			
	1977 (1)	1984 (2)	1991	1998
Residential Wastewater Flow	0.04	0.14	0.72	1.17
Hotel and Commercial Flow	0.04	0.20	0.28	0.35
Infiltration	0.21	0.22	0.20	0.20
Total Wastewater Flow Southern System	0.29	0.57	1.20	1.72

(1) From "1979 Facilities Plan."
(2) Based on flow analysis performed in June of 1984.

Source: Assessment of Existing Wastewater Facilities, Interim Report, 1984.

owned treatment works that discharge into marine waters. Several sections of this recent amendment, however, require clarification, and the U.S. Environmental Protection Agency is currently in the process of formulating specific guidelines and procedures for waivers.

- This action is not irreversible. The proposed primary treatment facility can be upgraded in the future to meet secondary treatment requirements.
- The impact of effluent from the primary treatment facility on the marine environment is not insignificant.

4. Problems Associated with the Wastewater System

The following Wastewater System problems have a direct impact on the Lagoon and Shoreline uses of this Plan's Project Area.

* Most of the facilities are now 12 years old and, because of practically no repair and maintenance, breakdowns are frequent. Unreliable sewer service is a constraint to any developing region. The absence of a repair or maintenance program has been recently noted by the U.S. Environmental Protection Agency in its April 15, 1984 NPDES Compliance Monitoring Report.
* In June 1984 an investigating team of Barrett, Harris and Associates confirmed that the Garapan outfall is broken at a depth of 42 feet and effluent discharges at that point.
* South of San Antonio, along the Lagoon's final stretch of coastline before Agingan Point, the beach is frequently polluted with sewage. The cause of this problem is suspected as overflow from the nearby "A-1" pump station when electrical power is interrupted. A standby generator is not always available during power outages. When the wet well fills without being pumped, sewage overflows through a bypass pipeline to the beach. This problem is under investigation by the Commonwealth Government as part of its "Assessment of Existing Wastewater Facilities" project, and a recommendation for correcting the situation will be developed.
* In Table VIII-8 and VIII-11 wastewater projections for Saipan's central and southern wastewater systems were extrapolated from the 1977 Wastewater Facilities Plan. Additionally, 1984 wastewater flows are presented from the 1984 Interim Study of Saipan's Wastewater Facilities. Both the 1977 projections (through 1998) and the 1984 estimates are plotted on Tables VIII-12 and VIII-13 for the central and southern systems, respectively. These plottings reveal that total wastewater flows for both systems are well under projections; however, while the hotel/commercial wastewater flow has kept pace with the central system projections, it already exceeds the southern system projections.

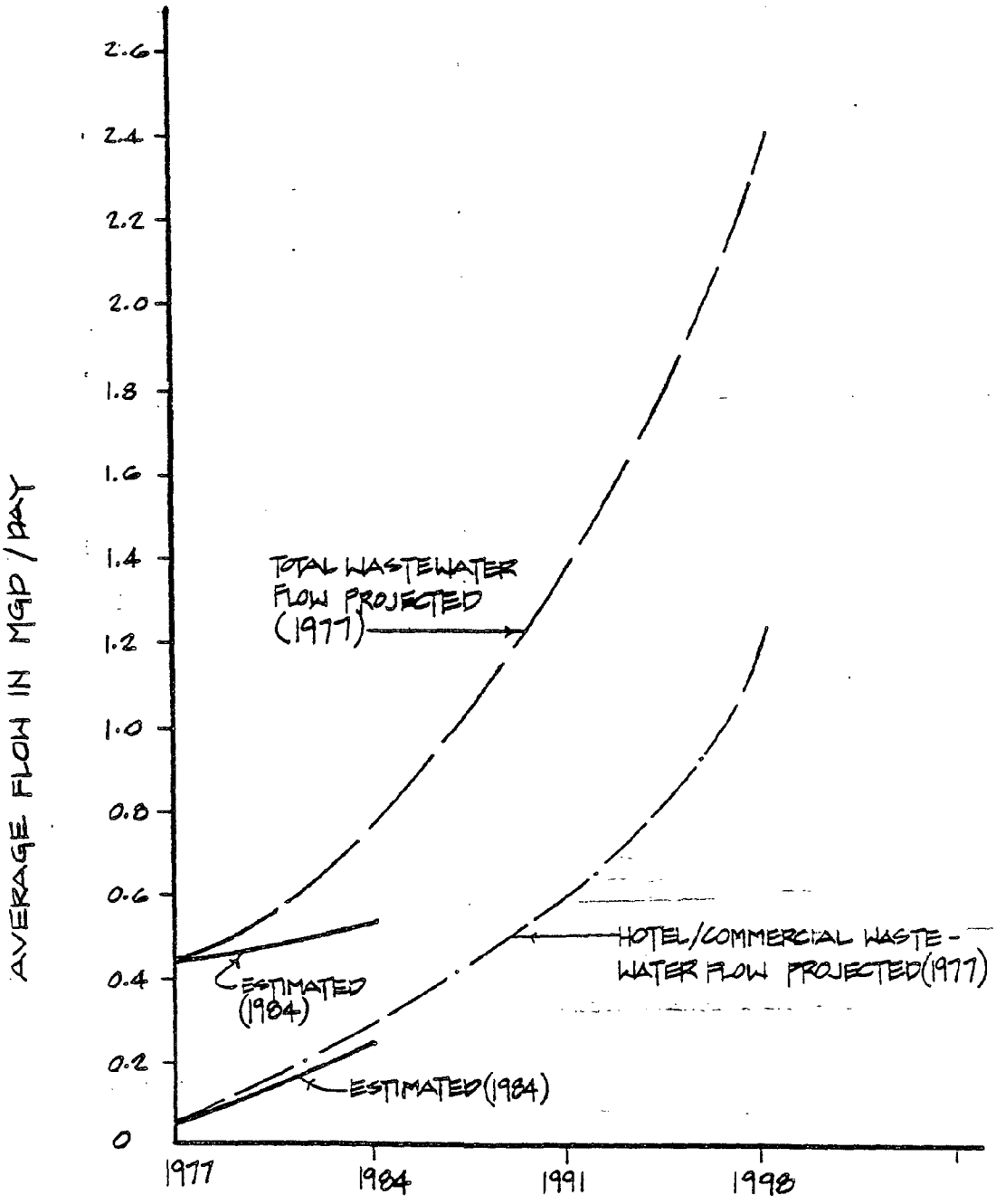


TABLE VIII - 12

CENTRAL WASTEWATER SYSTEM:
1977 FACILITIES PLAN PROJECTIONS AND
1984 INTERIM STUDY ESTIMATES

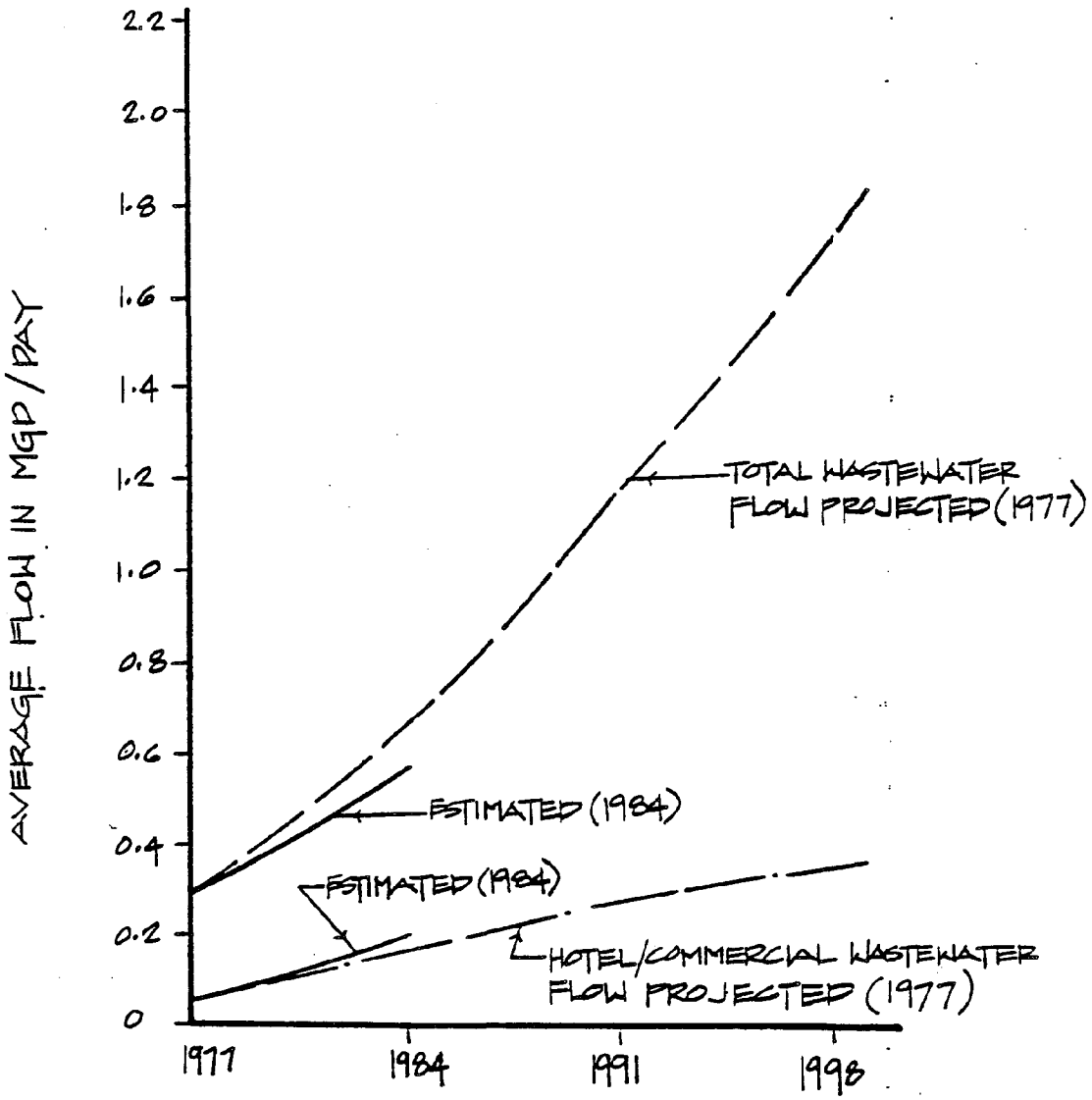


TABLE VIII - 13

SOUTHERN WASTEWATER SYSTEM

1977 FACILITIES PLAN PROJECTIONS AND 1984 INTERIM STUDY ESTIMATES

* In projecting future wasteloads on both systems as a result of resort development (only) within the project area, Table VIII-15 indicates that 992 new rooms are proposed for construction along the Saipan Lagoon shoreline area by 1988. Based on an average of double occupancy and 100 gallons per guest per day, this projected construction will contribute approximately .2 mgd to the wastewater flow. This additional wasteload from hotels will be more or less balanced between the central system's service area, (covering the Puntan Magpi, Tanapag Harbor and Puntan Muchot Planning Areas) and the southern system's service area (covering the Garapan Lagoon, Puntan Susupe and Puntan Agingan Planning Areas). Therefore, each system can expect to handle about half of the total projected wastewater, or an additional .1 mgd by 1988. Of course, these projections do not reflect wastewater generated from other tourist support and commercial businesses.
* Based on this analysis, therefore, the 1977 projections established for the southern wastewater system fall short of those which more current wastewater planning data now indicate. The wastewater flow projections for the central system fairly reflect available data at this time. However, those projections should continue to be monitored closely.

c. Beach Road

March 1984 traffic count statistics are presented in Figure VIII-10 for Beach Road.

2. Water Quality Management

The Division of Environmental Quality within the Department of Public Health and Environmental Services is directed through provisions of the Federal Water Pollution Control Act of 1972 (Public Law 95-217), and its Amendments, to establish a water quality management program for the protection, maintenance, conservation and improvement of water quality in the CNMI. This program is established to protect the growth and propagation of aquatic life in all State or Territorial waters. In response to this direction the Commonwealth Environmental Protection Act (Public Law 3-23) was enacted in 1982 to ... "develop and administer a program to collect and to cause to be collected, information regarding the quality of the environment of the Commonwealth." Water quality standards were first promulgated as a part of this program in 1983. The explicit purpose of these standards was to establish standards of water quality for all Commonwealth waters to protect their use and value. Groundwaters were excluded from these standards.

A water quality monitoring program has been on-going since 1983. Twenty seven (27) points are regularly sampled in nearshore (Saipan) waters within the Saipan Lagoon (SLUMP Planning Area). In addition to these points twenty five points in knee deep water and twelve (12) points approximately 150 ft. off-shore surrounding Managaha Island are regularly sampled. Other points around Saipan are sampled irregularly or when specific problems exist.

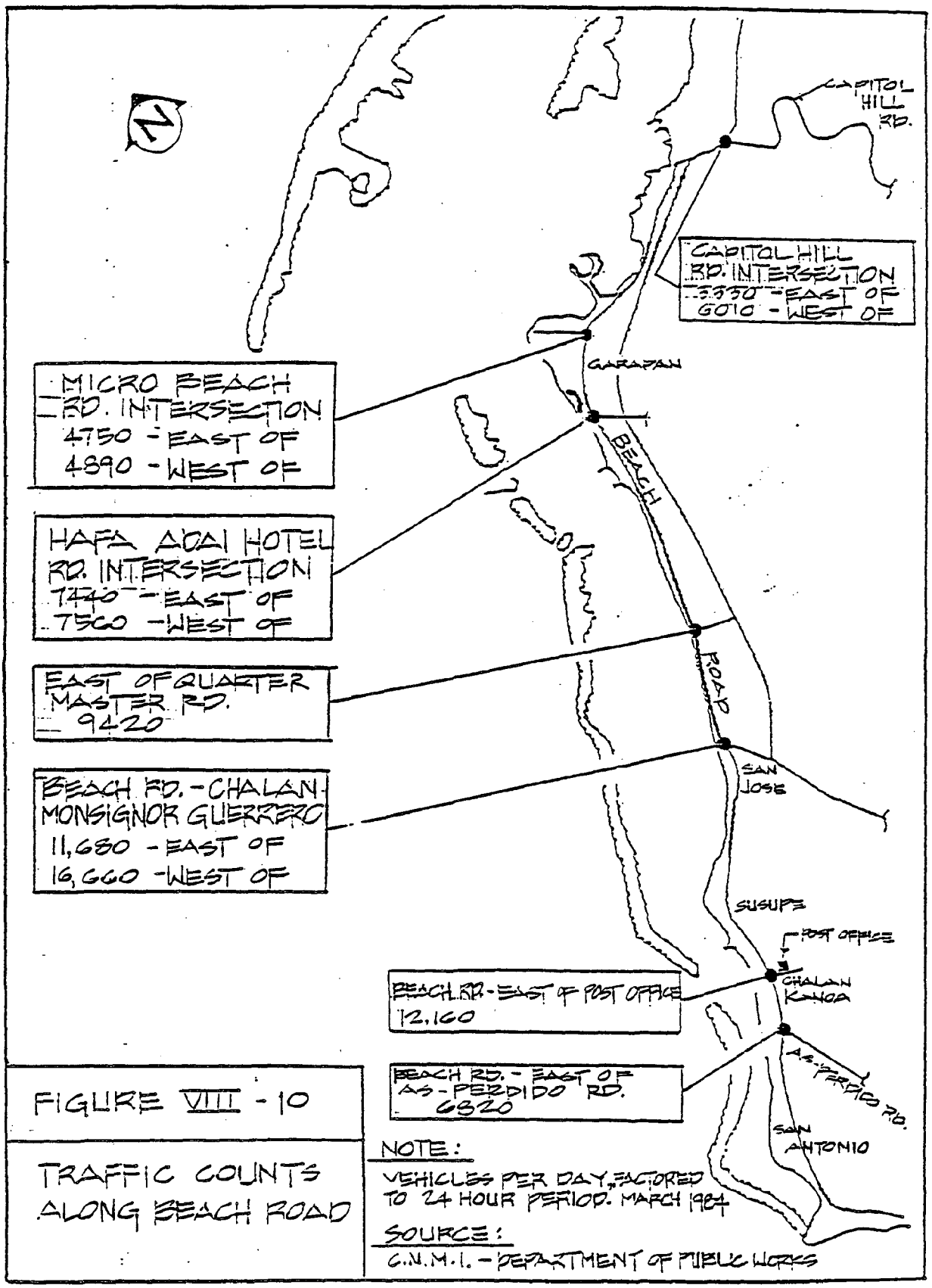


FIGURE VIII - 10

TRAFFIC COUNTS ALONG BEACH ROAD

NOTE:

VEHICLES PER DAY, FACTORED TO 24 HOUR PERIOD. MARCH 1984

SOURCE:

C.N.M.I. - DEPARTMENT OF PUBLIC WORKS

The monitoring program samples for biological, physical and chemical characteristics of water quality. Of primary importance is the presence of fecal coliforms which suggest the presence of a human pathogen. Sampling for fecal coliforms is particularly important in nearby recreational waters near known sources like sewer treatment plant effluent outfalls or storm drainage ditches. A number of physical parameters are analyzed regularly in the monitoring program. These include: Suspended Solids and Turbidity. Temperature is maintained occasionally particularly in the vicinity of the Tanapag Power Plant. Chemical parameters include: Biological Oxygen Demand (BOD), Chlorine, Salinity, Dissolved Oxygen and pH.

In early 1985, the Division of Environmental Quality developed a proposal to expand the existing Water Quality Monitoring Program in the CNMI to "more effectively understand the environmental impacts of the activities of man upon the valuable water resources of the Commonwealth." This comprehensive proposal is divided into three parts: An Introduction which identifies the various activities which may cause pollution in the CNMI; Part I defines a Strategy which differentiates between monitoring for land based causes of pollution and sources of pollutants resulting from nearshore and offshore activities, the methodology and implementation procedures; Part II is a Scope of Work which defines the Sampling Locations in terms of the specific parameters to be analyzed and specific resources required to accomplish the program objectives. Following is a brief description of each part.

a. Introduction

The introduction defines the general physical structure of the islands and paints a realistic picture of natural phenomena and human activities that pose environmental problems in the CNMI.

The introductory remarks define in general terms the physical characteristics of the various islands, reef structure, presence of off-shore islands, lagoons and beaches. The level of human development, existing and proposed, is detailed for each island. Both local and federal government planning programs are defined and important studies either completed, on-going or proposed are identified. Major public facilities like the power plant, sewer treatment plants and the dump are identified and evaluated in terms of their impact on the environment. Nearshore and off-shore recreational facilities in the lagoon are briefly defined in this section.

b. Strategy

The existing DEQ marine monitoring strategy consists primarily of sampling for fecal coliform contamination and other physical and chemical parameters within specific marine waters. The program is designed to monitor for microbiological pathogens in areas of heavy human impact. The DEQ proposes to expand the marine monitoring program as part of their continuing effort to protect the Commonwealth's valuable coastal

marine resources. In addition to the 27 original nearshore monitoring stations, four others have been identified. These include the Puerto Rico and Agingan Point Sewage Treatment Plant outfalls, Puerto Rico Dump and the Mobil facility. Samples have been taken regularly from the sewage treatment plant outfalls, however, these sites were not sited in the original monitoring strategy since they were not operational or built at that time. Identification of environmental pollution near sewage outfalls and the nearshore zone in the village of San Roque north to Marpi is to continue in the new monitoring strategy. Discontinued sampling points will be those that undergo temporal variations in concentrations.

The intent of the new monitoring strategy is to observe and define the general health of the benthic community and detect purturbations which suggest the presence of environmental pollution. If abnormal conditions suggest pollution, then specific studies will be designed to determine the cause of the problem.

The monitoring strategy is structured in two parts. The first part will deal with land based or coastline development activities which have the potential to degrade the marine environment. These include the sewage treatment plant outfalls, Puerto Rico Dump, flood control projects, proposed hotel complexes and land clearing activities that impact on the marine environment. The second part will monitor for the effects of water based activities. These activities include dredging in the marine environment, the transfer of oil and fuel from ship to ship or ship to land, general shipping in the lagoon or other water oriented activities.

Implementation of the revised marine biological monitoring program does have its problems. Of primary concern is distinguishing between biological changes induced by man's activities and those changes from naturally occurring purturbations. Ambient baseline data forms the backbone upon which to base these determinations. These data have been collected for nearly two years and are being filed in STORET with the US EPA. In some instances it will take several years to establish meaningful baseline data to predict purturbations.

Apart from this problem, biological monitoring can be used to track long-term changes in the marine ecosystem in three ways.

1. By detecting changes within pristine areas of the benthic community over time.
2. By detecting changes over time at specific locations in the biological community where stress is suspected to have occurred as a result of known pollution.
3. By determining if the biological community is returning to its predisturbed state in areas of past pollution or if succession is being retarded by residual or persistent pollution.

The data base upon which to make these evaluations will take place on specific indicator organisms (particularly sessile invertebrates like hermatypic corals).

c. Methodology

The DEQ marine monitoring program is charged with the responsibility of determining the best possible monitoring methodology in order to achieve the desired degree of results. The methods chosen in this new monitoring strategy include some from the old strategy and new methods as well.

Sampling for Total and Fecal Coliform Bacteria will continue in the new program. Samples will be taken at existing sampling stations and new sites as well to identify unreasonable risk to the public's health in areas where water contact sports and recreation occur. Sampling for physical and chemical parameters defined earlier will continue in the new program. Added as a part of the new program will be the analysis of heavy metals, pesticides and radioisotopes. Most likely these new samples will be sent off-island for analysis.

Five new sampling methodologies have been added to the new monitoring strategy. These include aerial surveys, current studies, transect studies, zooplankton studies and sampling for petroleum products.

d. Implementation

The proposal suggests that the marine monitoring program will be implemented by mid-FY 1985. The program will require a gearing up period which will take most of 1985. This work will include the establishment of permanent transects and other fixed monitoring stations, procurement of equipment and creation of a computer filing program to handle data.

e. Sampling Locations

Sampling locations defined in the old monitoring strategy will remain. New sampling locations are divided into land and water based sites and particular monitoring parameters are given.

f. Monitoring for Land-Based Activities

1. Location: Island Wide
   Parameter: Microbiological Sampling
   Time Frame: Monthly

2. Location: Island Wide
   Parameter: Aerial Survey
   Time Frame: One initial survey

3. Location: Agingan Sewer Outfall
   Parameter: Current Studies
   Time Frame: Three Months
   Parameter: Biological Studies
   Time Frame: Biannual

4. Location: Puerto Rico Sewer Outfall
   Parameter: Current Studies
   Time Frame: Three Months
   Parameter: Biological Studies
   Time Frame: Biannual

5. Location: Puerto Rico Dump
   Parameter: Current Studies
   Time Frame: Three Months
   Parameter: Heavy Metals, Pesticides, Radioisotopes
   Time Frame: Annual or as-needed
   Parameter: Biological Sampling
   Time Frame: Biannual

6. Location: Managaha Island
   Parameter: Current Studies
   Time Frame: Three months
   Parameter: Biological Studies
   Time Frame: Biannual and intermittent reconnaissance

g. Monitoring for Ocean Based Activities

1. Location: Mobil Oil Facility
   Parameter: Current Studies
   Time Frame: Three months
   Parameter: Petroleum Studies
   Time Frame: Biannual with periodic inspections during offloading activities

h. Monitoring for Special Projects

There are a number of special projects which can affect the environment and should be monitored. These projects involve major sitings as identified by the CRMO and presently include the following. Various forms of monitoring will take place in regards to these projects and actual parameters will not be defined until the projects are well defined by the developers.

1. Japan Airlines Hotel in San Roque
2. Garapan and Susupi Flood Control Projects
3. Channel and Dockside Dredging
4. Small Boat Basin Construction at Lower Base

i. Fiscal and Personal Resource Requirements

Personnel resources required to initialize and continue this new monitoring program are defined in terms of tasks in the field and in the laboratory for each of the target sampling locations.

Fiscal budgetary requirements for the program are divided between the CRMO and DEQ as follows.

1. Equipment
   CRMO = $7,347.76
   DEQ = $3,150.00

2. Other (DEQ)

Off-island Analysis =	$ 1,500
Diving certification =	$ 400
Communication,	
Travel =	$ 500
Maintenance =	$ 250

3. Energy Resources

Saipan's energy resources are discussed in this chapter in three respects. First, the current world energy picture is reviewed to provide a background, secondly, Saipan's energy supply status and finally, alternative sources of energy available to Saipan and the CNMI are discussed as a preface to the various energy-related siting criteria which are presented in Volume II.

a. World Energy Supply

The world energy supply picture for the remainder of this century is clouded. There is no clearly defined energy policy or a consensus on what fuel will be the "swing fuel" for supplying the major portion of projected supply deficits. In fact, the world energy picture, historically, has always been clouded with shifts between various fuels as primary energy sources depending on need, technology and available resources. The newest aspect is an increased emphasis on centralized long-range planning which focuses unprecedented attention on the central role of energy supply in our society.

On the world energy scene, it is likely that demand will continue to rise. The exponential growth experienced in this century alone in terms of metric tons of coal equivalent (tce) has exceeded the rate of population increase by a large margin. It is now clear that even if the world population is stabilized at 10 to 15 billion in the early part of the twenty-first century, our present energy output must more than double just to stay even with population growth. It is not guaranteed that population will stabilize at any level, and staying even with demand may not be good enough.

The relationship between per capita energy consumption and standard of living has been repeatedly demonstrated. The standard of living is measured here in terms of gross domestic product, probably the best indicator now available for expressing the ability of a society to provide for its tangible needs and desires. In order for developing countries to realize a level of prosperity comparable to that now enjoyed by the world's major, western industrialized nations, average world energy use per capita would have to increase by a factor of more than four. Couple this with a projected increase in population for the balance of this century and it would require an increase in world energy production by one order of magnitude (a factor of almost ten).

During the period 1860 to 1960, overall world energy production did increase by one order of magnitude (Economy 1983). While this performance is probably not repeatable, the

changing pattern of primary energy supply sources during this period provides a lesson for the future.

In 1860, wood accounted for the largest fraction (about 50 percent) of the world's energy consumption. By 1900, bituminous coal production had increased by a factor of four and took over the largest share of the market. Oil accounted for nearly 8 percent of the total at the time. Between 1900 and 1930, oil production increased by a factor of seven, taking over nearly 20 percent of the market while coal and lignite retained the lead positions. By 1960, oil had just surpassed coal and occupied the position of largest single supply source, where it remains today by even a larger margin.

During this period, these three energy sources held lead positions for energy production. From the stand point of an energy analyst living in 1900, the question of identifying a single "fuel for the future" must have been as puzzling then and, in retrospect, as meaningless as it does to us today. The only clear picture regarding world energy production is that the issue is still complex and likely to remain so, with different fuels occupying lead positions according to the situation of the moment.

The world's total non-renewable energy resource base consists primarily of coal, unless nuclear breeder reactor technology were to continue to develop at pre-1980 rate, which does not appear likely. Crude oil, which now accounts for the largest single factor in the world's energy supply, is only 15 percent of proven and currently recoverable reserves. This is equivalent to 3 percent of total remaining recoverable resources, assuming pre-1980 commercialization of breeder reactors. A switch from oil to more abundant non-renewable fuels will be necessary in the near future. However, if such a switch is, indeed, inevitable there is no time for complacency.

In one major respect, the present situation differs markedly from that confronting the analyst living in 1900. We are now using non-renewable energy at a rate which is appreciable compared to total resources. The year in which the world's remaining fossil fuel reserve/production ratio drops to ten years ranges somewhere between 2005 to 2130, depending on the annual rate of growth in energy use, whether the calculations are based solely on proven resources or on total recoverable resources and the extent to which non-fossil fuel technologies are developed. Note that the growth rate in this century has been about 5.1 percent per year and in order to achieve the factor-of-ten increase by the end of this century (that would be required to bring the world's entire projected population up to the standard of living now enjoyed by citizens of western industrial countries), a growth rate of 10-12 percent per year would be required.

Like most industrial countries, the U.S. now depends primarily on fossil fuels and utilizes its energy mostly in the form of heat.

Remaining recoverable world oil resources appear to be concentrated in the Middle East, with significant other resources found in the U.S., Africa and the U.S.S.R. It is believed that the average ultimate recovery of oil-in-place may reach 40 percent. If 60 percent were attainable, recoverable resources would increase by 50 percent. Middle Eastern countries possess about half the world's proven resources of crude oil as is graphically evident when a map of the world is distorted to reflect percentage of reserves. World crude oil production has been increasing dramatically in recent decades, exceeding 30 billion barrels in 1980. Due to limitations in the total resources projected, total world oil production cycles are extremely rapid. Production will peak-out just before the turn of the century at approximately 70 million barrels per day.

It is clear that in the long term a switch must eventually be made away from non-renewable energy sources (such as fossil fuel) and to renewable sources, most of which are derived from solar energy in one form or another or from nuclear fusion.

b. Saipan's Energy Supply

The SAIPAN LAGOON USE MANAGEMENT PLAN represents a comprehensive planning effort to not only identify resources, facilities and activities and other uses affected by the PLAN Area, but also to plan for their efficient use in the future. Numerous resources exist in the Lagoon as identified in Volume I. Some of these resources, like fish and other edible marine life, have been utilized for centuries by the inhabitants of these islands. A few resources like sand mining or coral harvesting have been there for the taking all along, but they were only recently exploited because of commercial expansion, mostly related to tourism. Numerous resources that are presently found in the Saipan Lagoon are not properly managed and will suffer degradation if left unchecked. Because the population of Saipan has always been small, except during the war, resource degradation has not yet been a significant problem. However, with the advent of expanded tourism industry and its subsequent rapid growth, there is an important need to not only identify and develop resources but to protect and conserve them as well. Only within the past eight years has there been any real attempt to regulate, monitor and manage the resources that exist in or within the vicinity of the Saipan Lagoon.

One particular resource yet to be studied and developed in the Saipan Lagoon is related to energy production. As we know it, Saipan and most other isolated islands have relied on conventional oil for power generation stations. Saipan, like many other similar islands, has built these generating facilities near to their seaports for logistical reasons.

This section of the PLAN describes alternate energy facilities and activities which exist or have the potential to exist in the PLAN area. These alternatives include a description of existing facilities (oil) and potential alternate forms such as coal, biomass, tidal current and solar salt-gradient ponds.

c. Present Energy Status in the CNMI

The principal energy source in the CNMI are a number of petroleum products. About 20% of the imported fuel is gasoline and mostly for automobiles and other forms of transportation like boats. More than half is Residual Fuel Oil (RFO.6) used for power generation.

There is 36 MW operating capacity Saipan and standby capacity amounts to 3 MW. A new 7.2 MW permanent unit was added to the old 28.8 MW unit and went on-line in 1983.

The 33 MW "Impedance" was returned to the United States Army Corps of Engineers in 1983. The large Saipan System operates on RFO but uses diesel for start-up. The new standby generator is considered to be more reliable and fuel efficient than older units acquired between 1968 - 1971. The electrical generating equipment on Saipan is reasonably new, and standby capacity barely meets current energy demand. Maximum peak load and base load for Saipan in 1981 was 15.4 and 11.6 MW respectively.

For eight years until September 1, 1976 an electrical rate of $.03/KWH was changed for all consumers. Since then, electricity is charged on a sliding scale: $.06/KWH for 0 - 2,000 KWH/month, $.07/KWH for 2,001 - 25,000 KWH/month and $.08/KWH for more than 25,000 KWH/month. In 1982 the cost to produce electricity including fuel, maintenance and personnel expenses was estimated at approximately $.12/KWH. In effect, consumers have been enjoying a substantial energy subsidy in the CNMI.

The largest energy users on Saipan are major hotels, followed by smaller commercial enterprises like laundromats which use dryers and water heaters. These units are heavy energy consumers and are inefficient in their operation. There are no large industrial energy users on Saipan and no significant military demand. Commercial airlines represent a large liquid fuel demand on Saipan. Although airline activities do have a direct effect on tourism, their purchases are made from the supplier and do not affect the local economy directly. Gasoline comprises an appreciable portion of the fuels used on the island, as does diesel oil. Both are bought by the private sector for miscellaneous uses (Table VIII-14). Note that electrical generation consumes nearly half of the imported petroleum products.

There are a number of energy-related facilities and operations that play a part in the overall energy picture on Saipan. These include the Commercial Port where oil is pumped from tankers, Mobil oil storage trucks, pipelines between the dock and holding tanks and the distribution system that brings oil to the generating facility. All three are located in the Tanapag Planning Area between Commercial Port and the power plant.

In decreasing order, the greatest electricity demand is for: air conditioning, water heating, cooking, lighting, refrigeration, TV and radio. There are roughly 3,000 energy customers, of which nearly one-third are unmetered and pay a

Table VIII-14

END USES OF FUELS, CNMI, 1981
(IN 1000'S OF BBL)

Fuel	Amount Purchased	Price (a, b) ($/bbl)	Gov't	Private	Comm'l/Indust/ Construction	Electric Generation
Motor Gasoline	67	52	8	59		
Aviation Gasoline	0.4	175		0.4		
Jet Fuel - K	84	73			84	
Kerosene	1	62		---- 1.0 ----		
Diesel	42	55			21	21
RFO - 6	136	32				136

(a) At Mobile Bulk Plant, February 1981, exclusive of taxes and local transportation.

(b) Guam Oil Refining Company supplied 182,000 bbl in 1980; difference is believed to be related to storage requirements and losses. RFO-6 price is as of August 1980.

(c) 1500 autos.

(d) 5500 autos, 192 boats.

(e) Private communication, George Chan: Comm'l/Indust-16%, Construction-84%.

Population: 16,862 (Septemeber 1980)

Households: 3,400 (September 1980)

flat $35 per month. These tend to be small energy users, yet they make up a significant number of consumers. CNMI government facilities do not pay for energy consumption, and the old Trust Territory government pays a flat rate of $400,000 per year. The result is that the effective income amounts to $.02/KWH or approximately six times less than the estimated cost of production.

Continued and increased federal funding is the only way the CNMI Government can keep-up with the cost of energy production on Saipan without resorting to full cost rate hikes. Unfortunately, at the present time the entire electrical power system and back-up on Saipan is based on oil imported from countries thousands of miles away. This presents special problems, the most drastic of which would be felt if the oil supply were to be depleted or if prices continue to rise. Both of these situations would stress an already fragile relationship between the energy suppliers (federal government) and energy users (CNMI residents and government), not to mention the disruption that would surely exist in a society so closely tied to petroleum.

d. Energy Alternatives for Saipan

Fortunately, there are a few renewable energy fuel sources that are abundant in the CNMI, and the government is seeking to revise the trend of oil dependency through the implementation of programs to develop alternate sources of energy, particularly those which are renewable. At least six indigenous renewable energy sources have been identified within the CNMI: solar, (including hot water, photovoltaics, salt gradient ponds and OTEC), wind, geothermal, biomass (including tree farms and biogas), tidal and currents and municipal solid waste. Of these, all but geothermal apply to Saipan. The prospects of tapping active volcanoes for geothermal power on Pagan and transporting electricity through underwater cables is not totally out of the question and this technology is presently being studied in Hawaii. However, the practicality of such power generation is at least a decade away at even the best sites like the Hawaiian Islands.

e. Energy Management on Saipan

In addition to the prospects of producing energy from indigenous energy sources, energy management, conservation and education form the basis for improving on Saipan's energy needs. Within the CNMI, particularly Saipan, a number of energy management and conservation options have been identified. While the options will not contribute to new energy sources, they will reduce the demand on existing generation facilities and make them available to help support CNMI economic development goals. It will take time to study and implement the numerous alternative energy possibilities for the CNMI and realize positive results. The first step is to build energy understanding among the users while providing them with energy needs at a reasonable rate.

f. Alternate Energy Sources for the CNMI

With the maximum baseload and peak electricity demand on Saipan running at 11.7 and 15.4 MW respectively, there is good opportunity to replace a significant portion of the oil-fired generating capacity with alternate fuels.

In addition to these baseload technologies, solar water heating and biogas technologies have great potential to reduce the demands on the central power system and make it available for more productive use.

Conservation and energy management are listed as baseload electrical energy sources because energy conserved and efficiently used reduces the requirement for additional generation equipment and releases the present capacity for more productive uses. It can provide immediate additional energy at a minimum of cost.

Coal is an exciting alternative fuel for existing oil-fired power generation facilities. The potential for a coal transshipment facility in the CNMI has been studied, and the potential is interesting enough to warrant further detailed studies.

A biomass tree farm is probably the most promising of the baseload energy generation techniques for the CNMI. It uses readily available resources and has the potential for both short-term and long-term contribution to the solution of energy supply problems in the CNMI. Note should also be taken that municipal solid waste and coal can be used as supplementary fuels in a properly designed biomass system.

While coal as a fuel has many attractive features, use levels in the CNMI may not be high enough to justify conversion from oil to coal. Such conversion would require significant land dedication for the plant and the coal handling facility as well as improvements in cargo handling capability at the port. The requirement for coal may be so small as to make them prohibitively expensive, and thus the generated electricity also expensive, unless it was tied to a larger concept.

The solar pond technology concept is progressing through a rapid growth period at the present time. Costs, prohibitive at this time, should drop considerably in the near future. The technology is very attractive, since it has the characteristics to act as a baseload energy producer as well as a peaking electrical energy source.

Ocean currents and tidal electricity have not been sufficiently characterized in the CNMI to determine their potential feasibility. However, the apparent energy content, the scale of the machinery necessary to utilize it and the presently undeveloped state of technology make it unlikely that this technology will be available for the CNMI in the near future.

OTEC has come a long way in the past 10 years. However, it is still not at a stage where a large, baseload volume of electricity can be generated at a reasonable cost.

4. Economic Resources

a. Tourism Industry

While Saipan's tourism industries are scattered throughout the island, many of the most important tourist-related businesses are located in the project area. It is important to review all existing data with a perspective of economic development and, in Saipan, that viewpoint is dominated by the tourism industry.

Presently, Saipan has 797 tourist-class hotel rooms among six hotels (Table VIII-15). Four of the hotels are planning expansions totalling another 468 rooms. Additionally Japan Air Lines is planning a new hotel north of San Roque. Saipan's current tourist attractions maintained by the MVB are listed in Table VIII-16. Three of these are located in the project area and are denoted by asterisk.

Other tourist attractions include the Saipan Museum, which displays many World War II artifacts along with items of cultural interest. There are two golf courses; the Whispering Palms Golf Club, (a flat, nine hole course and Country Club) and a more challenging 18-hole golf course located in Marpi. Saipan also offers scuba diving, snorkeling, water skiing, glass bottom boat excursions, sailing, jet skiing, and a deep sea and sports fishing. Each of the major hotels has tennis courts, and there are several night clubs available for evening entertainment. Tourism is a big business on Saipan. Arrivals increased by 500% during the decade 1971-1981 and in 1983 124,024 visitors arrived and in 1984 there were 131,823 arrivals.

The Marianas Visitors Bureau reports that each tourist spends $170 per day on the average. However, this is generally disputed as being too low. It is recognized that those tourist who travel directly from Japan tend to spend more than those who travel to Saipan via Guam.

In 1982, approximately 1300 people were directly employed in the marianas tourism industry.

Because most of the tourists (more than 80%) are Japanese, the MVB is expanding its promotional efforts to attract visitors from Hong Kong, Taipei, Singapore, Korea and the U.S. Mainland. Furthermore, the MVB is emphasizing Saipan's sightseeing attractions such as Lagoon boat trips, Managaha Island, sport fishing, diving and water sports in general.

C. Legislation and Policies

1. Legislation

a. Areas of Particular Concern

Public Law 3-47 established, among other things, four Areas of Particular Concern (APC). They are:

* Port and Industrial APC
* Lagoon and Reef APC
* Shoreline Zone APC
* Wetland and Mangrove APC

Table VIII-15

SAIPAN TOURIST ACCOMMODATIONS
ALONG SAIPAN LAGOON

Hotel	Existing Rooms	Proposed Rooms	Facilities and Services
Hafa Adai Beach Hotel (Garapan)	198	110 (1986)	Restaurant, outdoor dining, cocktail lounge, coffee shop, gift shop. Swimming pool on the beach. Air Conditioning. Laundry Services. Also, 110 additional rooms proposed for construction start in 1986.
Diamond Hotel (formerly Royal Taga Hotel) (Susupe)	80	329 (1986)	Air conditioned. Laundry service. Japanese restaurant, dining room, cocktail lounge and bar with dancing. Duty fee shop. Swimming and wading pools, tennis courts, volleyball. Two meeting rooms. Renovations planned for 10 story, 329 room hotel.
Saipan Grand Hotel (Susupe)	120	32 (1985)	Air conditioned. Laundry service. Restaurant and bar with dancing. Snack shop. Duty Free Shop. Swimming pool and game room. Conference room. An additional 44 rooms are under construction.
Hyatt Regency Saipan Hotel (Garapan)	183	80 (1988)	Air conditioned. Laundry service. Japanese restaurant. Informal restaurant with outdoor terrace. Formal restaurant. Bar with nightly entertainment and dancing. Gift shop. Beauty and barber shop. Swimming pool, volleyball, shuffle board, horseshoes, tennis courts and fish pond. Meeting room.
Surf Hotel (formerly White Sands Hotel) (San Antonio)	41	71 (1985)	36 hotel rooms and 5 lodges. 71 additional rooms planned for construction in 1986.

Table VIII-15 continued.

Hotel	Existing Rooms	Proposed Rooms	Facilities and Services
Saipan Beach Hotel (Garapan) (formerly Intercontinental)	175		Air conditioned. Laundry Service. Restaurant and bar, coffee shop. Duty Free Shop. Swimming pool, outdoor recreation areas.
Kan Pacific Beach (Tanapag-Proposed)		50 (1986)	Beachside Hotel.
Hotel Nikko Saipan (San Roque-Proposed)		320 (1987)	Resort complex with full accomodations.

Table VIII-16

SAIPAN TOURIST ATTRACTIONS

	-	Banzai Cliff
	-	Bird Island Look-out
	-	Grotto
	-	Japanese Government Memorial Park
	-	Korean Peace Memorial
	-	Ladder Beach
	-	Last Command Post
*	-	Managaha Island
*	-	Micro Beach
	-	Obyan Beach
	-	Okinawa Memorial Park
	-	Old Japanese Hospital
	-	Sugar King Park
	-	Suicide Cliff
	-	Susupe Japanese Memorial
*	-	Tank Display (Beach Road)
	-	Three Memorial Triangles
	-	Yamatomi Rest House

These APC's for the PLAN area are delineated as Maps S2,S1, S4 and S7 on the APC Map Index (Figure VIII-10). Each map is also presented separately on Figure VIII-11, VIII-12, VIII-13, and VIII-14 respectively.

All project activity within or partially within these areas requires a coastal permit from CRMO. Since all four resources are within this PLAN's project area, the following excerpts reflect the standards and highest priorities considered in the granting of permits within the APCs.

Lagoon and Reef APC

Standards:

(A) Manage the development of the reef fishery and mariculture within productive renewable marine resources areas.

(B) Conservation and management of living and non-living resources.

(C) Designate underwater preservation areas for non-extractive recreation purposes in areas representing the richness and diversity of the reef community.

(D) Prevent significant adverse impacts to reefs and corals.

(E) Evaluate and consider the effects of proposed projects on the subsistence fishery.

Use Priorities:

(A) Highest

(1) Conservation of open space, high water quality, historic, and cultural resources.

(2) Preservation of fish and wildlife habitat.

(3) Activities related to the prevention of beach erosion.

Wetland and Mangrove APC

Standards:

(A) Ensure adequate water flow, nutrients, and oxygen levels and avoid adverse effects on natural drainage patterns, the destruction of important habitat, and the discharge of toxic substances.

(B) Preserve the integrity of the mangrove community through strict management, including vigorous enforcement of legal sanctions, on any activity or development which threatens the ecological process of the mangrove community.

(C) Maintain critical wetland habitat so as to increase the potential for survival of known rare and endangered flora and fauna.

(D) Manage development to preclude significant adverse impact to natural hydrological processes.

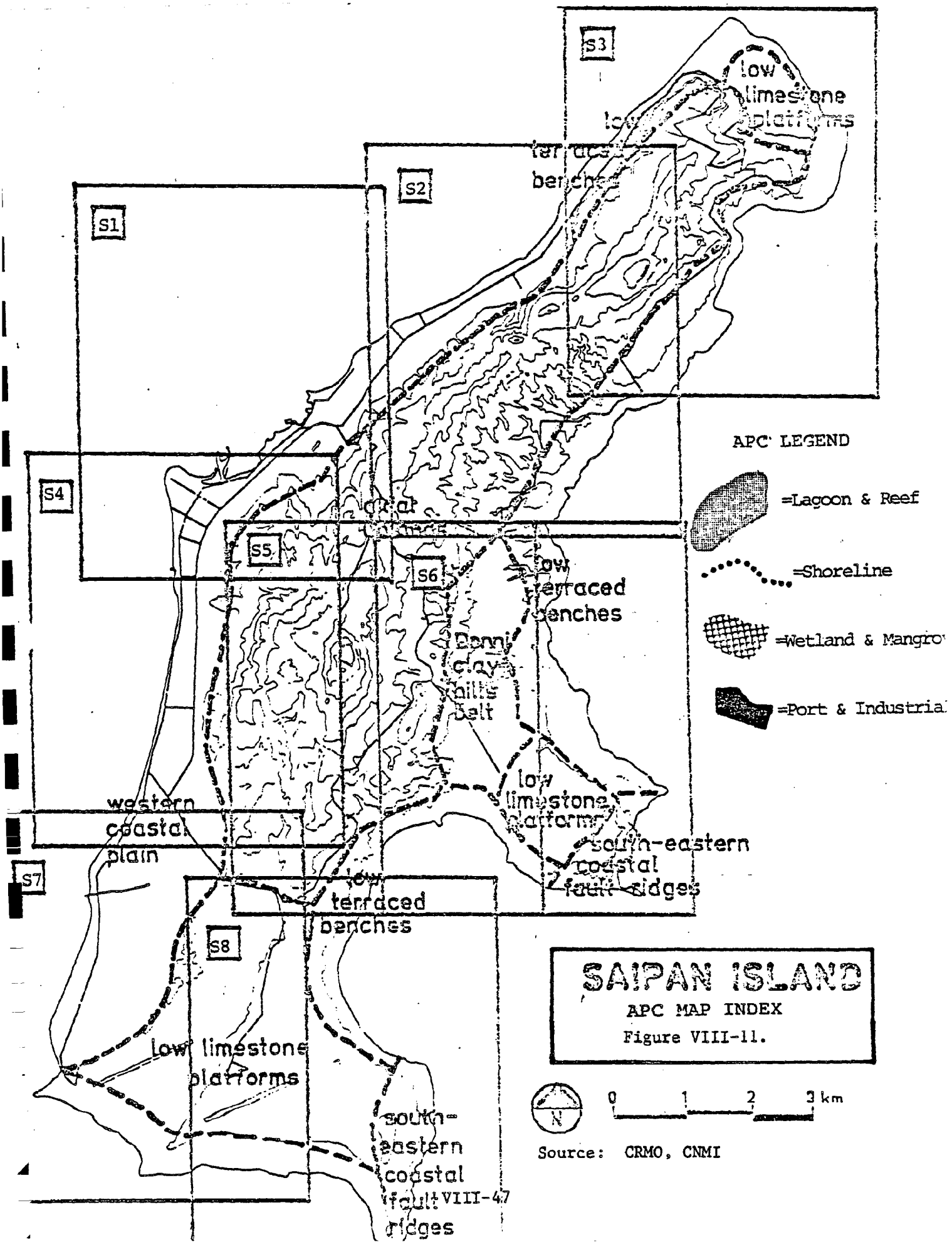
(E) Increase and maintain public land-holdings in and adjacent to the APC.

Use Priorities:

(A) Highest

(1) Preservation and enhancement of mangrove and wetlands area.

(2) Preservation of wildlife, primary productivity, conservation areas, and historical properties in both mangrove and wetland areas.



SAIPAN ISLAND
APC MAP INDEX
Figure VIII-11.

Source: CRMO, CNMI

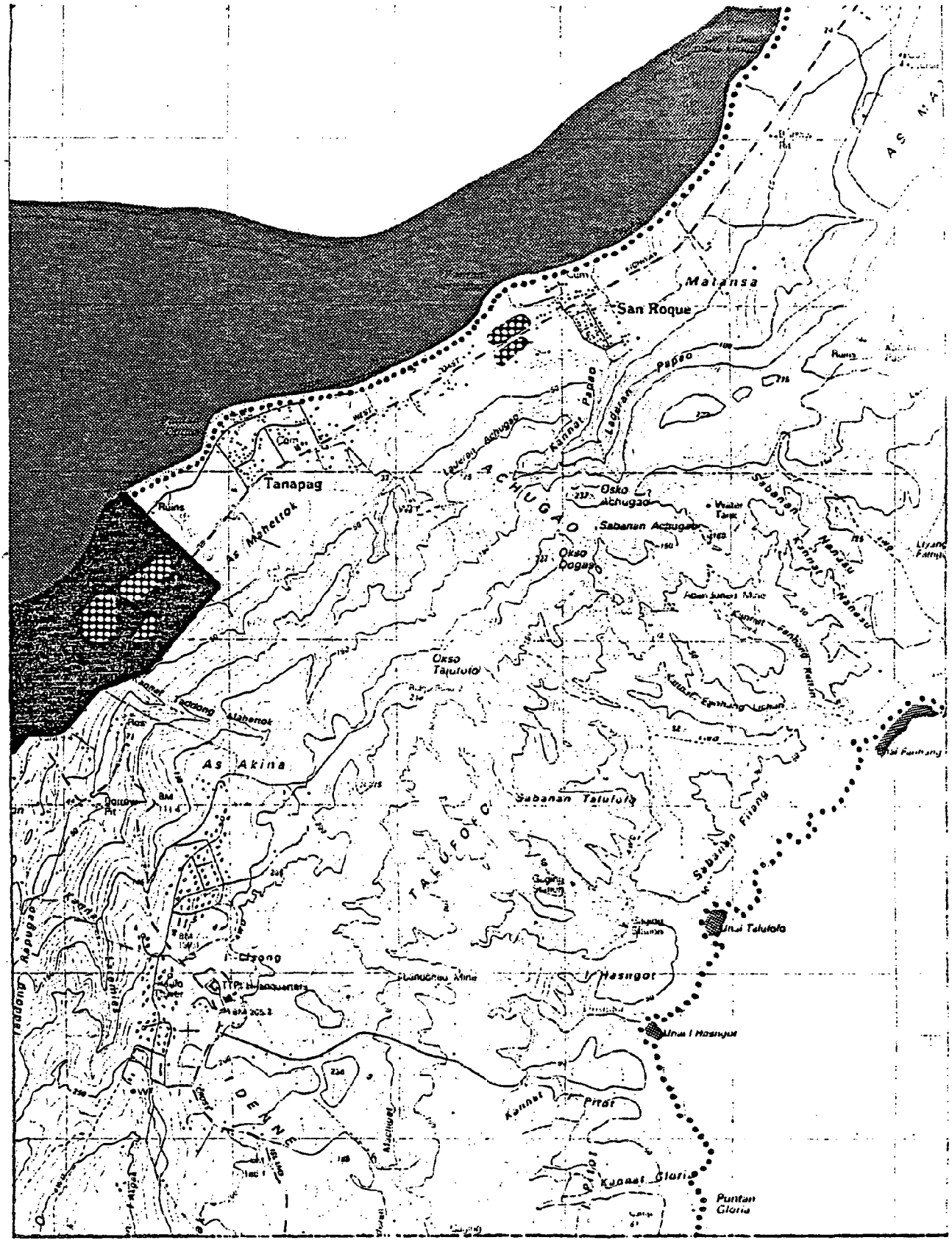


Figure VIII-12.
Source: CRMO, CNMI

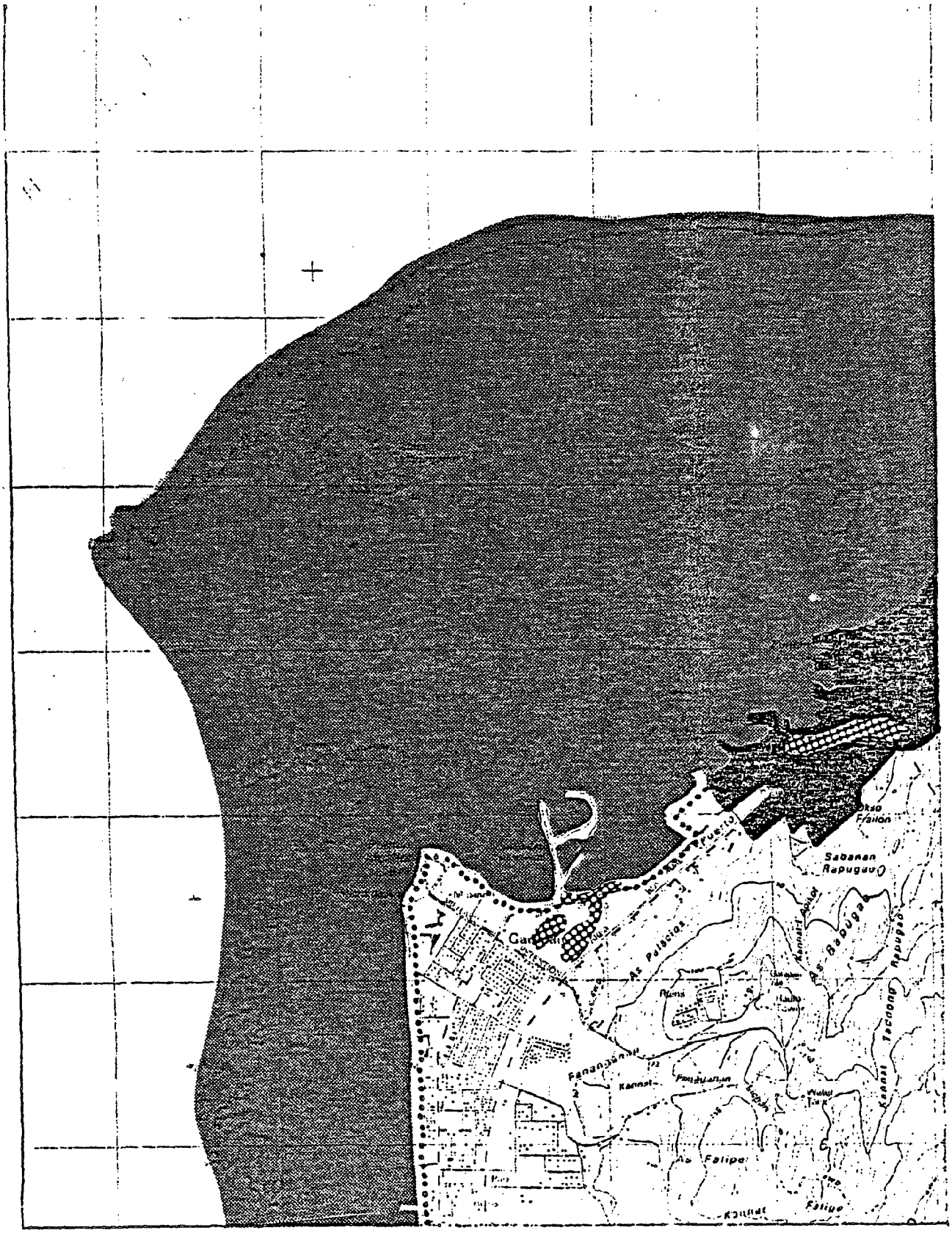


Figure VIII-13.
Source: CRMO, CNMI

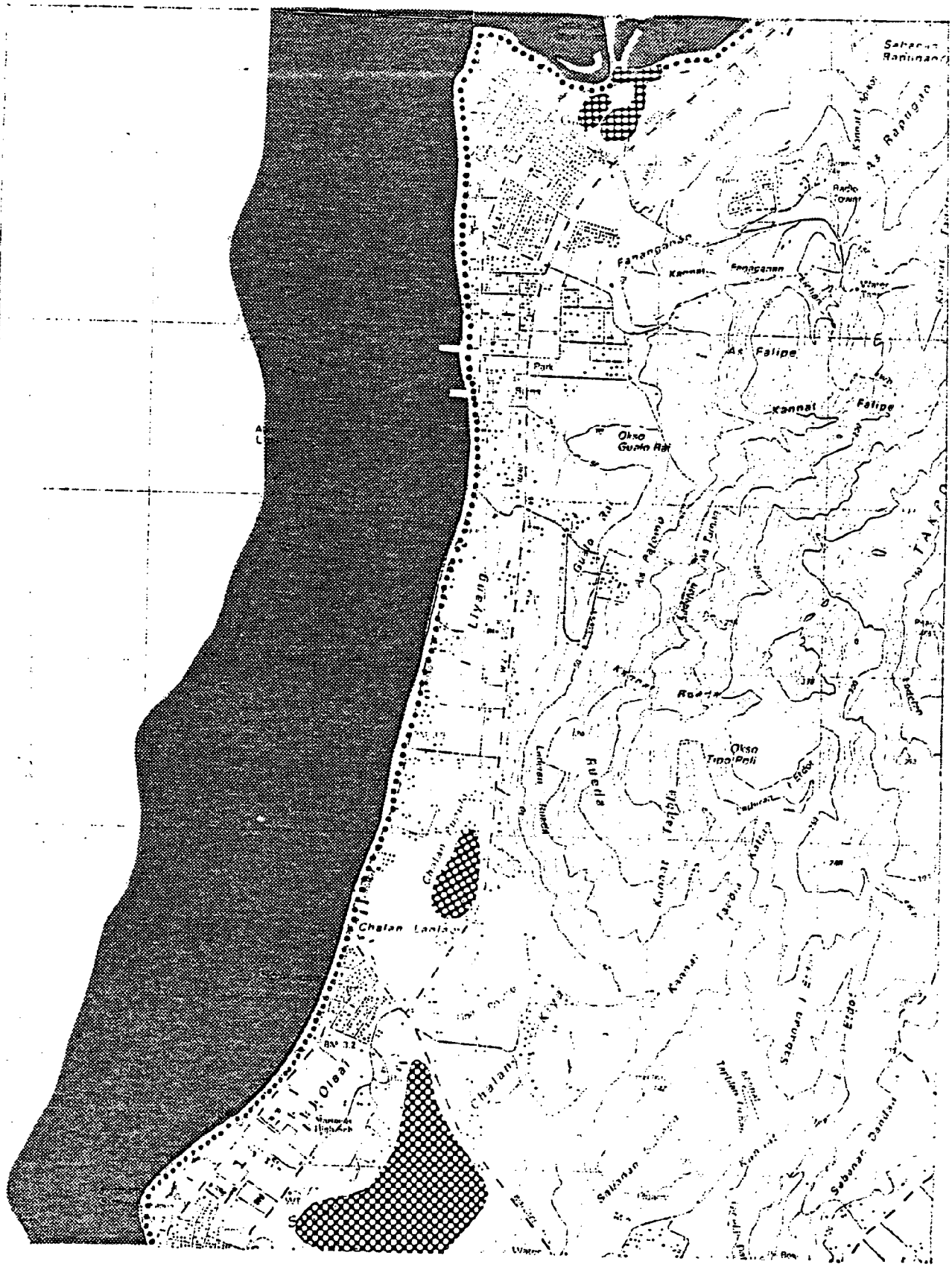


Figure VIII-14.
Source: CRMO, CNMI

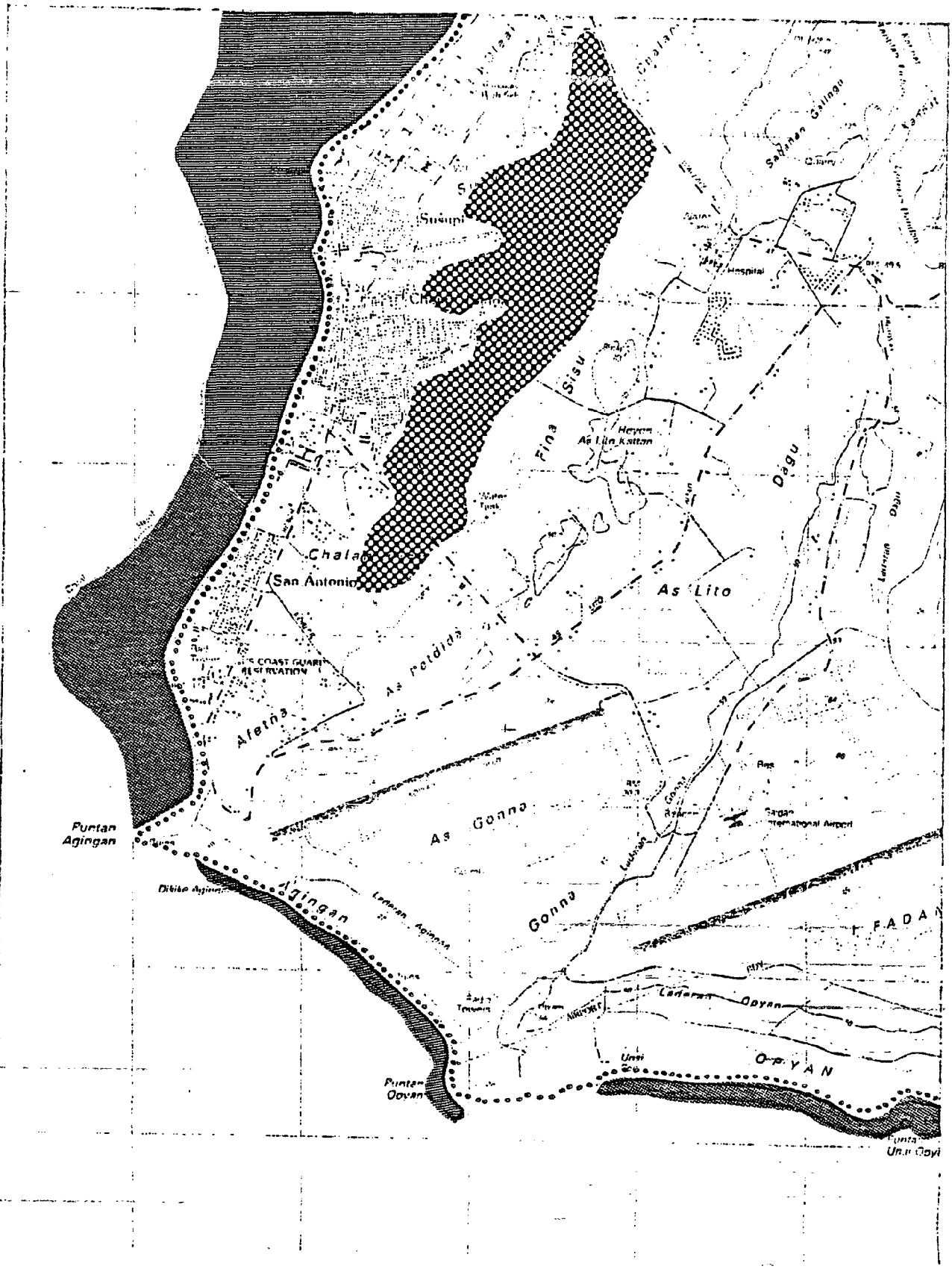


Figure VIII-15.
Source: CRMO, CNMI

Shoreline Zone APC

Standards:

(A) Evaluate and consider in shoreline development decisions, the impact of onshore activities upon the productivity of coastal resources.

(B) Evaluate and consider the effects of shoreline development on natural beach processes.

(C) Reduce the taking of beach sands, gravel, other aggregate, and minerals for any purpose.

Use Priorities:

(A) Highest

(1) Public recreational uses of beach area, including the creation of public shoreline parks and structures enhancing access such as grills, picnic tables, docks, shelters, and boardwalks.

(2) Preservation of fish and wildlife habitat.

(3) Preservation of natural open areas of high scenic beauty.

(4) Activities related to the prevention of beach erosion.

b. Taxation and Revenue-Producing Legislation

The Commonwealth has its own set of tax laws for NMI source income and the rates become effective in June 1982. The two major taxes are gross annual wage and salary taxes (which range from 2% of wages over $1,000 to 9% of wages over $50,000) and gross revenue taxes (which range from 1.5% of amounts over $5,000 to 5% of amounts of $750,000) Exemptions to the gross revenue tax are:

* Agriculture and fisheries production businesses are taxed at the rate of 1% of gross revenues over $5,000 per quarter or over $20,000 per year.
* Commercial banks, savings and loans and other financial institutions are taxed at rates no greater than 2% of gross revenues or 5% net income.
* Exporters are exempted from business revenue tax on export sales.
* Gross revenue derived from manufacturing, wholesaling and ocean shipping is taxed at a maximum rate of 2%. However, the computation of the tax for businesses with combined income is based on the total gross revenues of the business.

There is no tax on real property and no tax on business net income. Excise taxes for first sale or use are assessed for cigarettes, tobacco, beer and malt beverages, wine, sake, soft drinks etc.

A Bar Tax assesses 3% of the total charges for any beverage sold or consumed.

A Hotel Occupancy Tax assesses 10% of the amount paid for accommodations.

c. Land Ownership

The constitution of the NMI restricts land ownership to persons of NMI descent. Persons of non-NMI descent may lease land; however such lease periods vary and never exceed 40 years, including renewal rights.

A corporation may be considered of NMI descent as long as it is incorporated in the Commonwealth, has its principal place of business in the Commonwealth, directors at least 51% of whom are persons of NMI descent, and has voting shares at least 51% of which are owned by persons of NMI descent.

d. Protection of Resources

Seven major public laws of the Commonwealth of the Northern Mariana Islands are concerned with protection of resources. The CNMI Department of Natural Resources and Department of Health and Environmental Services are created under PL 1-8, "The Executive Branch Organization Act of 1978" (CMC, Div. 2, Chapter 12 1 CMC, Div. 2 Chapter 12).

The DNR is to manage the use of the submerged lands of the Commonwealth for purposes such as mineral and petroleum extraction under PL1-23, "The Submerged Lands Act" (2 CMC, Div. 1 Chapter 2).

PL 2-7, the "Marine Sovereignty Act of 1980" (2 CMC, Div. 1, Chapter 1) declares sovereignty over internal waters of the Commonwealth, archipelagic waters and territorial seas, "regardless of their depth or distance from the coast, as well as their airspace, seabed, and subsoil and the resources contained therein." A 200 mile exclusive economic zone is declared. (2 CMC, Div. 1, Chapter 1).

The Division of Environmental Quality of the Department of Health and Environmental Services is created under PL 3-23. (1 CMC, Div. 2, Article 5).

PL 3-42 declares the CNMI a "nuclear and chemical free zone" (2 CMC, Div. 2, Chapter 3).

PL 3-47 establishes the Coastal Resources Management Program in law (2 CMC, Div. 1, Chapter 5).

These laws supersede previous Trust Territory Code and Marianas District Code Provisions which covered similar issues.

Coastal wetlands, beaches, reefs, estuaries and fish and wildlife habitats receive specific protection under Commonwealth Public Law 3-47 (effective February 11, 1983) which establishes the Coastal Resources Management Program in the Commonwealth of the Northern Mariana Islands. CRMP Regulations, effective August 26, 1981, specifically recognize these areas as "areas of particular concern" and give the highest priority to their protection and proper use. A permitting system with use standards and priorities is in place for review of all activities which have the potential to directly and significantly impact coastal resources. The CRMO has an enforcement staff which implements permits, the law, and regulations through daily monitoring.

According to section 5, PL 2-51 (effective October 19, 1981) protection of fish, game and endangered and threatened species is vested exclusively in the CNMI Department of Natural Resources. By law, the DNR Director must determine whether resident species of fish, wildlife or plants are endangered or threatened. The survival of such species is the responsibility of the Director, to be effected, if necessary, through acquisition of land or aquatic habitat or through additional regulations. Regulations imposing hunting and fishing seasons, licenses and other restrictions were adopted in August 1983. The Fish and Wildlife Division of DNR and CRMO have an enforcement staff to carry out the law and its regulations.

PL 3-23 creates the Division of Environmental Quality of the Department of Health and Environmental Services which regulates discharge of pollutants and hazardous substances and which would include within its authority all of the areas in question. The DEQ also monitors marine and drinking water and pesticides. DEQ regulations have been adopted covering earthmoving, erosion control, underground injection, and air pollution control. DEQ does not have an enforcement staff per se, but staff personnel regularly test water quality and act on problems reported to them or encountered during monitoring in the field. Their concerns include threshold levels of water quality to ensure a healthy marine habitat. Civil penalties for violations are provided for.

"The Submerged Lands Act," PL 1-23 (effective February 23, 1979) directs the Commonwealth DNR to manage the use and disposition of submerged lands of the CNMI. Regulations covering licenses for mineral and petroleum exploration and a permitting program were issued in February 1983.

PL 2-7, "The Marine Sovereignty Act of 1980," would also include many, if not all of these areas within its claim of sovereignty. Penalties for violations of this law are included. Responsibility for enforcement rests with the Director of the Commonwealth Department of Commerce and Labor.

Dumping of nuclear and chemical wastes into the ocean or seabed surrounding the Commonwealth is also banned under PL 3-42 (effective January 1983), which would directly or indirectly apply to relevant areas. Criminal and civil penalties are provided for violations. DNR and CRMO have the primary enforcement responsibility.

By its Constitution, adopted in December 5, 1976, the Commonwealth of the Northern Mariana Islands set major policy on designation of natural resources for public purposes under Article XIV: Natural Resources. In section 2, Uninhabited Islands, the island of Managaha is to be maintained as an uninhabited place and used only for cultural and recreational purposes.

Under the Constitution's Article IX, "Public Lands," the Marianas Public Land Corporation is responsible for "the management and disposition of public lands" in the Commonwealth. The nine member board of directors of the MPLC is

appointed by the Governor with the advise and consent of the Senate and is to "direct the affairs of the corporation for the benefit of the people of the Commonwealth who are of Northern Marianas descent."

3. Policies

a. Established CZM Goals and Policies

The following goals and policies have been established with respect to coastal resources. They are excerpted below.

It shall be the Commonwealth's goals to:

- Provide for the orderly use and development of coastal resources of the Northern Marianas.
- Protect, maintain and replenish the coastal resources of the Northern Marianas.
- Provide for governmental coordination in order to implement the Coastal Resources Management Program in a manner which is direct and effective.
- Promote social and economic development and growth while recognizing the need to balance the limited coastal resources.
- Manage the impacts of human activity on the use and development of renewable and non-renewable resources so as to maintain and enhance the long-term productivity of the coastal environment.
- Protect, maintain, preserve and restore to the extent practicable the overall quality of the coastal resources, the natural and man-made resources therein and the scenic and historic resources for the benefit of residents and visitors to the Commonwealth.

Commonwealth-wide Policies

Government Processes

The Commonwealth shall:

- Encourage land-use master planning, floodplain management and the development of zoning and building code legislation.
- Provide for adequate consideration of the national interest, including that involved in planning for, and in the siting of, facilities (including energy facilities in, or which significantly affect, the Commonwealth's coastal zone) which are necessary to meet requirements which are other than local in nature.
- Not permit to the extent practicable, development of identified hazardous lands including floodplains, erosion-prone areas, storm wave inundation areas, air installation crash and sound zones and major fault lines unless it can be demonstrated that such development does not pose unreasonable risks to the health, safety or welfare of the people of the Commonwealth and complies with applicable laws.

- While developing an efficient and safe transportation system including that which is waterborne, mitigate to the extent practicable adverse environmental impacts, including those on aquifers, beaches, estuaries and other coastal resources.
- Require any development to strictly comply with erosion, sedimentation, and related land-use districting guidelines, as well as other related land and water use policies for such areas.
- Maintain or increase coastal water quality through control of erosion, sedimentation, runoff, siltation and sewage and other discharges.
- Recognize and respect locations and properties of historical significance throughout the Commonwealth, and ensure that development which would disrupt, alter, or destroy these shall be subject to Commonwealth and any applicable federal laws and regulations.
- Recognize areas of cultural significance. Development which would disrupt the cultural practices associated with such areas shall be subject to a consultation process with concerned ethnic groups and any applicable laws and regulations.

Resource Policies

The Commonwealth shall:

- Require compliance with all local air and water quality laws and regulations and any federal air and water quality standards.
- Not permit, to the extent practicable, development with the potential for causing significant adverse impact in fragile areas such as designated and potential historic and archaeological sites, critical wildlife habitats, beaches, designated and potential pristine marine and terrestrial communities, limestone and volcanic forests, designated and potential mangrove stands and other wetlands.
- Manage ecologically significant resource areas for their contribution to marine productivity and value as wildlife habitats, and preserve the functions and integrity of reefs, marine meadows, salt ponds, mangroves and other significant natural areas.
- Manage the development of the local subsistence, sport and commercial fisheries, consistent with other policies.
- Protect all resources within the coastal waters, particularly sand, corals, fish and habitat from any taking beyond sustainable levels and in the case of marine mammals and any species on the Commonwealth and Federal Endangered Species list, from any taking whatsoever.
- Encourage preservation and enhancement of, and respect for the Commonwealth's scenic resources

through the development of, increased enforcement of, and compliance with sign, litter, zoning, building codes, and related land-use laws.

- Discourage to the maximum extent practicable visually objectionable uses so as not to significantly degrade scenic views.
- Encourage the development of recreation facilities which are compatible with the surrounding environment and land-use.
- Encourage the preservation of traditional rights of public access to and along the shorelines consistent with the right of private property owners.
- Pursue agreements for the acquisition and/or use of any lands, where necessary, to guarantee traditional public access to and along the shorelines.
- Encourage agricultural development and the preservation and maintenance of critical agricultural lands for agricultural uses.

APPENDIX

APPENDIX A

Checklist of Algae, Coralline Algae and Seagrass found in the various planning areas of Saipan Lagoon

SPECIES	PLANNING AREA						
	1	2	3	4	5	6	7
Chlorodesmis fastigiata	x		x			x	
Microcoleus lyngbyaceus	x	x	x	x	x	x	x
Avrainvillea laceerata	x		x		x		
Halimeda opuntia	x	x	x	x	x	x	x
H. macroloba	x	x	x	x			
Caulerpa sertularioides		x		x		x	x
Schizothrix calcicola	x	x	x		x	x	x
Dictyota sp.	x	x	x	x	x	x	x
D. bartayresii	x			x			
Sargassum polycystum	x		x	x		x	
Padina tenuis	x	x	x	x			
Hydroclathrus clathratus				x			
Turbinaria ornata	x	x			x	x	x
Schizothrix mexicana	x	x		x	x	x	x
Avrainvillea obscura				x	x		
Enteromorpha clathrata					x	x	
Gelidiella acerosa				x	x		
Jania capillacea				x		x	
Chnoospora minima				x			
Udotea argentia		x					
Tydemania expeditionis		x					x
Caulerpa cupressoides					x	x	x
Hypnea sp.					x		x
Gracilaria sp.				x	x		
Acanthopora spicifera				x	x		
Seagrasses							
Halodule uninervis		x		x	x	x	x
Enhalus acoroides	x	x		x	x	x	x
Halophila minorx	x	x	x	x	x		
Coralline Algae							
Parolithon onkoides	x	x	x	x	x	x	x
Lithophyllum moluccense	x	x	x	x	x	x	x
	1	2	3	4	5	6	7
TOTALS							
Algae 25	12	11	9	16	14	12	10
Seagrass 3	2	3	1	3	3	3	1
Coralline Algae 2	2	2	2	2	2	2	2

APPENDIX B

Checklist of Corals found in Planning Areas of the Saipan Lagoon.

SPECIES	PLANNING AREA						
	1	2	3	4	5	6	7
Acanthastrea echinata			x				
Acropora syringodes				x			
A. teres		x					x
A. hebes				x			
A. sp.				x			
A. valida							x
A. tenuis							x
A. palifera					x		
A. gravida					x		
A. irregularis					x	x	x
A. nasuta	x	x	x	x	x	x	x
A. smithi	x		x	x	x		x
A. sp.	x						
A. formosa	x			x		x	
A. palifera	x	x	x	x			x
A. surculosa				x	x		x
A. striata	x						
A. aspera	x	x	x	x		x	x
A. variabilis	x						
A. vigata	x						
A. humilis			x	x	x		
A. squarrosa			x				
A. cerealis	x						
A. studeri	x						
A. convexa		x					
Acrhelia horrescens			x			x	
Astreopora myriopthalma	x		x				
Alveopora sp.	x						
Coscinaraea columna				x			
Diploasthrea heliopora	x				x		x
Distichopora violacea	x						
Echinopora lamellosa	x		x				
Echinophyllia aspera		x					
Euphyllia glabrescens						x	
Favia matthaii			x	x	x	x	x
F. favus	x						x
F. favites						x	
F. stelligera	x		x	x	x		
F. pallida	x	x	x	x		x	x
F. danae		x					
Favites palavensis						x	
F. favosa			x			x	

SPECIES	PLANNING AREA						
	1	2	3	4	5	6	7
Fungia fungites	x	x	x				
F. scutaria	x		x				
Galaxea facicularis			x	x			
G. hexaganolis	x		x				
Galaxura sp.					x		
Goniastrea pectinata	x	x	x			x	
G. edwardsi			x		x	x	x
G. retiformis	x	x	x			x	
G. parvistella	x	x	x			x	
Goniopora sp.	x						
Heliopora coerulea	x		x	x	x		x
Hepolitha limax			x				
Leptastrea purpura	x	x	x				
L. bottae	x		x				
L. sp.						x	
Leptoria phrygia	x					x	x
Leptoseris explanata	x		x				
Lobophylla corymbosa			x				x
L. costata		x	x				
L. hemprichii	x		x				x
Lobophytum sp.				x			
Merulina sp.	x						
Millepora exaesa	x			x			
M. dichotoma	x	x	x	x	x	x	
M. latifolia						x	
M. platyphylla	x	x		x	x		
Montipora tuberculosa							x
M. verrilli		x	x			x	x
M. hoffmeisteri		x					
M. verrucosa			x	x	x	x	
M. elschneri	x		x	x			
M. lobulata		x					
M. ehrenborgii	x		x				
M. foveolata				x	x		x
M. caliculata				x			
M. sp.		x		x		x	x
M. sp.			x	x		x	x
M. sp.			x				
Neliopa sp.	x						
Oulophyllia crispa				x			
Pachyseris sp.					x		
Pavona (Polyastra) sp.			x	x			
P. (Pseudocolumnastrea) pollicata				x			
P. venosa	x						
P. obtusata		x					
P. rondifera			x				
P. sp.			x				
P. varions			x				
P. duerdeni	x				x	x	x

SPECIES	PLANNING AREA						
	1	2	3	4	5	6	7
Pocillopora danae	x					x	
P. setchelli	x			x	x		x
P. elegans	x			x	x		
P. damicornis	x	x	x	x	x	x	x
P. eydouxi	x	x		x	x		x
P. verrucosa			x				x
P. elegans	x						
Polyphyllia talpina	x						
Platygyra pini			x		x		x
P. sinensis	x		x				
P. rustica	x		x				
P. lamellina		x					
P. daedalea		x	x			x	x
Plesiastrea versipora	x						
Plerogyra sinuosa		x					
Porites (Synaraea) iwayamaensis			x				
P. reticulosa			x				
P. cylindrica				x		x	
P. australiensis					x		
P. rus		x	x	x	x	x	x
P. cocosenensis		x					
P. annae		x					
P. lutea	x	x	x	x	x	x	x
P. compressa				x			
Psammocora stellata	x						
P. contigua	x		x	x	x	x	x
P. nierstraszi			x	x			
P. digitata	x				x	x	
P. (Stephanaria) togianeusis		x	x				
Sarcophyton sp.			x				
Scapophyllia cylindrica	x						
Seriatopora hystrix	x		x				
S. crassa			x				
Stylocoeniella armata	x	x	x	x		x	
Symphyllia valenciennesii		x					
Stylophora mordax	x		x	x	x	x	x
Tubastraea aurea		x					
Tubipora musica	x						
ALL AREAS	1	2	3	4	5	6	7
TOTALS 129	61	31	61	41	29	37	32

VOLUME I

PART C

BIBLIOGRAPHY OF REFERENCES

Listing of References
Key to Understanding

The following bibliography is a compilation of references used during the preparation of the SAIPAN LAGOON USE MANAGEMENT PLAN. Many of these are already referred to in Volumes I, II and III of the PLAN.

Because of the number of references used, the listing is organized differently than a conventional listing of references. There are no double listings, even though some report/study may fall into more than one section heading. Each report/study is listed under the section heading most appropriate to the references use in this PLAN. The format is as follows.

Section Heading

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern

The following is a brief description of each part of the bibliography.

Sections Headings:
- Population
- Housing
- Economics
- Terrestrial Flora & Fauna
- Administration
- Coastal Zone Management
- Port & Harbor
- Coastal Resources
- Maps
- Land Use
- Dumps
- Environmental Impact Statements
- Hydrology
- Parks and Recreation
- Tourism
- Water/Wastewater
- Marine Flora & Fauna
- Historical Properties/Cultural Resources
- Physical Paramaters
- Energy
- Miscellaneous

Title : As given on the Report/Study
Author: Individual author where noted, otherwise the agency or organization
Date : Specific date where given: day/month/year where given
No. of Pages: Total number including appendices

Source/
Publisher: Organization/agency the report/study was done for

Location of
Reference: Coded as follows:

- CRMO: Coastal Resource Management Office Library (Saipan)
- C&L : Dept. of Commerce & Labor, CNMI (Saipan)
- NFML: Nieves Flores Memorial Library (Agana, Guam)
- CPP : Office of the Chief Physical Planner, CNMI (Saipan)
- DEQ : Division of Environmental Quality (Saipan)
- DPW : Department of Public Works CNMI (Saipan)
- UOGML: University of Guam Marine Laboratory (Guam)
- F&W : Fish and Wildlife (Guam)
- UOG : University of Guam Library (Guam)
- HPO : Historic Preservation Office (CNMI)

Area of Concern:

- International
- National (US)
- CNMI
- Saipan
- Saipan Lagoon Project Area (Lagoon-wide)
- Guam

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
The Development Criteria of the Preliminary Coastal Plan	Lutz, R., T. Rauk and B.J. Washom	Aug. 1975	29	U.S. Dept. of Commerce, NOAA, Office of Sea Grant. USC-SG-AS1-75	CRMO	National
Coastal Environmental Management	Conservation Foundation for the Council on Environmental Quality	1980	158	Conservation Foundation for the Council on Environmental Quality	CRMO	National
Coastal Land & Water Use Plan	Coastal Resources Management Office: Planning & Budget Affairs Office	1979	219	Commonwealth of the Northern Marianas Islands	CRMO	CNMI
Ecological Guidelines for Tropical Coastal Development	Odum, William E.	1976	54	UNESCO, United Nations Environment Programme, Savedish Int'l Development Authority & World Wildlife Fund	CRMO	International
			PORT AND HARBOR			
Preliminary Port and Harbor Study of the Commonwealth of the Northern Marianas Islands	U.S. Army Corps of Engineers, Pacific Ocean Division	1981	54	U.S. Dept. of Interior	CRMO	Saipan Lagoon Project Area Tanapag Harbor Planning Area

LISTING OF REFERENCES

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
			POPULATION			
Number of Inhabitants 1980 Census of population	Bureau of the Census	1980	N/A	Government Printing Office	C&L	CNMI, Saipan
			HOUSING			
General Housing Characteristics	Bureau of the Census	1980	17	Government Printing Office	C&L	CNMI, Saipan
			ECONOMICS			
Assessment of Current and Prospective Socio-Economic Conditions in the Commonwealth of the Northern Mariana Islands	Robert S. Nathan Associates, Inc.	1977	478	The Commonwealth Development Commision and Commonwealth Office of Planning & Budget Affairs	CRMO C&L	CNMI
Overall Economic Development Strategy-1981	Commonwealth of the Northern Marianas Islands	1982	66	CNMI	CRMO	CNMI
Overall Economic Development Strategy-1983	Planning and Budget Office of the Governor, CNMI	1984	100	U.S. Dept. of Commerce Economic Development Administration	CRMO	CNMI

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Economic Growth & Development through Unity	Pacific Basin Develop. Conf. Real	1980	298	Pacific Basin Development Council	CRMO	CNMI
Business Prospectus Under Coastal Zone Management	Estate Research Corp.	1976	18	Office of Coastal Zone Management	CRMO	National
		TERRESTRIAL FLORA & FAUNA				
A study on Carolinian Medicinal Plants on Managaha Island	Kaster, Hatnat and Vicente Tebit	July 1981	37	Saipan CRMO	CRMO	Saipan Lagoon Managaha Island
Ornithological Survey of Wetlands in Guam, Saipan Tinian and Pagan	J.C. Tenorio and Asso.	Aug. 1979	202	ACOE	CRMO	Guam & CNMI: Saipan, Tinian Pagan
		ADMINISTRATION				
35th Annual Report to the United Nations in the Administration of the Trust Territory of the Pacific Islands	Dept. of Interior	1982	248	Government Printing Office	CRMO	CNMI
		COASTAL ZONE MANAGEMENT				
Proceedings-Pacific Basin Coastal Zone Management Conference	Economic Development and Planning/ Tourism Office. American Samoa Government	1982	N/A	American Samoa Government	CRMO	International

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
			COSTAL RESOURCES			
Bibliography of Coastal Planning Resources	Coastal Zone Mgt. Program, CNMI	1979	8	CNMI/CRMO	CRMO	All Areas of Concern
			MAPS			
Bibliography of Maps for Saipan, Tinian, Rota and CNMI	Not Listed	Not Listed	9	Unknown	CRMO	CNMI
			LAND USE			
Zones and Land Use Districts for Saipan, Rota and Tinian	Duenas & Swavely Incorporated	April 1984	75	Office of the Chief Physical Planner CNMI	CPP CRMO	Saipan, Rota, Tinian
National Landmarks' Survey of the Islands of the Pacific	Depts. of Botany & Zoology University of Hawaii	Sept. 1982	179	University of Hawaii, Honolulu	CPP	CNMI, International
Baseline Information and Problem Identification: Water and Related Land Resources, CNMI	U.S. Army Corps of Engineers	1984	___	Dept. of the Army Engineer District, Ft. Shafter, Hi	CRMO	CNMI, Saipan

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
			DUMPS			
Interim Operations Plan, Puerto Rico Dump	Duenas & Swavely Incorporated	Aug. 1984	32	Division of Environmental Quality, DPH&ES	DEQ	Saipan Lagoon Project Area Puntan Maggi Planning Area
			ENVIRONMENTAL IMPACT STATEMENTS			
Detailed Project Report and Environmental Statement, Saipan Small Boat Harbor	U.S. Army Corps of Engineers	March 1981	335	U.S. ACOE Fort Shafter, Hi.	CRMO	Saipan Lagoon Project Area Tanapag Harbor Planning Area
Environmental Assessment for General Management Plan and Comprehensive Design, American Memorial Park, Saipan	National Park Service Dept. of Interior	Sept. 1983	31	National Park Service, Dept. of Interior	CPP CRMO	Saipan Lagoon Project Area, Puntan Muchot Planning Area
Hotel Nikko Saipan EIS	M&E Pacific, Inc.	March 1985	81	M&E Pacific, Inc.	CRMO	Saipan Lagoon Project Area, Puntan Mudot Planning Area
			HYDROLOGY			
Reconnaissance Report-Lake Susupe/Chalan Kanoa Area Flood Control	U.S. Army Corps of Engineers	July 27, 1978	16	U.S. ACOE Fort Shafter, Hi.	CRMO	Saipan Lagoon Project Area, Puntan Susupe Planning Area

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Garapan Flood Control-Detailed Project Report and Environmental Statement	U.S. Army Corps of Engineers	1984	375	U.S. Army Corps of Engineers, Fort Shafter, Hi	CRMO	Saipan Lagoon Project Area Garapan Lagoon Planning Area
			PARKS & RECREATION			
General Management Plan and Comprehensive Design American Memorial Park, Saipan	National Park Service, Dept. of Interior	Sept. 1983	29	National Park Service, Dept. of Interior	CPP CRMO	Saipan Lagoon Project Area Puntant Muchot Planning Area
Park and Outdoor Recreation Resource Study-Northern Mariana Island	H. Mogi-Planning and Research Inc.	April 1977	253	Northern Mariana Island Planning Office	CRMO	CNMI, Saipan
Coastal Recreation: A Handbook for Planners and Managers	U.S. Dept. of Commerce: National Oceanic & Atmospheric Admin. Office of Coastal Zone Management	1976	36	U.S. Dept. of Commerce	CRMO	National
Park and Outdoor Recreation Resource Study	H. Mogi-Planning and Research, Inc.	April 1977	253	CNMI Planning Office	CRMO	Lagoon Wide
Managaha Island Marine Park Management Plan, Draft	Pacific Basin Environmental Consultants	May 1985	91	PBEC, Inc.	CRMO	Saipan Lagoon Managaha Island
CNMI Marine Parks Management Plan	Pacific Basin Environmental Consultants	March 1985	99	PBEC, Inc.	CRMO	CNMI: Saipan, Tinian, Rota

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
			TOURISM			
1983 Annual Report-Marianas Visitors Bureau	Marianas Visitors Bureau	1983	33	Marianas Visitors Bureau, CNMI	CRMO MVB	CNMI, Saipan
Tourism Services Manpower Development Study of the American Pacific Islands	School of Gravel Industry Mgt.	1982	161	Pacific Basin Development Council	CRMO	CNMI
			WATER/WASTEWATER			
Assesment of Existing Wastewater Facilities-Interim Report	Barrett, Harris & Associates, Inc.	1984	25	Dept. of Public Works, CNMI	DPW	Saipan
Wastewater Facilities Plan for the Island of Saipan	M&E Pacific, Inc.	1980	____	Dept. of Public Works, CNMI	DPW	Saipan
Saipan Water System Study	GK²/Magire Group	1981	____	Dept. of Public Works, CNMI	DPW	Saipan
			MARINE FLORA AND FAUNA			
A Survey of the Fish Resources of Saipan Lagoon	Amesbury, S.S. et. al	March 1979	58	UOGML Tech. Rpt. No. 52	UOGML, UOG, F&W, CRMO	Lagoon-Wide
Marine Survey of Tanapag, Saipan: The Power Barge "Impedence"	Doty, J.E. and J.A. Marsh Jr.	March 1977	147	UOGML Tech. Rpt. No. 33	UOGML, UOG, CRMO	Inner-Tanapag Harbor

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
The Acanthaster Survey of Saipan, Mariana Islands, 1969. Structure and Ecology of the Saipan Reefs in Relation to Predation by Acanthaster planci (Linnaeus)	Goreau, T.F. et. al.	1969	35	Office of Naval Research/Research Foundation of the State University of New York	UOGML, UOG	Lagoon-Wide
Marine Survey of Saipan Lagoon. A Preliminary Coral Survey of Saipan Lagoon	Gawel, M.	July 1974	13	UOGML Environmental Survey Report No. 11	UOGML	Lagoon-Wide
Atlas of the Reefs and Beaches of Saipan, Tinian and Rota	Eldredge, L.G. and R.H. Randall	July 1974	161	UOGML Environmental Survey Report No. 11	UOGML	Island-Wide
		HISTORICAL PROPERTIES/CULTURAL RESOURCES				
Cultural Resource Survey of the Susupe-Chalan Kanoa Flood Control Study Area	Thomas, M.R. & S.T. Price	March 1980	59	Pacific Studies Institute, Guam, for U.S. Army Corps of Engineers	HPO	Chalan Kanoa
Archaelogical Reconnaissance of the American Memorial Park	Thomas, M.R. and S.T. Price	Nov. 1979	62	Pacific Studies Institute, Guam, for National Park Service	HPO	America Memorial Park (Micro Beach to Tanapag Harbor
Underwater Suvey of Tanapag Lagoon for Historic Properties	Pacific Basin Environmental Consultants	May 1985	94	PBEC, Inc.	HPO	Saipan Lagoon

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Mini-submarine Search Project Report in the Tanapag Historic Lagoon: Saipan CNMI	Concepcion, Vicente M.	March 1982	25	Historic Preservation Office	HPO	Tanapag Harbor
Saipan Lagoon Circulation Study	M&E Pacific Inc.	June 1980	64	M&E Pacific Inc. Honolulu, Hi. for U.S. Army Corps of Engineers	CRMO	Garapan and Susupe/Chalan Kanoa
Beaches, Coastal Environments and Alternate Sources of Fine Aggregate in the Northern Mariana Islands	Doan, D.B. and H.G. Siegrist	Dec. 1979	107	Not Listed		CRMO, CEO Island Wide
Atlas of the Reefs and Beaches of Saipan, Tinian and Rota	Eldredge, LG. and R.H. Randall	1980	___	UOGML for CRMO	CRMO	Island Wide
			ENERGY			
Energy Strategies Toward a Solar Future	Kendall, H.W. & Steven J. Nadis	1980	320	Ballinger Publishing Co. Cambridge Mass.	CPP	General
Energy Source Present and Future	Naylor, Benjamin F.	1975	27	Laneford Publishing Co.	CPP	General
Review of Energy Supplies	Lindaeu, H.R.	1973	39	12th World Gas Conf. Report	CPP	General

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
1982 State of Energy	Lee, Bernard S.	Feb. 1982	19	9th Energy Tech. Conf.	CPP	General
Energy, The New Look	Hyde, Margret O.	1981	138	McGraw Hill Book Company	CPP	General
The National Energy Policy Plan	U.S. Dept. of Energy	July 1981	25	U.S. Dept. of Energy	CPP	General
Solar Energy	U.S. Dept. of Energy	1979	27	U.S. Dept. of Energy	CPP	General
Prospectus for World Energy Resources	Frank C. Schora J.S. Sanka, H.L. Feldkirchner, R. L. Mociut	July 1979	58	Pacific Energy Challenge and Perspectives. Gas Dev. Corp. Calif.	CPP	General
Territorial Energy Assessment	U.S. Dept. of Energy	Dec. 1982	206	U.S. Dept. of Energy	CPP	(TTPI) General
Energy Topics; International Gas Tech. Highlights	Inst. of Gas Tech.	Oct, 1979	4	Inst. of Gas Tech.	CPP	General
Energy Topics; International Gas Tech. Highlights	Inst. of Gas Tech.	Aug 1982	6	Inst. of Gas Tech.	CPP	General
Energy Topics; International Gas Tech. Highlights	Inst. of Gas Tech.	Jan 1980	4	Inst. of Gas Tech.	CPP	General

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Pacific Coal Trade: Economic Opportunities for CNMI, Coal Movement in the Pacific Basin Study	Dr. W. Miklus & Raymond W. Jenkens	June 1983	146	The Research Institute; Pacific Basin Dev. Council	CPP, CRMO	Coal
Clean Energy from Coal, Domestic Resources for America's Energy Future	U.S. Dept. of Energy	Oct. 1983	8	U.S. Dept. of Energy	CPP	Coal
Demonstrated Reserve Base of Coal in the U.S. Jan. 1983	U.S. Dept. of Energy	May 1983	121	U.S. Dept. of Energy	CPP	Coal
Coal Distribution Jan. - June 1981	U.S. Dept. of Energy	Oct 1981	77	U.S. Dept of Energy	CPP	Coal
Coal Production-1979 Energy Data Report	U.S. Dept. of Energy	April 1981	108	U.S. Dept. of Energy	CPP	Coal
The Substitute of Coal for Oil and Natural Gas within the Industrial Sector	U.S. Dept. of Energy	Nov. 1980	40	U.S. Dept. of Energy	CPP	Coal
Biofuels: A Survey	Benemann, John R.	June 1978	89	Electric Power Research Inst.	CPP	Biofuel
Proeedings: Bioenergy '80 World Congress and Exposition	The Georgia World Congress Center	Apr. 1980	586	Bioenergy Council	CPP	Biofuel

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Status Review of Wood Biomass: Gassification Pyrolysis and Densification Technologies	The MITRE Corp.	Jan. 1979	133	Dept. of Energy	CPP	Biofuel
Hydropyrolysis of Biomass to Produce Liquid Hydrocarbon Fuels	Holderman, James	June 1982	110	Hawaii Natural Energy Institute	CPP	Biofuel
Methane Production by Anarobic Digestion of the Water Hyacinth (Eichnornia Orassipes)	Klass, Donald & S. Ghosh	Aug. 1980	15	America's Chemical Society	CPP	Biofuel
Bogassification of Blends of Water Hyacinth and Domestic Sludge	Chynoweth, D.P. & M.P. Henry	1981	14	Inst. of Gas Tech.	CPP	Biofuel
Biomethantion of Giant Brown Kelp Macrocystis pyrifera	Chynoweth, D.P. & D.L. Klass	Aug. 1978	23	Inst. of Gas Tech. Symposium on Energy From Biomass and Waste	CPP	Biofuel
Anacrotic Digestion of Marine Biomass	Chynoweth, D.P.	Oct. 1979	22	Inst. of Gas Tech Biogas & Alcohol Seminar	CPP	Biofuel
Energy From Biomass and Wastes: 1982 Update	Klass, Donald L.	Jan. 1983	65	Inst. of Gas Tech Symposium on Energy From Biomass & Waste	CPP	Biofuel

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Waste to Resources: Appropriate Tech. for Sewage Treatment and Conversion	U.S. Dept. of Energy	July 1983	28	U.S. Dept. of Energy	CPP	Biofuel
Anaerobic Digestion of Kelp	Chynoweth, David S. Ghosh & D.L. Klass	July 1979	46	Inst. of Gas Tech Biomass Conversion Process for Energy and Fuels	CPP	Biofuel
Biomass as a Long Range Source of Hydrocarbons	Waterman, W.W. & D.L. Klass	Oct. 1976	20	Inst. of Gas Tech Symposium: "The Future of the Rubber Industry"	CPP	Biofuel
Wastes and Biomass of Energy Resources	Klass, D.	June 1979	14	Inst. of Gas Tech. 14th World Gas Conf.	CPP	Biofuel
Fuels from Biomass and Wastes	Inst. of Gas Tech.	1984	20	Inst. of Gas Tech.	CPP	Biofuel
Ethane: Fuel from Crops	Solar Energy Research Inst.	Oct. 1980	10	Dept. of Energy	CPP	Biofuel
Small Scale Bio Gas Plant-India	Parith, Mohau	1983	17	Indian Ag. Research Inst.	CPP	Biofuel
Methane Production from Aquatic Biomass by Anerobic Digestion of Giant Brown Kelp	Klass, D.L., S. Ghosh & D.P. Chynoweth	1979	5	Inst. of Gas Tech	CPP	Biofuel
Evaluation of Biomass for Electricity Generation	Bahelle Columbus Laboratories	Feb. 1982	69	Electric Power Research Inst.	CPP	Biomass

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Comparitive Assesment of Marine Biomass Materials	Science Applications, Inc. Northwest	Sept. 1979	105	Electric Power Research Inst.	CPP	Biomass
Biomass: Solar Energy from Farms and Forest	Solar Energy Research Inst.	March 1980	13	Solar Energy Research Inst.	CPP	Biomass
Giant Leucaena (Koa Haole) Energy Tree Farm: An Economic Feasibility Analysis for the Island of Molokai, Hawaii	Brewbaker, James	Sept. 1980	90	Hawaii Natural Energy Inst.	CPP	Biomass
Biomass Energy Options for the American Territories of the Pacific	Brewbaker, J.L. & Kenneth G. MacDecker	Nov. 1982	73	U.S. Dept. of Energy	CPP	Biomass
Energy from Biomass & Wastes: 1983 update	Klass, Donald	Feb. 1984	90	Inst. of Gas Tech	CPP	Biomass
EPRI/GRI Workstation Biomass Resources and Conversion	Spencer, D.F.	Nov. 1978	384	Electric Power Research Inst.	CPP	Biomass
Ocean Energy Systems Multiyear Program Plan	U.S. Dept. of Energy	May 1980	117	U.S. Dept. of Energy	CPP	Ocean
Ocean Energy Systems: Program Summary	U.S. Dept. of Energy	1979	275	U.S. Dept. of Energy	CPP	Ocean

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Research and Development: OTEC	Tokoyo Electric Power Services Co., Ltd	Aug. 1981	11	Tokyo Electric Power Services Co., Ltd	CPP	Ocean
Environmental Assesment: OTEC Pilot Plant	Interstate Electronics Corp.	Dec. 1981	345	U.S. Dept. of Energy	CPP	Ocean
OTEC Pilot Plant Program	Science Applicatons Inc.	Feb. 1981	425	U.S. Dept. of Energy	CPP	Ocean
Energy Topics	International Gas Technology Highlights	Oct. 1982	12	Institute of Gas Technology	CPP	Fossil Fuel
Energy Topics	International Gas Technology Highlights	Aug. 1983	6	Institute of Gas Technology	CPP	Fossil Fuel
Energy Topics	International Gas Technology Highlights	Feb. 1983	4	Institute of Gas Technology	CPP	Fossil Fuel
Energy Topics	International Gas Technology Highlights	May 1978	4	Institute of Gas Technology	CPP	Fossil Fuel
Energy Topics	International Gas Technology Highlights	Nov. 1982	4	Institute of Gas Technology	CPP	Fossil Fuel
Energy Topics	International Gas Technology Highlights	Aug. 1982	8	Institute of Gas Technology	CPP	Fossil Fuel

Title	Author	Date	No. of Pages	Source/ Publisher	Location of Reference	Area of Concern
Energy Topics	International Gas Technology Highlights	July 1982	4	Institute of Gas Technology	CPP	Fossil Fuel
Suitability of Salt Gradiant Solar Ponds for Electrical Power Generation in the U.S. Trust Territory of the Pacific Islands, Guam and American Samoa	McCord, T.B.	Nov. 1982	116	SETS, Inc.	CPP	Solar Salt Gradiant Ponds
			MISCELLANEOUS			
Glimpses of Guam "Saipan's Got Me", Vol. 16, No.3	Staff of Glimpses of Guam Co. Ltd.	3rd qtr. 1976	80	Glimpses of Guam Co, Ltd. Agana Guam	NFML	Saipan
Proceedings-Year of the Pacific Conference, Saipan 1983.	South Pacific Conference	1984	53	South Pacific Conference	CRMO	CNMI, International

SAIPAN LAGOON USE MANAGEMENT PLAN

FINAL DRAFT

VOLUME II

LAGOON AND SHORELINE USE MANAGEMENT PLAN

Prepared for
Coastal Resources Management Office
Commonwealth of the Northern Mariana Islands

Prepared by
Duenas and Swavely, Incorporated
in Association with
Pacific Basin Environmental Consultants, Inc.

TABLE OF CONTENTS

PART ONE
INTRODUCTION

CHAPTER	I	PURPOSE AND SCOPE OF VOLUME II	I-1
	A.	STATEMENT OF INTENT	I-1
	B.	PROJECT AREA AND RELATIONSHIPS TO OTHER PLANNING	I-1
	C.	PURPOSES	I-3
	D.	MAPS OF EXISTING DATA AND PLANS FOR IMPROVEMENTS	I-4
	E.	ADOPTION OF THIS PLAN	I-4
CHAPTER	II	SUMMARY OF PLAN	II-1

PART TWO
LAND USE PLAN ELEMENT

CHAPTER	III	LAND USE PLAN	III-1
	A.	SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS	III-1
	B.	OBJECTIVES	III-2
CHAPTER	IV	ZONING AND LAND USE DISTRICTS PLAN FOR THE SAIPAN LAGOON PROJECT AREA	IV-1
	A.	STATEMENT OF INTENT	IV-1
	B.	ADOPTION OF PROPOSED ZONES AND LAND USE DISTRICTS	IV-1
		1. Segregation of Public Recreation Areas from Residential Zones	IV-1
		2. Expansion of Village Zone, San Antonio	IV-3
		3. Additional Resort Zone in Northern Saipan	IV-3
	C.	RESORT ZONES ALONG THE SAIPAN LAGOON SHORELINE	IV-3
	D.	PAUPAU RESORT ZONE	IV-6
	E.	ESTIMATED COST FOR ZONE AND LAND USE DISTRICT AMENDMENTS AND ENACTMENT	IV-9

CHAPTER	V	LAND USE REGULATIONS	V-1
	A.	STATEMENT OF INTENT	V-1
	B.	SHORELINE SETBACK REGULATIONS	V-1
	C.	PROPERTY COVERAGE RATIO/PROPERTY SETBACKS/HEIGHT REGULATIONS	V-3
		1. Lot Coverage Ratios	V-3
		2. Setback and Height Regulations	V-6
	D.	SHORELINE FENCING REGULATIONS	V-7
	E.	LANDSCAPING GUIDELINES	V-9
	F.	ESTIMATED COST OF PROMULGATING NEW LAND USE REGULATIONS AND DISSEMINATING LANDSCAPING GUIDELINES	V-17
CHAPTER	VI	BEACH RESTORATION PLAN	VI-1
	A.	STATEMENT OF INTENT	VI-1
	B.	REGULATIONS FOR DREDGING, DIKING AND LANDFILLING ALONG COASTAL AREAS	VI-1
	C.	REGULATIONS FOR STRUCTURES IN NEAR-SHORE AND BEACH STRAND ECOLOGICAL ZONES	VI-3
	D.	REGULATIONS FOR MINING ALONG COASTAL AREAS	VI-4
	E.	BEACH AND SHORELINE RESTORATION PLAN	V1-5
		1. Typical Remedial Measures For Beach Erosion	VI-5
		2. Non-structural Measures	VI-6
		3. Structural Measures	VI-8
	F.	RECOMMENDED SHORELINE EROSION CONTROL STRUCTURES AND ESTIMATED COST OF STRUCTURES AND PROMULGATING REGULATIONS FOR COASTAL AREAS	VI-13
CHAPTER	VII	INFRASTRUCTURE PLAN	VII-1
	A.	STATEMENT OF INTENT	VII-1
	B.	WATER FACILITIES PLANNING FOR FUTURE SHORELINE USES	VII-2
		1. Scope of Work	VII-3
		2. Groundwater Management Task Force	VII-4
		3. Estimated Cost and Project Schedule	VII-5

	C.	WASTEWATER FACILITIES PLANNING FOR FUTURE SHORELINE USES	VII-5
		1. Scope of Work	VII-6
		2. Estimated Cost and Project Schedule	VII-8
	D.	STORM DRAINAGE DESIGN CRITERIA MANUAL	VII-8
		1. Scope of Work	VII-8
		2. Estimated Cost and Project Schedule	VII-10
	E.	PLANNING CRITERIA FOR EVALUATING DEVELOPMENT IMPACTS ON INFRASTRUCTURE	VII-11
		1. Water Service	VII-12
		2. Sewer Service	VII-12
		3. Electrical Power Service	VII-13
		4. Telecommunications	VII-13
		5. Roads and Parking	VII-13
	F.	IMPACT EVALUATION BY MATRIX	VII-14

PART THREE
LAGOON WATERS USE PLAN ELEMENT

CHAPTER	VIII	LAGOON WATERS USE PLAN	VIII-1
	A.	SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS	VIII-1
	B.	OBJECTIVES FOR LAGOON USE PLAN ELEMENT	VIII-4
CHAPTER	IX	WATER RECREATION ZONES PLAN	IX-1
	A.	STATEMENT OF INTENT	IX-1
	B.	RECREATION USE ZONES FOR SAIPAN LAGOON	IX-1
		1. Swimming Zones	IX-1
		2. Diving Zones	IX-5
		3. Boating Zones	IX-5
		4. Surfing	IX-7
		5. Water Recreation Advisory Board	IX-7
		6. Cost Estimates for Establishing Recreation Use Zones through an Advisory Board	IX-7

	C.	WATER SAFETY INFORMATION PROGRAM	IX-8
		1. Boating	IX-9
		2. Swimming	IX-10
		3. Cost Estimates for Water Safety Information Program	IX-11
CHAPTER	X	WATER HAZARDS AND MARINE NUISANCE ABATEMENT PLAN	X-1
	A.	STATEMENT OF INTENT	X-1
	B.	REMOVAL OF LAGOON HAZARDS	X-1
	C.	LOCATION AND EXTENT OF MARINE NUISANCE ANIMALS	X-2
	D.	MARINE NUISANCE ABATEMENT PLAN	X-4
		1. Crown-of-Thorns Starfish Nuisance Abatement Plan	X-4
		2. Jellyfish Nuisance Abatement Plan	X-5
		3. Monitoring Program	X-6
	E.	BUDGET ESTIMATE FOR MARINE NUISANCE ABATEMENT AND HAZARDS REMOVAL PLAN	X-6

PART FOUR
BEACH PARKS AND RECREATION PLAN ELEMENT

CHAPTER	XI	BEACH PARKS AND RECREATION PLAN	XI-1
	A.	SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS	XI-1
	B.	OBJECTIVES	XI-2
		1. Outdoor Recreation Plan	XI-2
		2. Upgrade Beach Parks	XI-3
		3. Establish New Beach Park	XI-4
		4. Bicycle Route	XI-4
CHAPTER	XII	SAIPAN OUTDOOR RECREATION PLAN	XII-1
	A.	STATEMENT OF INTENT	XII-1
	B.	SCOPE OF WORK FOR SAIPAN OUTDOOR RECREATION PLAN	XII-1
	C.	COST ESTIMATE AND PROJECT SCHEDULE	XII-2

CHAPTER XIII		BEACH PARKS AND SHORELINE RECREATION FACILITIES IMPROVEMENTS PLAN	XIII-1
	A.	STATEMENT OF INTENT	XIII-1
	B.	CLASSIFICATION OF SAIPAN LAGOON BEACH PARKS AND RECREATION AREAS	XIII-1
	C.	PRELIMINARY NEEDS ASSESSMENT AND IMPROVEMENTS PLAN FOR VILLAGE PARKS AND PLAYGROUNDS	XIII-4
	D.	PRELIMINARY NEEDS ASSESSMENT AND IMPROVEMENTS PLAN FOR COMMUNITY BEACH PARKS	XIII-5
	E.	DESCRIPTION OF RECOMMENDED IMPROVEMENTS AT BEACH PARKS	XIII-6
	F.	COMMONWEALTH PARKS	XIII-10
	G.	ESTIMATED COST OF PARK IMPROVEMENTS	XIII-10
CHAPTER XIV		AFETNA BEACH PARK PLAN	XIV-1
	A.	STATEMENT OF INTENT	XIV-1
	B.	AFETNA BEACH PARK IMPROVEMENTS	XIV-1
	C.	COST OF IMPROVEMENTS	XIV-2
CHAPTER XV		SAIPAN LAGOON SHORELINE BICYCLE ROUTE PLAN	XV-1
	A.	STATEMENT OF INTENT	XV-1
	B.	PLANNING CRITERIA FOR THE BICYCLE ROUTE	XV-2
	C.	TYPICAL PROFILES OF BIKE ROUTES	XV-3
		1. Class I Bikeways	XV-3
		2. Class II Bikeways	XV-5
	D.	BICYCLE ROUTE IMPROVEMENTS	XV-10
CHAPTER XVI		BEACH FACILITIES MAINTENANCE PROGRAM	XVI-1
	A.	STATEMENT OF INTENT	XVI-1
	B.	FACILITY INVENTORY AND MAINTENANCE SCHEDULE	XVI-1
CHAPTER XVII		SOILS EROSION AND SEDIMENTATION CONTROL TECHNICAL MANUAL	XVII-1
	A.	STATEMENT OF INTENT	XVII-1
	B.	SCOPE OF WORK	XVII-1
	C.	COST ESTIMATE AND PROJECT SCHEDULE	XVII-3

PART FIVE
IMPORTANT HABITATS MANAGEMENT ELEMENT

CHAPTER XVIII		IMPORTANT HABITATS MANAGEMENT PLAN	XVIII-1
	A.	SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTI-	XVIII-1
		1. Mangrove Stands Habitats	XVIII-1
		2. Coral Patch Reefs Habitats	XVIII-4
		3. Managaha Island Underwater Trail Plan	XVIII-4
		4. Seagrass Beds Habitats	XVIII-5
	B.	OBJECTIVES FOR IMPORTANT HABITATS MANAGEMENT PLAN ELEMENT	XVIII-5
CHAPTER XIX		IMPORTANT HABITATS MANAGEMENT PLAN	XIX-1
	A.	LEGISLATION FOR THE PROTECTION OF IMPORTANT HABITATS	XIX-1
	B.	IMPORTANT HABITATS MANAGEMENT PLANS	XIX-3

PART SIX
ENERGY FACILITIES PLAN ELEMENT

CHAPTER XX		SITING CRITERIA FOR ENERGY FACILITIES	XX-1
	A.	SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS	XX-1
	B.	OBJECTIVES FOR ENERGY FACILITIES SITING CRITERIA	XX-2
	C.	SITING CRITERIA	XX-2
		1. Conventional Oil Fired Energy Facilities Siting Criteria	XX-2
		2. Coal Fired Energy Facilities Siting Criteria	XX-3
		3. Biomass Fueled Energy Facilities Siting Criteria	XX-3
		4. Solar Salt Gradient Energy Facilities Siting Criteria	XX-3

PART SEVEN
IMPLEMENTATION PLAN ELEMENT

CHAPTER XXI	SUMMARY OF PLAN RECOMMENDATIONS	XXI-1
CHAPTER XXII	ADMINISTRATIVE, FINANCIAL AND LEGAL REQUIREMENTS FOR IMPLEMENTATION OF PLANS	XXII-1
A.	COASTAL RESOURCES MANAGEMENT OFFICE	XXII-1
B.	ZONING ADMINISTRATION OFFICE	XXII-3
C.	DEPARTMENT OF PUBLIC WORKS	XXII-3
D.	DEPARTMENT OF NATURAL RESOURCES	XXII-6
E.	DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENTAL SERVICES	XXII-6
F.	DEPARTMENT OF PARKS AND RECREATION	XXII-7
CHAPTER XXIII	IMPACT ASSESSMENT OF SAIPAN LAGOON USE MANAGEMENT PLAN	XXIII-1

PART ONE
INTRODUCTION

CHAPTER I - PURPOSE AND SCOPE OF VOLUME II

A. STATEMENT OF INTENT

The SAIPAN LAGOON USE MANAGEMENT PLAN is the Commonwealth's first comprehensive analysis and PLAN for managing the Saipan Lagoon and its shoreline. Volume I of the PLAN analyzes both original data as well as previously collected information about the Lagoon itself and on-shore environs between the coastline and Beach Road, in addition to Managaha Island. In Volume II plans, programs, policies and projects are recommended for managing the various uses and resources associated with this project area. Where appropriate, legislation, rules and regulations, and budgets are included to implement the recommendations. Volume III is a six-sheet set of maps which portray the PLAN's project area and depict both the existing data and planned uses. An Executive Summary of this PLAN is presented as Volume IV.

Volume I and II of the SAIPAN LAGOON USE MANAGEMENT PLAN are relatively complex documents, because, by their nature, both breadth and depth of data are required to accurately portray the project area. This PLAN encompasses an area roughly one-third the size of Saipan Island and reflects such divergent uses and resources as energy facilities siting; tourism; commerce; residential, commercial, industrial and public land uses; infrastructure; public recreation and facility maintenance; lagoon water quality; critical habitats; beach erosion control; and soil erosion control. In short, these two Volumes are not written for the public-at-large but, rather, intended to guide more technical applications of resource management by various agencies of the Government of the Northern Mariana Islands. Chapter XXIV specifically addresses the budgetary and scheduling aspects of the PLAN in order to serve as a framework for implementing the various recommendations. In many cases, the documents are also useful to developers contemplating projects within the Saipan Lagoon area.

B. PROJECT AREA AND RELATIONSHIPS TO OTHER PLANNING

While this PLAN studies lagoon and coastline issues more broadly and more deeply than any other previous project, it is, nonetheless, improper to think of development within

this project area as totally separable from the remainder of Saipan's physical and social development.

In fact, not one of the PLAN's recommendations for improvement can be contained exclusively within the lagoon and coastline area. The impact of each proposed recommendation ultimately reaches beyond those geographical boundaries to influence both social and economic development of all Saipan. Some recommendations have an indirect effect on the Commonwealth as a whole. Nor is it correct to think of this PLAN's influence only in terms of the Lagoon's integrated relationship with the island of Saipan to the east. The Lagoon's harbor also serves as the only maritime link between Saipan and other islands of the CNMI, surrounding deep-water resources and oceanic commerce to the west and beyond.

It can become difficult, therefore, to strike the exact balance of which data, analyses and existing plans are relevant to such an amorphous project area and, conversely, which are not. For example, fishing within the Lagoon, per se, can be quantified and qualified, but those data are insufficient to understand the importance of fishing's contribution to family subsistence or as a second-income generator within the Saipanese economy. Likewise, recommendations for providing Lagoon-oriented recreation opportunities to tourists must be gaged by the anticipated growth of Saipan-bound tourists, a brand of market forecasting which relies heavily on international economics. Additionally, the allocation of resort land-base and support infrastructure for Saipan's largest economic sector is subject to a myriad of supply and demand factors that comprise the volatile, price-sensitive industry of tourism.

Exactly how much Saipan-wide or Commonwealth-wide social and economic data should be incorporated into this PLAN becomes a matter of good planning judgment and report editing of existing documents. Volume I, "Data and Analysis" does not repeat much of Saipan's basic historical and current data relating to political status, commerce and trade, natural resources, governmental services and private sector development. While those subjects are naturally considered as integral to any planning for Saipan, their data are incorporated by reference into this PLAN from such documents as listed below..

"Socioeconomic Development Plan for the Northern Mariana Islands, 1978 to 1985 - Volume I and II"
"Physical Development Master Plan (1978) Volume II - Saipan"
"1980 Census of Population - Northern Mariana Islands"
"Coastal Land and Water Use Plan, CNMI, May 1979"
"Annual Reports - Marianas Visitors Bureau"

"Overall Economic Development Strategy, 1981, 1982 and 1983"
"Proceedings - Year of the Pacific Conference, 1984, South Pacific Conference"
"Annual Report to the United Nations in the Administration of the Trust Territory of the Pacific Islands," (Various Years)

In addition to buttressing this PLAN with a data base from those documents, other plans which have been proposed for the Lagoon and its coastline are also incorporated. Specifically, the following proposed projects and programs are integrated into this PLAN at appropriate places, although not always without certain qualifications and changes.

"Zones and Land Use Districts Study for Saipan, Tinian and Rota, 1984"
"Garapan Flood Control Project, 1984"
"Chalan Kanoa/Susupe Redevelopment Project, 1979"
"Small Boat Harbor-Saipan CNMI, 1971"
"Saipan Water System Study, 1982"
"Wastewater Facilities Plan for the Island of Saipan, 1978"
"Port and Harbor Study of Saipan, CNMI, 1980"
"Lake Susupe Flood Control, 1981"
"American Memorial Park - General Management Plan and Comprehensive Design, 1980"

Finally, the data and analyses presented in Volume I of the Plan, including the significant contributions and valuable insights by the participants of SALAPAT (Saipan Lagoon Planning Advisory Teams), provided the bulk of this volume's technical and general planning data.

C. PURPOSES

The primary purposes of Volume II, SAIPAN LAGOON USE MANAGEMENT PLAN are threefold:

1) To synopsize the Volume I data analyses and identification of problems into six major elements.

* Land Use Element
* Lagoon Use Element
* Beach Park and Recreation Element
* Lagoon Water Quality Management Element
* Rare, Threatened and Endangered Habitats Management Element
* Energy Facilities Siting Criteria Element

2) To recommend appropriate plans, programs, policies and projects for managing the various uses and resources within each Element of the PLAN.

3) To determine administrative requirements and cost estimates for implementing the recommendations.

D. MAPS OF EXISTING DATA AND PLANS FOR IMPROVEMENTS

Volume III is a six-sheet set of maps (one for each Planning Area, except the Tanapag Harbor and Managaha Island Planning Areas are combined on one sheet) which graphically portrays much of the existing data for the project area in addition to the planned improvements. These maps serve as a basic reference for both Volume I and Volume II of the PLAN.

These maps are:

Sheet 1 - Puntan Magpi
Sheet 2 - Tanapag Harbor
Sheet 2 - Managaha Island
Sheet 3 - Puntan Muchot
Sheet 4 - Garapan Lagoon
Sheet 5 - Puntan Susupe
Sheet 6 - Puntan Afetna

E. ADOPTION OF THIS PLAN

This Volume of the PLAN recommends specific legislation, rules and regulations, plans, programs, projects and policies for managing the Saipan Lagoon and its on-shore environs. Legislative adoption of the PLAN shall be construed as formal CNMI legislative support for the recommended laws, rules and regulations, plans, programs, projects, and policies herein.

Table I-1 serves as an index to this PLAN's recommendations.

TABLE I-1
INDEX TO PLAN'S RECOMMENDATIONS

EXHIBIT (E) No. FIGURE (F) No. TABLE (T) No. SECTION (S)	SHORT TITLE	FORM OF RECOMMENDATION
(S) IV.B	Zones and Land Use District Act of CNMI	Legislation
(S) IV.B.1	Amendment to Section 9 of Zones and Land Use District Act	Legislation
(S) IV.B.2	Expansion of Village Zone, San Antonio-Zones and Land Use District Act	Legislation
(S) IV.B.3	Paupau Resort Zone in Northern Saipan-Zones and Land Use District Act	Legislation
(E) V-1	Shoreline Setbacks	Regulations
(T) V-1	Property Setbacks, Structure Heights and Densities	Regulations
(E) V-2	Lot Coverage for Commercial and Resort Zones	Regulations
(E) V-3	Setback and Height Regulations for Commercial and Resort Zones	Regulations
(E) V-4	Shoreline Fencing Regulations	Regulations
(E) VI-1	Landscaping Guidelines	Government Policy
(E) VI-1	Regulations for Dredging, Diking and Landfilling along Coastal Areas	Regulations
(E) VI-2	Regulations for Structures located on Near Shore and Beach Strand Ecological Zones	Regulations
(E) VI-3	Regulations for Mining along Coastal Strand	Regulations

(S)	VI.E	Beach and Shoreline Restoration Plan	Design & Construction
(T)	VII.B.1	Shoreline Water Facilities Planning	Design & Construction
(S)	VII.B.2	Groundwater Management Task Force	Government Program
(S)	VII.C.1	Shoreline Wastewater Facilities Planning	Design & Construction
(S)	VII.D.1	Storm Drainage Design Criteria	Policy
(S)	VII.E.	Planning Criteria for Evaluating Development Impacts	Policy
(S)	IX.B	Recreation Use Zones for Saipan Lagoon	Improvements Plan
(S)	IX.B.5	Water Recreation Advisory Board	Government Program
(S)	IX.C	Water Safety Information Program	Government Program
(S)	X.B	Hazards Removal Plan	Contractual Service
(S)	X.D	Marine Nuisance Abatement Plan	Government Program
(S)	XII.B	Saipan Outdoor Recreation Plan	Master Plan
(T)	XIII-4	Improvements for Beach Parks - Natural	Design & Construction
(T)	XIII-5	Improvements for Beach Parks - Developed	Design & Construction
(S)	XIV.B	Afetna Beach Park Improvements	Design & Construction
(F)	XV-7	Bicycle Route Improvements	Preliminary Engineering
(T)	XVI-1	Recreation Facilities and Maintenance Schedule	Program
(S)	XVII.B	Soil Erosion and Sedimentation Control Technical Manual	Policy

(E)	XIX-1	An Act to Protect Important Habitats	Legislation
(S)	XIX.C	Important Habitats Management Plans	Master Plan
(S)	XX.C	Energy Facilities Siting Criteria	Policy

CHAPTER II - SUMMARY OF PLAN

This PLAN recommends the following plans, programs, policies and projects to address the problems identified within each of the Elements.

* Amendments to Saipan's Zones and Land Use Districts, as well as to the rules and regulations to be promulgated thereto.

* Regulations governing shoreline setback; property coverage ratios; property setback/height limitations; and shoreline fencing.

* Landscaping guidelines for property development.

* Regulations for shoreline landfilling, diking and dredging.

* Regulations for constructing shoreline structures.

* Beach restoration structures.

* Water facilities planning for future shoreline uses.

* Wastewater facilities planning for future shoreline uses.

* Stormwater drainage facilities design criteria.

* Planning criteria for evaluating development impacts on infrastructure.

* Recreation use zones for the Lagoon.

* Water safety information program.

* Plan for removal of lagoon hazards.

* Plan for abating marine nuisances.

* Outdoor recreation plan for Saipan.

* Improvements for existing beach parks and playgrounds.

* New beach parks Puntan Afetna.

* Shoreline bicycle route plan and improvements.

* Maintenance program for beach facilities.

* Technical manual for soil erosion and sedimentation control.

* Important habitats management plan.

* An act to protect important habitats.

* Criteria for siting coastal energy facilities.

* Administrative, financial and legal requirements to implement recommended plans, policies, programs and projects.

PART TWO
LAND USE PLAN ELEMENT

CHAPTER III - LAND USE PLAN

A. SYNOPSIS OF DATA ANALYSES FROM VOLUME I DATA AND IDENTIFICATION OF PROBLEMS

Land use planning for Saipan is in its embryonic stage. Two different land use plans now exist in the form of the "Physical Development Master Plan" prepared in 1978 for the Office of Transitional Studies and Planning and the "Zoning and Land Use Districts Report" prepared for the Costal Resources Management Office in 1984. While both plans are basically compatible, neither carries the necessary enforcement and regulatory authority for bona-fide implementation. Without a legally adopted and enforce-able land use plan and associated regulations, public and private development will continue to determine land use on an incremental, project-by-project basis. The legislative adoption of this PLAN will enact the land use zoning plan recommended in this Part Two.

The project area encompassed by this SAIPAN LAGOON USE MANAGEMENT PLAN is especially vulnerable to disjointed land use planning decisions because the coastline comprises a mix of development ranging from Saipan's rural to most urban, and includes residential, village, commercial, resort, industrial and public uses. Infrastructure and other community support facilities are, for the most part, planned as a reaction to existing demands and development pressures, rather than as a guide to the growth of social and economic resources in accordance with a preconceived plan. This situation is, of course, not unusual for Micronesia in general, nor for most developing re-gions. However, this need not be the case; and the SAIPAN LAGOON USE MANAGEMENT PLAN is an appropriate vehicle for strengthening land use planning and supporting regula-tions for the project area.

Land use planning does occur, de facto: individual site planning decisions for private and public projects, extending infrastructure to new areas, resizing and improving existing infrastructure, and islandwide program planning and promulgation of regulations by such agencies as the Marianas Public Land Corporation and the Department of Public Health and Environmental Services all function, cumulatively, as "land use planning". Unfortunately, this

occurs with sometimes self-defeating results. For example, public subdivision development, leasing of public lands for resorts, government-guaranteed loans for commercial projects, and new public facilities must be inextricably coordinated with islandwide land use planning, timely infrastructure improvements and increases in maintenance and support operations. Otherwise, piecemeal improvements will be negated by the inevitable problems they create through placing impossible burdens for public services into the hands of the local Government.

The basic land use pattern for Saipan, enabling legislation, and rules and regulations now under consideration by the Legislature, (see "Zones and Land Use Districts for Saipan, Rota and Tinian",March 1983), are generally endorsed by this SAIPAN LAGOON USE MANAGEMENT PLAN. Some of those proposed zones and land use districts within the project area must be adjusted to conform with land use planning goals and objectives established by this PLAN. Additionally, supportive rules and regulations dealing with landscaping, fencing, set-backs, height and property coverage must be revised or, in some cases, established for the first time.

Due to the interdependent nature of land use planning and infrastructure development, it is necessary to supplement this project area's Land Use Plan Element with an infrastructure plan that provides for an adequate capacity of sewer, water and roads as well as design criteria for storm drainage facilities. The last aspect of this Land Use Plan Element involves a Beach Erosion Control Plan to remedy seashore erosion along the Lagoon's shoreline.

B. OBJECTIVES

As a result of analyzing data and problems from Volume I, several objectives were identified relating to land use zones and regulations, infrastructure planning, infrastructure maintenance, and beach erosion control. Those objectives have been consolidated into six basic plans which collectively comprise the Land Use Plan Element.

* A Zoning Plan which adopts, in part, and adjusts the Government's now proposed "Zones and Land Use Districts Study". Two major purposes of adjusting the proposed land uses are to distribute the Resort Zone to another location along the Lagoon shoreline and to segregate public recreation uses from other Zones within the Urban Land Use District.

* Regulations encompassing property coverage ratios, set-backs, fencing, and height limitations, established with an environmental sensitivity towards preserving view corridors and an open, non-congested profile of shoreline development. The proposed landscaping regulations, which already accompany the Government's "Zones and Land Use Districts Study" are customized to the project area by this PLAN through including references to Saipan-specific flora.

* An Infrastructure Plan is needed to accommodate the projected utility requirements generated by the Land Use Plan Element. The Infrastructure Plan must update (or establish) the Government's existing facility plans for water and sewer so that future CIP projects are designed to accommodate the preferred land use patterns.

* A maintenance program must address the Government's long standing efforts to wrestle control over its ponderous responsibility of maintaining public recreation facilities with pitifully inadequate resources of trained manpower, reliable equipment and sufficient materials.

* A Beach Erosion Control Plan must account for stabilization and preservation of the Beach Strand and Near-Shore Ecological Zones. Shoreline erosion is now occurring, and the likelihood of additional development mandates immediate attention to regulating fill and excavation operations; dredging, diking and landfilling; structures; and beach restoration projects.

* Lastly, planning criteria for assessing the impacts by residential, commercial and industrial projects on public infrastructure and other resources must be developed in order to better evaluate the anticipated impact of proposed projects.

CHAPTER IV - ZONING AND LAND USE DISTRICTS PLAN FOR THE SAIPAN LAGOON PROJECT AREA

A. STATEMENT OF INTENT

The intent here is to amend, in part, and then have enacted the Government's land use patterns as proposed in its "Zones and Land Use Districts Study" for the Saipan Lagoon shoreline areas covered by this PLAN. The amendments provide for a Resort Zone along a portion of the project area's northern shoreline, expanding the Village Zone of San Antonio, and providing for a Recreation Zone in the Urban District. With the exception of these amendments to the text and official zoning and land use districts map for Saipan, the Commonwealth's proposed Zoning and Land Use District boundaries and regulations meet the goals and objectives of this SAIPAN LAGOON USE MANAGEMENT PLAN. The recommended zones are depicted on the applicable sheets of the six-sheet set of Plans in Volume III.

B. ADOPTION OF PROPOSED ZONES AND LAND USE DISTRICTS

In April 1984, the Commonwealth Government completed a study which recommended zoning and land use districts for Saipan, Rota and Tinian. The proposed legislation and accompanying maps, regulations and procedures are now undergoing legislative and public review as part of their ultimate enactment.

In general, the proposed zones, districts and regulations are compatible with the SAIPAN LAGOON USE MANAGEMENT PLAN; and, with the three exceptions described below, the Government's proposal is endorsed by this PLAN.

1. Segregation of Public Recreation Areas from Residential Zones

   The "Zones and Land Use Districts Study" proposes that parks, playgrounds and recreation areas are classified as permissable uses within the zones of residential, commercial, resort, and industrial. In the village zone, open-space and recreation are listed as a principle use.

   While this system of land-use classification is fully satisfactory for accommodating the park and recreation uses as one of several aspects of community development, it does not provide for open space

and public recreation as a primary land use. This PLAN finds that the importance of open space and public recreation to be so significant that it deserves recognition as an exclusive zone for those large areas relegated to such uses. Of course, park and recreation uses should continue to be designated as permissible or principle uses in the other zones, as originally proposed.

It is recommended, therefore, that the following amended language be included into the Commonwealth's "Zones and Land Use Districts Act". The new language is underlined.

SECTION 9 URBAN DISTRICT: ZONES, USES, CHANGES

(a) Zones. The Urban District shall be subdivided into <u>six</u> zones: Residential, Commercial, Resort, Industrial, Village <u>and Recreation</u>. The permissible land and building uses for each zone are described below.

(g) <u>Recreation Zone Uses. The purpose of the Recreation Zone is to provide for public open space, park and recreation uses. While such uses are also encouraged in other zones as either permissible or principal, this Recreation Zone is intended primarily for larger parcels of land (generally larger than one acre) which are exclusively designated for passive or active recreation purposes.</u>

(1) <u>Principal uses of the Recreation Zone.</u>
<u>(aa) Public Parks.</u>
<u>(bb) Public open space.</u>
<u>(cc) Public sports and recreation facilities.</u>

(2) <u>Permissible uses of the Recreation Zone.</u>
<u>(aa) Private concessions.</u>
<u>(bb) Parking.</u>
<u>(cc) Historical and culturally significant sites.</u>
<u>(dd) Community halls.</u>
<u>(ee) Non-conforming uses.</u>

(3) <u>Conditional Uses of the Recreation Zone.</u>
<u>(aa) Flood plains.</u>
<u>(bb) Storm drainage percolation basins.</u>

(cc) Government and quasi-government facilities.
(dd) Any permitted use located in an Area of Particular Concern as depicted on Coastal Resources maps or regulations.
(ee) Other uses in consonance with the zone's purpose and character, as determined by the Zoning Administrator.

(4) Prohibited Uses of the Recreation Zone.
(aa) All uses other than those specified as principal, permissible, or conditional are prohibited for the Recreation Zone

These changes to the Government's proposed zones are reflected in the six sheet Plan for Improvements, enclosed in this Volume.

2. Expansion of Village Zone, San Antonio

This PLAN recommends the northern expansion of San Antonio's Village Zone to include the 30 to 40 structures which now comprise the northern portion of the community. This expansion is also reflected in Figure IV-1 and should be incorporated into the official CNMI Zone Map for Saipan.

3. Additional Resort Zone in Northern Saipan

This third and last proposed amendment is described in Section C, Resort Zones along the Saipan Lagoon Shoreline. This new zone is reflected in Figure IV-2 and should be incorporated into the official CNMI Zone Map for Saipan.

C. RESORT ZONES ALONG THE SAIPAN LAGOON SHORELINE

Recognizing the importance of Saipan's tourist industry to CNMI's overall economic development, proper land use planning must provide for adequate land base, infrastructure support and protection as well as enhancement of environmental quality for both resorts and tourist-related development. Within guidelines that promise to enhance the Commonwealth's natural resources, while simultaneously raising the standard of living through more and better-paying jobs, tourist industry development is beneficial and fostered by this SAIPAN LAGOON USE MANAGEMENT PLAN .

Presently, two Resort Zones are proposed for Saipan: in Garapan, approximately 40 acres in size, and in

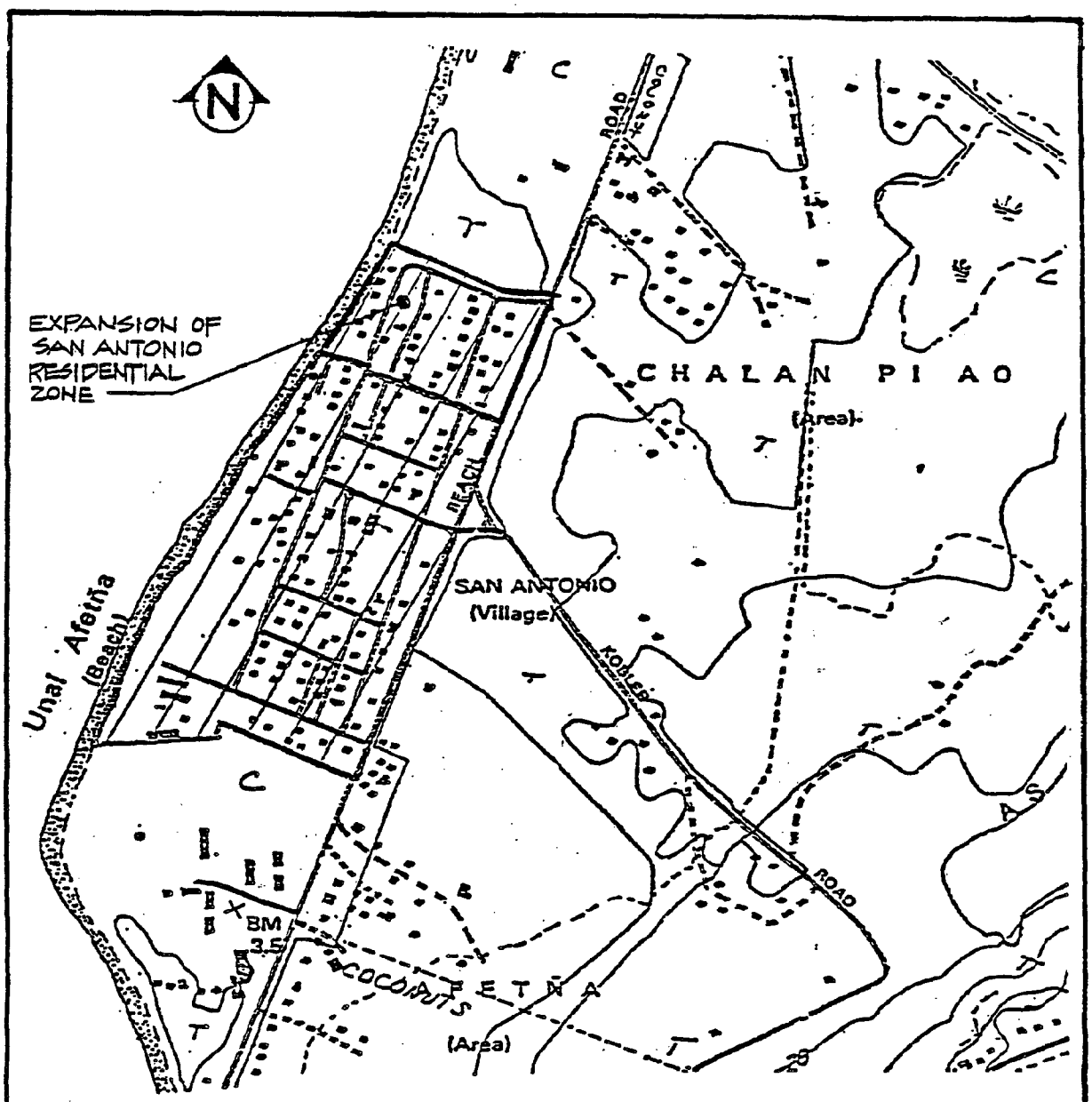


FIGURE IV-1

EXPANSION OF SAN ANTONIO RESIDENTIAL ZONE

Susupe/Chalan Kanoa, about 30 acres, refer to Plan for Improvements, Puntan Muchot Planning Area and Puntan Susupe Planning Area. Long term tourist arrival projections, coupled with the anticipated ancillary businesses which proliferate around hotels and resorts, indicate a need for additional land use designated as Resort zone.

The question of expanding Garapan's and Susupe's Resort Zones verses that of designating other areas along the shoreline must be evaluated in terms of tourist preferences, opportunities for peripheral development, and general planning policies. The general planning policy expressed by SALAPAT participants is that the Saipan Lagoon shoreline should provide for tourist industry development more or less uniformly, as opposed to continuing the concentrated development in only Garapan and Susupe. While Garapan will serve as Saipan's commercial/tourist center for the foreseeable future, that municipality is also the Island's major residential sector. Already the peripheral tourist-related businesses have usurped the majority of former, downtown Garapan residences on the Lagoon side of Beach Road and spurred a transition of substantial downtown redevelopment. While this is not necessarily detrimental to the community's development (and certainly not unexpected) a limit does exist after which tourist-related development enroaches upon and consumes other beneficial characteristics of a community. This PLAN recognizes that such a limit will be reached for Garapan when the area now contained by the proposed Resort Zone becomes fully saturated with tourist industry development.

Likewise, Susupe is the Commonwealth's seat of Government as well as a major residential area; and the existing, proposed Resort Zone, while far from reaching it's point of development saturation at this time, is permanently boxed-in by other well established land uses.

Not much data has been collected and analyzed in order to evaluate and articulate visitor preference from among Saipan tourists. As with Guam's case, sun, sand and surf are likely to rank among the highest desirable attributes of Saipan as a destination. Additionally, Saipan's major role in Japan's pre-WWII and WWII eras contributes an historical preference by tourists from Japan.

Close proximity to the Lagoon waters and shoreline is always an important criterion for siting resorts and for designating additional resort land base. This effectively eliminates expanding the Resort Zone in Garapan since that zone's shoreline is blocked to the north by the American Memorial Park and to the south by Government land as well as by successively-narrowing beach front property.

While it can be argued that all but a few peripheral businesses to hotels and resorts are community assets, the opportunity for indirect economic growth in the form of retail shops of all kinds, restaurants, grocery stores, entertainment and rentals are often common around resort areas in small communities; and this business translates into local employment, higher property values and an expanding tax base. To date, Garapan is the only municipality which has been able to fully capitalize on this peripheral aspect of economic growth for Saipan's tourist industry, although some evidence of this type of peripheral growth is also beginning in Susupe. Distributing such opportunities among other shoreline villages is consistent with the aforementioned policy of balanced growth.

Two significantly large, undeveloped tracts of shoreline still exist: one in the Tanapag/San Roque area and one in the San Antonio vicinity. Additionally, both the Hopwood Junior High School site as well as the San Antonio Elementary School site have been offered for lease by MPLC to prospective resort developers on the condition that the respective schools be first reconstructed at a different, suitable location. As for the northern Tanapag/San Roque area, enough vacant land is available between Tanapag and San Roque as well as north of San Roque to support full scale resort development. As for developed land along the Lagoon's southern shoreline, the former US Coast Guard Station (now CNMI land) is large enough to support resort development.

This PLAN recommends that north Saipan be targeted as the next location for decentralizing the shoreline's existing resort development. The general (but not unanimous) consensus to retain publicly owned shoreline lands, such as the former Coast Guard Station, for public use precludes this area from being leased to a private developer. On the other hand, nearly all of the northern shoreline lands within the PLAN's project area are in private ownership and, therefore, not subject to public use.

D. PAUPAU RESORT ZONE

In northwestern Saipan a new Resort Zone is recommended for the shoreline project area directly north of San Roque, see Figure IV-2 and refer to Exhibit I-1. Basically,only two choices present themselves for new resort development within this portion of the project area: the relatively undeveloped stretch of land between Tanapag and San Roque which is bounded by the shoreline and Beach Road; and the area being recommended, north of San Roque.

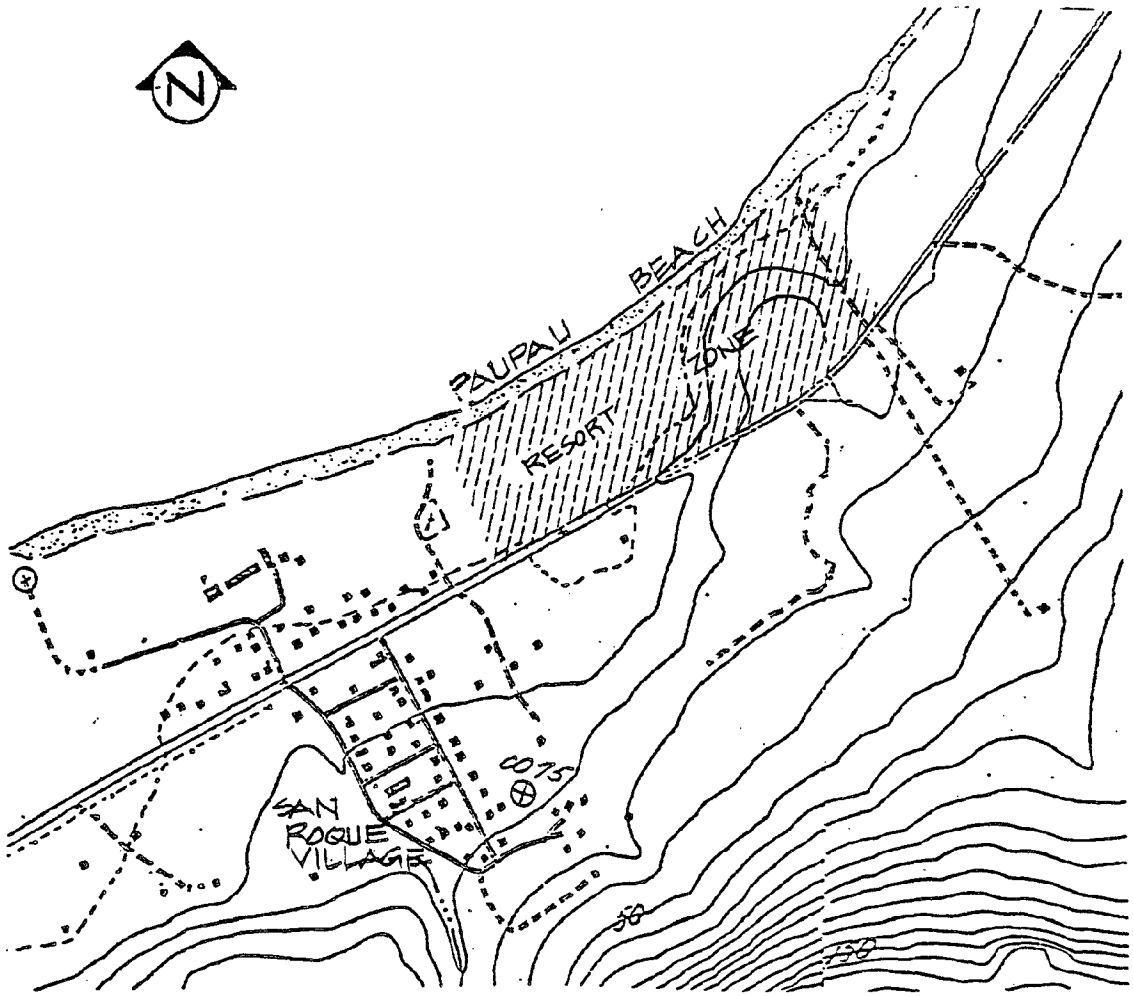


FIGURE IV-2

NEW PAUPAU RESORT ZONE

The area lying between Tanapag and San Roque, which is proposed by the "Zones and Land Use Study" as a Rural District, comprises approximately 50 acres of easily developable land with prime beach frontage. However, this area is unsatisfactory as a Resort Zone for the following reasons.

* Recognizing the future growth of both Tanapag and San Roque between the shoreline and Beach Road, a gradual residential infilling will likely take place along Unai Achugao. Tanapag's growth potential to the south is eventually constrained by the Tanapag Harbor and Industrial Area which is developing northward, towards the village, as well as by other potential uses in this vicinity such as aquaculture. Tanapag's growth inland, across Beach Road is always possible; but Saipanese communities display a clear propensity for coastal development rather than inland, wherever sufficient coastal land base is available.

* Furthermore, land such as the area between Tanapag and San Roque should not be designated for such incongruous uses as resort and tourist-commercial development between two relatively similar and historically well-established residential communities. Acres of hotels, shopping centers and enclaves of tourists situated between Tanapag and San Roque are akin to building a sociological barrier that will forever separate the community and cultural comradery which now bonds these two "north Saipan" sister villages.

* Lastly, the peripheral economic and infrastructure amenities that accompany a major resort development will not extend to San Roque if the new Resort Zone is situated south of San Roque. Because the major centers of business, government, transportation and infrastructure are located in central and southern Saipan, the orientation from Tanapag and San Roque is generally directed southward towards the major population centers. Both Tanapag and San Roque can avail themselves of an equitable degree of economic growth opportunities only if that development is designated northward of San Roque.

Therefore, the area between Tanapag and San Roque should be reserved for longterm future municipal growth of both municipalities; and a new coastal Resort Zone should be designated beyond that area of the two Villages' common influence.

The proposed new Resort Zone, designated Paupau Resort Zone, is approximately 30 acres in size and parallels the northern stretch of Unai Paupau. It is to be subject to the same land use regulations prescribed for the other Resort Zones, as established in the "Zones and Land Use Districts Study". This new zone should be incorporated into the official CNMI Zone Map for Saipan.

E. ESTIMATED COST FOR ZONE AND LAND USE DISTRICT AMENDMENTS AND ENACTMENT

Because these amendments are incidental to the CNMI Zones and Land Use Districts Act, no special costs are identified for this Plan. The budget for implementing the proposed CNMI zoning program was developed as part of the "Zones and Land Use Districts for Saipan, Tinian and Rota" project at an annual cost of approximately $150,000. This cost is not reflected in the implementation costs for the SAIPAN LAGOON USE MANAGEMENT PLAN.

CHAPTER V - LAND USE REGULATIONS

A. STATEMENT OF INTENT

The intent of this chapter of the PLAN is to propose new regulations for shoreline setbacks, property coverage ratios and height limitations, shoreline fencing, and supplement the Government's existing proposed regulations for landscaping with examples of Saipan indigenous plants.

Section 5 (h) of the proposed Zoning and Land Use Act, "Zones and Land Use Districts Study", authorizes the Zoning Administrator to promulgate rules and regulations to carry-out the intent and purposes of the Act. The Land Use Regulations recommended in this Chapter should be promulgated under that proposed Act. During the interim, however, these Regulations could be promulgated by the Coastal Resources Management Office under the authority of Public Law 3-47.

B. SHORELINE SETBACK REGULATIONS

Exhibit V-1 presents the recommended shoreline setback regulations.

EXHIBIT V-1
REGULATIONS
SHORELINE SETBACKS

(A) Authority. Section 5(f) of the Zoning and Land Use Act, Commonwealth of the Northern Mariana Islands.

(B) Scope of Regulations. The shoreline setback regulations herein prescribed apply to all coasts of the Commonwealth for all districts and zones, except for Village Zones, where only Shoreline Setbacks A and A1 shall apply and except for Industrial Zones where no shoreline setback regulations shall apply. Shoreline setbacks shall be measured inland from the mean high water level contour as determined by a Registered Land Surveyor of the Commonwealth.

(C) Shoreline Setbacks

Shoreline Setback A, from 0-35 feet	Beach reservation zone for use as public access and recreation. Generally, structures are prohibited. Any proposed development within this

Shoreline Setback B, from 35-75 feet	No vertical construction which will obstruct the visual openness and continuity of the beach area is permitted. Open space, rest and recreation areas, swimming pools, terraces, landscaping and related outdoor improvements are allowed. Parking areas are not permitted.
Shoreline Setback C, from 75-100 feet	Single-story structures, covered porches, trellises and similar improvements not to exceed 12-feet in height measured from the natural grade line. Parking is permitted.
Shoreline Setback D, from 100-feet or more	Building height based on Property Setback/Height Regulations.

For any lot where thirty percent (30%) or more of the land area is affected by the mandatory shoreline setback above, such seashore setback regulations are modified as follows:

Shoreline Setback A-1, from 0-20 feet	Beach recreation zone for use as public access and recreation.
Shoreline Setback B-1, from 0-20 feet	Shall be open space with no vertical construction or parking permitted.
Shoreline Setback C-1, from 60-100 feet	Single and two-story structures only, with the total height not to exceed 20 feet.

Shoreline Setback D-1, from 100-feet or more	Building height based on proposed Property Setback/Height Regulations.

Figure V-1, Shoreline Setback/Height Graph, graphically depicts Shoreline Setbacks A,B,C and D.

C. PROPERTY COVERAGE RATIO/PROPERTY SETBACKS/HEIGHT REGULATIONS

Setbacks, lot coverage ratios and height limitations are interdependent functions of property development. The minimum setbacks and maximum heights and lot coverage ratios presented in Table V-1 are established by the Commonwealth's proposed Zoning and Land Use Act.

These proposed regulations were established with the purpose of applying to all Zones within all of the Commonwealth's Urban Districts; therefore, they cannot be expected to exemplify any unique features or requirements of the Saipan Lagoon project area, per se. With the data analysis from Volume I of this project and SALAPAT as a background, however, the property setback, property coverage, and height limitations for the Commercial Zone and the Resort Zone can be improved to reflect more design flexibility for developers while protecting the project area's natural beauty and openness.

1. Lot Coverage Ratios

Lot coverage for structures means the "footprint" of buildings on the site and does not consider the floor area of upper floors or the overall density of the development. Where the first floor is elevated above the ground level, its lot coverage ratio shall be based on the proposed use for the area below the structure.

The lot coverage ratio for open space is considered to include plazas, terraces, decks and other outdoor areas which are not covered or walled, landscaped areas, recreation and open space, improved or unimproved natural areas, covered storm water disposal areas, and pedestrian walkways. The continuity, conservation and maintenance of open space must be provided for; any later modification must be first approved as a variance.

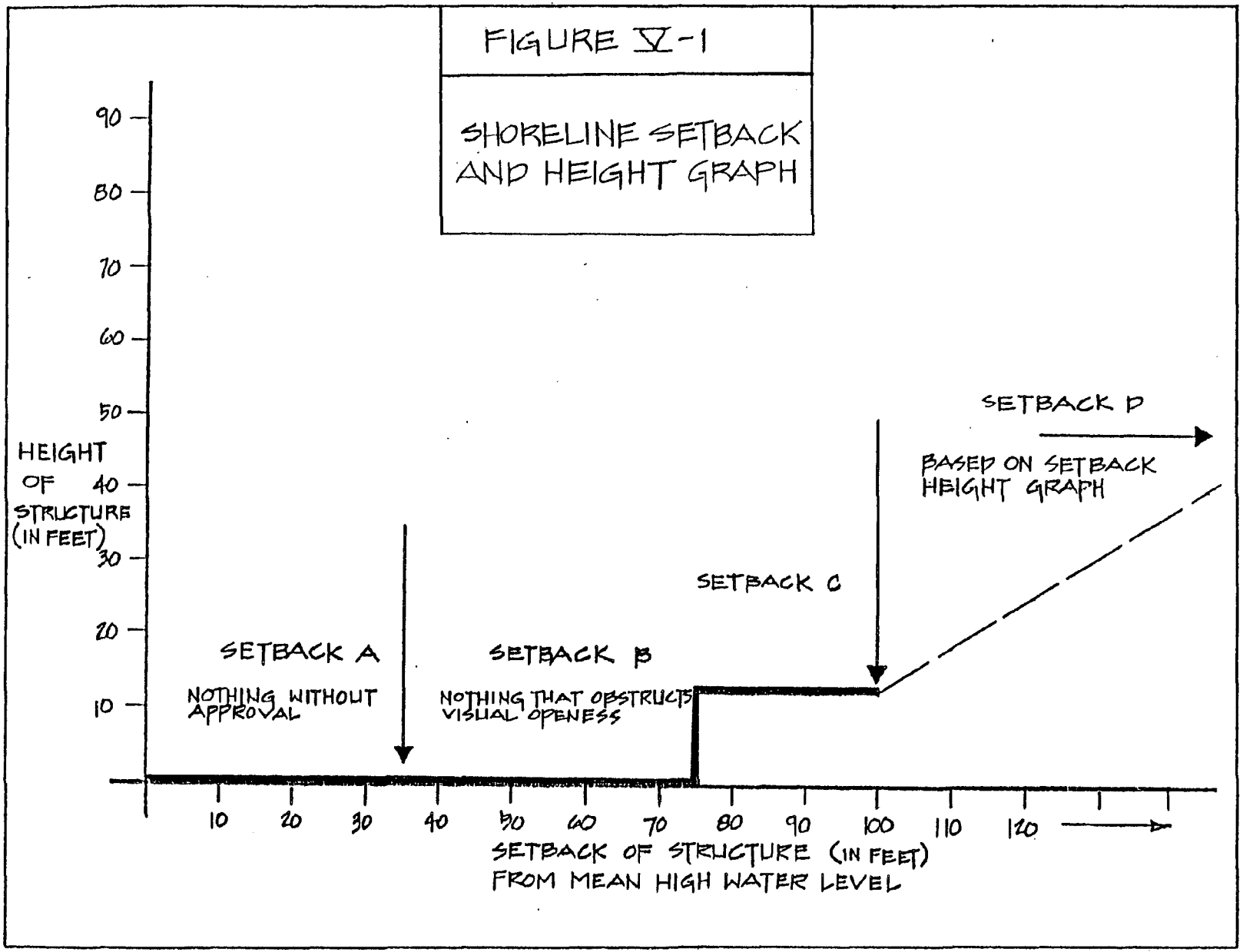


FIGURE V-1
SHORELINE SETBACK AND HEIGHT GRAPH
HEIGHT OF STRUCTURE (IN FEET)
90
80
70
60
50
40
30
20
10
SETBACK A
NOTHING WITHOUT APPROVAL
SETBACK B
NOTHING THAT OBSTRUCTS VISUAL OPENESS
SETBACK C
SETBACK D
BASED ON SETBACK HEIGHT GRAPH
10 20 30 40 50 60 70 80 90 100 110 120
SETBACK OF STRUCTURE (IN FEET) FROM MEAN HIGH WATER LEVEL

TABLE V-1

MINIMUM PROPERTY SETBACKS, MAXIMUM STRUCTURE HEIGHTS AND DENSITIES FOR ZONES, PER PROPOSED ZONING AND LAND USE ACT

ZONE	MINIMUM PROPERTY SETBACK FOR STRUCTURE	MAXIMUM HEIGHT FOR STRUCTURES	MAXIMUM DENSITY OF DEVELOPMENT
Residential	20' from primary and secondary roadways. 10' from collector roadways. 4' (front yard) and 5' (rear yard) for tertiary roadways.	None, per se, except that a single or multi-family residential structure shall not exceed a height that inhibits access to sunlight for adjacent lots.	6 units/acre for single and two-family dwelling units. Lot coverage of 40% for non-sewered lots for single-family units. Lot coverage of 50% for non-sewered and 60% for sewered lots for multi-family units.
Commercial	None	25'	None
Resort	20' side yard	85' or eight stories	20 guest units/ acre
Industrial	None	45'	None
Village	None	None	None

EXHIBIT V-2
LOT COVERAGE REGULATIONS FOR
COMMERCIAL AND RESORT ZONES

(A) Authority. Section 5(f) of the Zoning and Land Use Act, Commonwealth of the Northern Mariana Islands.

(B) Scope of Regulations. These regulations apply to the Commercial Zone and to the Resort Zone as established by Section 9(c) and (d), respectively of the Zoning and Land Use Act, Commonmwealth of the Northern Mariana Islands.

Commercial Zone	-	Maximum lot coverage by structures - 25% Maximum lot coverage for parking, roads and service entries - 45% Minimum lot coverage by for open space - 30%
Resort Zone	-	Maximum lot coverage by structures - 20% Maximum lot coverage for parking, roads and service entries - 35% Minimum lot coverage for open space - 45%

2. Setback and Height Regulations

The major considerations when evaluating property coverage ratios and setback-height standards are light, air, open space, compatibility with adjacent uses, preservation of scenic views and the overall aesthetics and character of the area. The objective with such regulations is to devise a formula which, on one hand, safeguards environmental design principles without, on the other hand, imposing burdensome and restrictive standards on a developer.

Recognizing, therefore, the potential and the need for economic development in CNMI as well as the imperativeness for general site design standards, the following regulations (Exhibit V-3) are recommended for commercial and resort zones to replace those now proposed in the "Zones and Land Use Districts Study."

EXHIBIT V-3
SETBACK AND HEIGHT REGULATIONS FOR
COMMERCIAL AND RESORT ZONES

(A) Authority. Section 5(f) of the Zoning and Land Use Act, Commonwealth of the Northern Mariana Islands.

(B) Scope of Regulations. These regulations apply to the Commercial Zone and Resort Zone as established by Section 9(c) and (d), respectively , of the Zoning and Land Use Act, Commonwealth of the Northern Mariana Islands.

(C) Setback and Height Regulations. A height-setback graph is provided for each zone. These curves reflect the relationship between the height and the space between buildings. Additionally it is recommended that taller buildings be clustered in a manner to minimize the impact of each individual tower. Certain concessions in the setback-height standards can be proposed where a desirable concept of clustering is possible.

(D) Height/Setback Graph. See Figure V-2.

D. SHORELINE FENCING REGULATIONS

While indiscriminate shoreline fencing is not now a significant problem along the Saipan Lagoon shoreline, the Commonwealth should promulgate specific regulations to prevent any undesirable situations where such fences may create access or aesthetic problems. Exhibit V-4 proposes such regulations.

EXHIBIT V-4
SHORELINE FENCING REGULATIONS

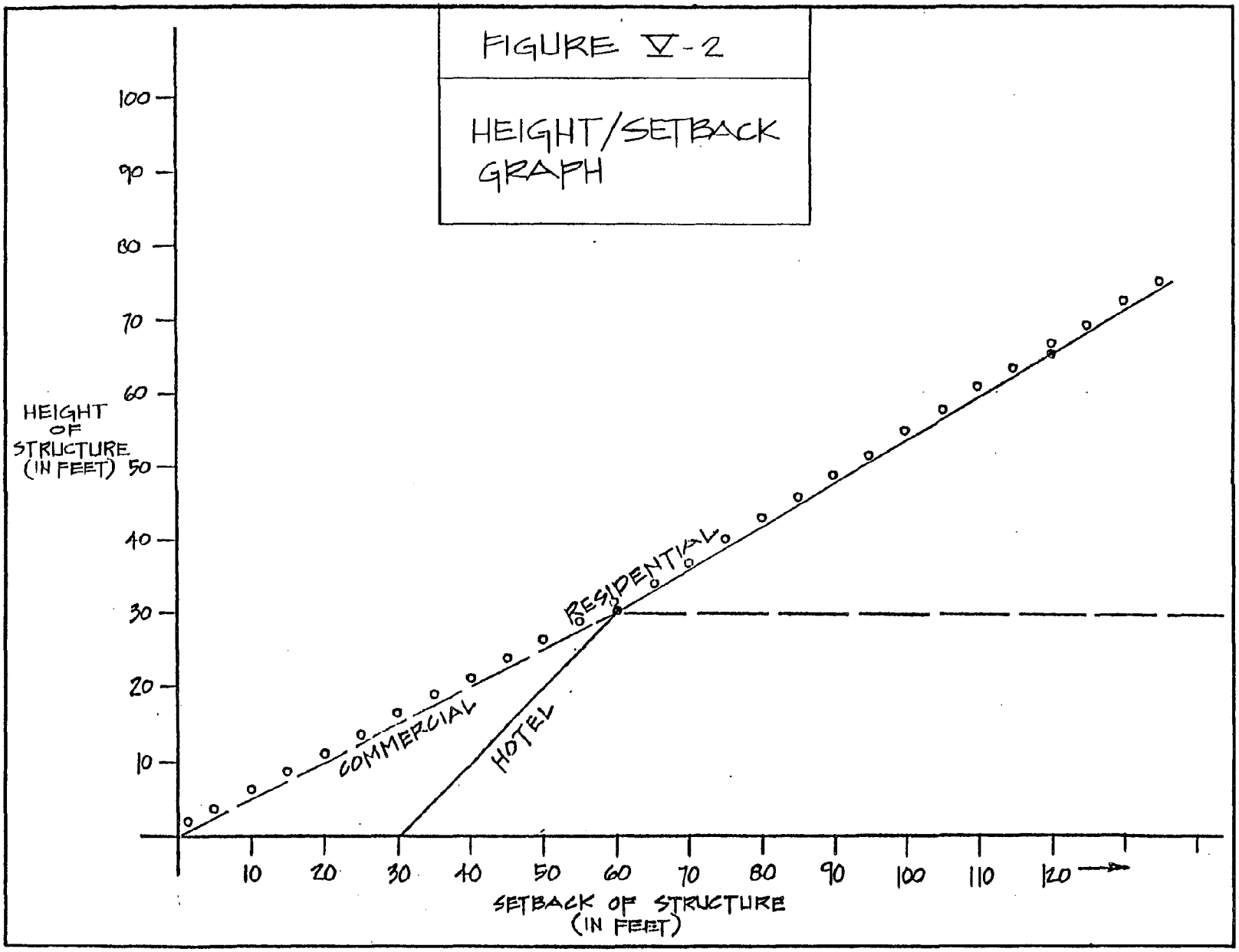
(A) Authority. Section 5(f) of the Zoning and Land Use Act, Commonwealth of the Northern Mariana Islands.

(B) Scope of Regulations. These regulations apply to all properties within the first 75 feet landward from the mean high water level.

(C) Conformity With Other Regulations. Shoreline Setbacks A and B as established by the Commonwealth's duly promulgated Shoreline Setbacks are hereby incorporated into the Shoreline Fencing Regulations.

FIGURE V-2

HEIGHT/SETBACK GRAPH



(D) Supplemental Regulations to Shoreline Setback Regulations A. The Zoning Review Board and the Coastal Resources Management Office shall not approve any construction for fences in this 0-35 feet setback.

(E) Supplemental Regulations to Shoreline Setback Regulations B. In the event that fencing is permitting by the Zoning Review Board and the Coastal Resources Management Office within the 35-75 feet shoreline setback such fencing must comply with all of the following criteria:

1. Such fencing shall not exceed 30" (thirty inches) in height or 24" (twenty-four inches) in width.

2. Such fencing shall not extend seaward beyond a point which is 25'(twenty-five feet) from the mean high water level contour.

3. Such fencing shall be primarily constructed of indigenous materials. Barbed wire is especially prohibited.

4. Such fencing shall not be used as a foundation for any objects extending vertically or horizontally from the fencing itself.

5. Such fencing which is lying perpendicular or askew of the coastline shall be provided with either ground level openings or with steps, both of sufficient size and convenience to accommodate easy pedestrian access.

E. LANDSCAPING GUIDELINES

Exhibit V-5, below, is adopted from the "Zones and Land Use Districts" report and supplemented with species of indigenous vegetation that are suitable for the respective landscaping guidelines.

EXHIBIT V-5

GUIDELINES FOR LANDSCAPING

The Authority for these regulations is Section 5(f) of the proposed Zoning and Land Use Act, Commonwealth of the Northern Mariana Islands.

GUIDELINE No. 1 Development should promote the lagoon's scenic qualities.

Variations in the natural coastline, beaches, and reef should be visually accessible.

Lagoon and beach activities should be visually featured.

On-shore topography and natural vegetation should be retained.

Areas of particular concern should continue to be protected by legislation. Unique ecological areas and significant stands of tropical limestone vegetation should be preserved through site development plans which protect such areas and vegetation from degradation by nearby construction.

GUIDELINE No. 2 Establish complementary relationships between development and the lagoon shoreline.

Maintain continuity of land form, topography and transitions to the beach. Minimize the use of retaining walls, dikes and seawalls. Design seawalls to also serve as benches and soften their appearance by providing tropical landscaping such as Hibiscus hedge, Panama Cherrytree, Coconut Palm, Beach Morning Glory and various beach grasses.

Maintain, define and develop beach access points. Provide for continuous beach walkways and incorporate beach walkways into all shore development, including the provision of benches, trash receptacles, low-level lighting and other conveniences. Public access to the beach should be established through pedestrian arcades and public corridors.

Maintain a open-view corridors to the Lagoon. Orient buildings perpendicular to the shoreline to allow view corridors between buildings. Open buildings at the ground level to permit views.

Parking adjacent to shoreline areas is subject to the prevailing Seashore Setback Regulations. Screen all views of parking in order to promote the natural Lagoon and shoreline setting.

Preserve stands of Coconut Palms, Ironwood, Flame, Kapok, Breadfruit, Barringtonia, Banyan and other mature trees. Clearing of low-level scrub such as tangan-tangan, and various grasses within and adjacent to the shoreline is encouraged to enhance views and provide for public security. Existing, tall Palm, Barringtonia, Ironwood, Banyan, Kapok, Breadfruit, Messerschmidia and Flame trees should not be damaged or removed.

GUIDELINE No. 3 Encourage accessibility to community assets which provide a sense of orientation, recognition and visual interest.

Maintain and improve the quality of open space areas and access to them for recreational purposes.

Maintain and improve accesses from the beach to park and recreation facilities.

Relate proposed developments visually and functionally to adjacent roadways and pedestrian walkways. Provide amenities such as rest areas, landscaping of natural flora, lighting, and appropriate street furniture. Plantings of low vegetation such as the Beach Sunflower, Dwarf Poinsettia, Beach Morning Glory or other common ground cover within rights-of-way are encouraged.

Relate proposed developments to nearby historic areas.

GUIDELINE No. 4 Development shall promote a positive visual image and impression of Saipan's character.

Resort, hotel or tourist industry facility environments should reflect a feeling of relaxation and leisure. The intensive building, congestion and activity of urban settings are discouraged.

Emphasize recreation, and pedestrian activity and landscaped open space.

Consideration should be given to preservation and improvement of the natural beauty of the proposed project site with emphasis on open space, water features, natural land form, and vegetation such as that found in the limestone forest, beach strand or savannah.

Consolidation of properties into the largest possible parcel is encouraged. Subdivision of property into smaller parcels is discouraged unless justified by an overall site master plan to be implemented through specific construction in consonance with the projected development of the basic lot.

Utilize green areas for on-site disposal of stormwater. Landscaped percolation basins, grass covered ponding basins, recreation and open-space areas and areas of natural vegetation will provide capacity for recharge of stormwater run-off. Ponding areas covered with various short grass such as Bluegrass Japanese grass or other appropriate types can be used.

Adequate lighting should be provided for outdoor areas. Lighting should have a precisely defined purpose and not be disruptive to the adjacent surroundings or to the overall environment. Light poles should be no more than 15-feet in height, with underground electrical service.

Screen all service and mechanical areas by using natural vegetation hedges such as Hibiscus, Crotans or close-cropped Ironwood.

Create hills and berms to integrate overall land and building forms. Accentuate natural land form in order to define the character of development and to promote the natural setting.

Provide underground, covered or screened parking. Screened parking is easily accomplished by hedges of Hibiscus, Crotons or Ironwood.

GUIDELINE No. 5 Use design elements to express function, use and tropical setting.

Provide variety in building envelope, wall plane and roof shape. Break structures into related components, with distinctive appearance.

Link buildings and activities through the use of vestibules, covered passages, terraces and arcades.

Promote indoor-outdoor relationships. Public spaces can be open to the outside to allow for natural breezes and the experience of the tropical environment.

Utilize recessed entries as shaded transitions.

Promote natural ventilation of spaces. Orient for maximum wind exposure. Provide breezeways to capture cooling breezes.

Give consideration to treatment of entry, windows, cornices and other building elements that contribute to style.

Consult architectural and construction references for energy-conscious design features.

Balance the use of concrete and masonry with the use of natural materials. Naturally-weathering materials provide a pleasant appearance with minimal maintenance requirements.

Permanent structures are encouraged. Temporary structures such as mobile homes and pre-engineered steel buildings and structures made of corrugated metal sheeting are not desirable for the long term appearance of the Lagoon area.

Utilize distinctive ground textures for visual character and continuity.

The nature, size, shape, style and lighting of all signs should be in harmony with the Lagoon setting and in conformance with prevailing Sign Regulations.

Signs should be subordinate to buildings and fit within existing features of the structure.

GUIDELINE No. 6 The proportion and scale of buildings should relate to human scale.

Structure should not dominate adjacent streets, pedestrian spaces and neighboring properties. Pedestrian viewpoints should relate to both the size and detail of buildings.

Provide for transitions between building scale and street scale through the use of plazas, trellises with overhanging plants such as epiphytic ferns from the limestone forest, street furniture, landscaping and other outdoor features which relate to human scale.

Extend form and relieve the massiveness and/or height of structures through the use of transitional elements. Ancillary structures such as entrance canopies, trellises, porches, stairs, terraces, plazas, gardens and other exterior spaces provide shade and inviting spaces, while enhancing the human scale of buildings.

Soften the bulk of structures by breaking them into smaller components. Examples include the use of several, connected structures in lieu of one large

imposing structure and provision of lower, ancillary buildings which surround tower structures.

Vary the wall plane, height and fenestration to provide an interesting configuration and silhouette.

Use roof forms which enhance the structure's overall scale; also, blend various forms.

Soften the bulkiness of structures through the use of landscaping with local vegetation like Coconut and

Betel Nut Palm, Hibiscus, Bamboo, Panama Cherrytree, Soursap, Papaya, Pandanus, Flame tree and other appropriate flora incorporated within the form of buildings.

GUIDELINE No. 7 Promote continuity of a proposed development with adjacent areas.

A structure's scale adjacent to the street shall relate to pedestrian scale.

Provide a variety of setback and exterior spaces separating adjacent developments.

Provide adequate open space as a component of the project.

Provide transitions between the structure's heights and the boundaries of the site. Construction at a corner site shall be less imposing in order to diffuse and open-up intersections.

Use special care in siting of high-density residential buildings where they are located adjacent to low-density residential developments.

The effect of tall structures on natural air circulation and wind turbulence should be considered. Building shadows should not interfere with neighboring activities.

A building significantly taller than its surroundings can experience high wind loads and create pedestrian-level winds.

Provide unobtrusive parking, walkway and landscape lighting for safety and public security.

GUIDELINE No. 8 Integrate infrastructure and service elements in an unobtrusive manner.

The underground installation of power, telephone and television service within the site are strongly encouraged.

Locate automobile and bus parking areas to the rear of buildings whenever possible. Screen parking areas at boundaries and break-up large, paved areas with islands that are land scaped in a natural setting.

GUIDELINE No. 9 Protect existing landscaping and design new landscaping around existing vegetation, especially mature trees and planting.

Existing trees and groupings such as coconut Palm, Ironwood, Barringtonia, Flame, Banyan, Pandanus, Papaya, Panama Cherry, Soursap, established in their natural condition, should be retained and protected during construction.

Selective pruning and removal are desirable in order to open specific vistas, to give shape and dimension to vegetative groupings, to create functional open space, and to frame architectural elements.

Prune and shape existing vegetation for viewing and to preserve mature Coconut Palm, Ironwood, Barringtonia, Flame, Banyan, Pandanus, Papaya Cherry, Soursap trees.

Parking area layouts should incorporate existing trees to the greatest extent possible.

Buildings should be located with respect to preserving large stands of mature trees.

Maintain visual continuity of existing vegetation by replacing cleared areas with new landscaping of similar species composition.

GUIDELINE No. 10 Utilize landscaping as functional solutions to site development.

Utilize landscaping for traffic and circulation control to screen objectional views of service and mechanical areas and to provide privacy by utilizing hedges of various Hibiscus species or thick Ironwood.

Buffer and shade parking areas with Coconut Palm, Banyan, Barringtonia, Ironwood, Breadfruit or other large trees to provide relief from sun glare and to reduce surface temperature of paved areas. Large paved areas are hot and uninteresting, landscaping cools and shades parking lots.

Utilize landscaping of appropriate height vegetation in order to enchance building line and form, to unfold an attractive vista or to frame a view. Islands of interspersed landscaping with a glimpse of the ocean may be more effective than a block-view or a sweeping panorama of horizon.

Utilize ground cover of varying heights and types to shade, cool and direct breezes, to absorb unpleasant sounds, smells and dust, and as erosion control on steep banks.

In some cases, plantings themselves become a focal point of development. Large planting groups representing natural tropical settings such as the limestone forest or beach strand, are strong determinants of spatial form.

Provide other landscape elements including rock forms, water and sculptures.

Landscape storm-water percolation basins with local ground cover such as the Beach Sun Flower or common grasses, to ensure attractive and maintained open space.

GUIDELINE No. 11 Utilize informal landscaping techniques to enhance the natural setting of the Lagoon area.

Random planting and naturalness should be created by planting to blend with the natural environment, like that which is found in the limestone forest, savannah or beach strand.

Plant in mass. Large trees such as Coconut, Breadfruit, Pandanus, and other natural forms of large and small plants should be grouped into clusters as simple landscape elements.

Consider seasonal variation of color, loss of leaves and susceptibility to pest attack. Transient floral aspects, no matter how striking, should not be the sole basis of selection unless the specimen is also a sound selection when not in flower.

Landscaping lighting shall be low level. Underlighting of plantings can serve also as walkway lighting. Limit any illumination spotting to specimen trees and to dominant landscape forms.

F. ESTIMATED COST OF PROMULGATING NEW LAND USE REGULATIONS AND DISSEMINATING LANDSCAPING GUIDELINES

Provisions for promulgating new or amended land use regulations are prescribed in the Zones and Land Use Districts Act. This procedure would be carried-out by staff of the proposed Zoning Administration Office staff as provided by the Act or, in the interim, by the Coastal Resources Management Office, and involve a period for becoming familiar with the materials, coordination among other agencies, and public hearing expenses. The Landscaping Guidelines should be printed for dissemination to prospective developers. The estimated cost for promulgating the regulations and printing the guidelines is $2,000.

CHAPTER VI- BEACH RESTORATION PLAN

A. STATEMENT OF INTENT

The intent of this section of the PLAN is to recommend both regulatory as well as preliminary plans for structural and non-structural improvements for protecting the beach along Saipan Lagoon. The regulatory measures address three activates which now affect the beach strand and near-shore ecological zones. They are:

* Regulations for dredging, diking and land-filling along coastal areas;
* Regulations for mining along coastal areas; and
* Regulations for structures which are located within the near-shore or beach strand ecological zones.

Appropriate structural and non-structural remedial measures for protecting and restoring beach erosion sites are adapted to the Lagoon's coastline and specific measures are recommended.

B. REGULATIONS FOR DREDGING, DIKING AND LANDFILLING ALONG COASTAL AREAS

Exhibit VI- 1, below, contains these proposed regulations.

EXHIBIT VI-1
REGULATIONS FOR DREDGING, DIKING AND LANDFILLING ALONG COASTAL AREAS

1. Authority. Public Law 3-47, Commonwealth of the Northern Mariana Islands.

2. Prohibited dredging, diking and landfilling along coastal areas. The dredging, diking or landfilling of coastal wetlands is prohibited.

3. Conditions for permitting landfilling, diking and dredging. Landfilling, diking and dredging shall be permitted only as part of a wetland or esturine restoration plan and under the auspices of a permit approved by by the Coastal Resources Management Office, Commonwealth of the Northern Mariana Islands and

of a permit approved by by the Coastal Resources Management Office, Commonwealth of the Northern Mariana Islands and

a) as part of an approved maintenance dredging project; or

b) as part of a port expansion; or

c) as part of an energy facility for which there is no alternative location that would result in less environmental damage.

4. Conditions upon approval for dredging. When dredging is allowed in accordance with Section 3, above, such dredging shall:

a) avoid unnecessary disruption to biological communities and water circulation through planning and scheduling of dredging operations;

b) shall avoid the dredging of toxic bottom materials; and

c) shall provide for the isolation and treatment of spoils material or for its disposal on land so as to prevent pollution of marine, surface and underground waters.

5. Disposal of dredged material. Dredged material which is suitable for beach replenishment shall be transported to appropriate beaches designated by the Coastal Resources Management Office. After a thorough assessment of potential disposal sites, all other dredge spoils shall be disposed at either:

a) dry land in authorized fill sites; or

b) in marine areas where studies demonstrate that it can be used with minimal environmental impact; or

c) in deep ocean areas subject to Federal and/or Commonwealth guidelines and at sites chosen so as to minimize adverse impacts to marine organisms.

EXHIBIT VI-2
REGULATIONS FOR STRUCTURES LOCATED IN
NEAR SHORE AND BEACH STRAND ECOLOGICAL ZONES

1. Authority. Public Law 3-47, Commonwealth of the Northern Mariana Islands.

2. Conformance with other regulations. These regulations shall supplement other prevailing applicable regulations for structures located in near shore and beach strand ecological zones such as those regulations administered by the U.S. Army Corps of Engineers.

3. Prohibited structures. Structures on the open beach strand shall be prohibited except for those necessary for public health, safety or welfare.

4. Conditions for approval. Near-shore and beach strand structures shall be permitted only when required:

   a) to maintain and serve public recreation areas or necessary public service facilities where there is no less environmentally harmful alternative; or

   b) to protect existing developments where the Coastal Resources Management Office determines that the public interest would be better served by such protection than instead, by protecting the natural shoreline processes.

5. Repair of structures. Repair, replacement or reconstruction of shoreline structures shall be planned and designed to protect and enhance marine life conditions. Existing shoreline structures which cause water pollution and fish habitat degradation shall be required to conform with these regulations within one year of the effective date of these regulations.

D. REGULATIONS FOR MINING ALONG COASTAL AREAS

Exhibit VI-3, below, contains these proposed regulations.

EXHIBIT VI-3
REGULATIONS FOR MINING
ALONG COASTAL STRAND

1. Authority. Public Law 3-23, Commonwealth of the Northern Mariana Islands.

D. REGULATIONS FOR MINING ALONG COASTAL AREAS

Exhibit VI-3, below, contains these proposed regulations.

EXHIBIT VI-3
REGULATIONS FOR MINING
ALONG COASTAL STRAND

1. Authority. .Public Law 3-23, Commonwealth of the Northern Mariana Islands.

2. Mining along beach strand. Mining activities within the beach strand ecological zone are prohibited.

3. Mining along other coastal areas. Mining may be permitted in other coastal areas if it can be demonstrated that:

   a) such extractions cannot be feasibly supplied from inland locations; and

   b) such extractions will not have substantial or longlasting adverse impact on coastal zone resources; and

   c) the sand supply at the extraction site is sufficient to allow mining without adverse impact; and

   d) buffer areas are provided to screen in-land mining from coastal areas; and

   e) mined areas will be reclaimed and replanted; and

   f) mined and dirty surface water pollution and waste materials and spoils disposal are controlled to minimize adverse impacts.

4. Mining along coastal streams. Excavations affecting coastal streams shall be permitted only when necessary for flood control and only if consistent with approved Commonwealth plans. Such excavation requires mitigation measures to:

   a) maintain sand transport capability;

   b) replace all fish, wildlife and habitat values; and

   c) protect recreational values.

E. BEACH AND SHORELINE RESTORATION PLAN

The Saipan Lagoon shoreline suffers from beach erosion at several sites, see Figure VI-1. In most cases, this erosion has been a progressive, long-term effect; however, periodic storm waves have accelerated some beach changes, especially when accompanied by high tides.

The causes of these beach erosion areas have not been studied and are not well understood at this time. Engineering investigation of existing coastal geology and oceanography processes must occur before major restoration projects are undertaken. However, several types of remedial measures are already well developed by the U.S. Army Corps of Engineers; and their general planning applications and design principles are appropriate for certain Saipan Lagoon beach erosion sites. Such recommended measures are not to be construed as a substitute for professional engineering services which are prerequisite to properly designed shoreline restoration. Rather, they are described and recommended as guidelines for those restoration plans.

1. Typical Remedial Measures for Beach Erosion

Various methods can be employed to protect property from beach erosion and other wave-induced damages and to replenish eroded beaches. Understanding the causes of erosion and the principles of design are the two keys in selecting the proper remedial measure. Established design principles include:

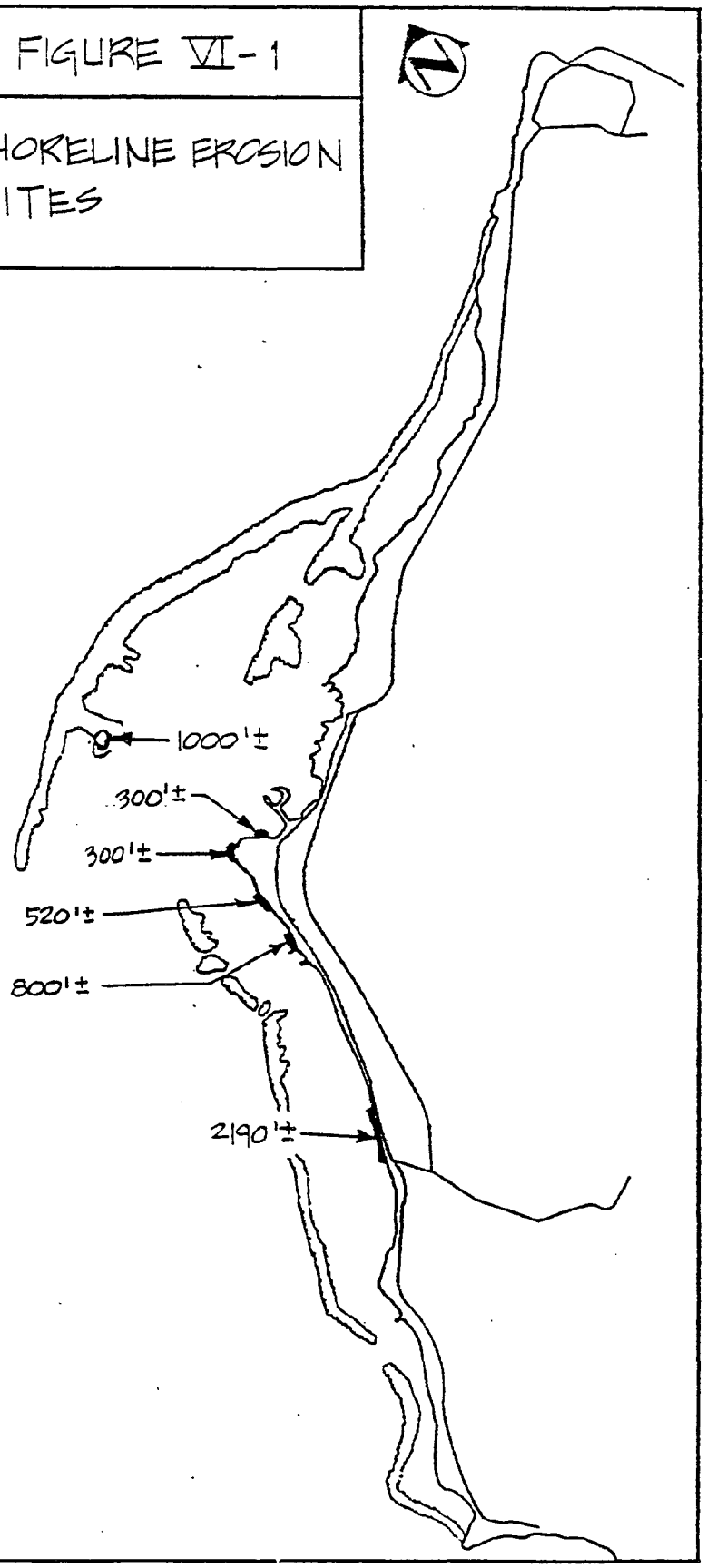
* adequate bedding for structural foundations;
* flank protection of revetments by return walls;
* structural stability of bulkheads or other structural devices;
* stone underlayers and filters beneath armour stone; and
* adequate elevation to prevent severe overtopping by waves.

Erosion control measures are categorized as either non-structural or structural. Non-structural measures may include:

* taking no action (not considered in this PLAN);
* regulation of shoreline uses;
* relocation of existing buildings and roads away from eroding land;
* beach fill and nourishment;
* piling supports for structures; and
* planting vegetation.

FIGURE VI-1

SHORELINE EROSION SITES



Structural measures should be considered only when non-structural measures cannot achieve the required shoreline protection. Structural measures may include:

* revetments;
* seawalls;
* other devices which protect the shoreline from direct erosion by waves;
* groins;
* offshore breakwaters; and
* other devices which protect the shoreline by controlling sand transport.

2. Non-structural Measures

Obviously, some measures have interchangeable and/or multiple functions; but serious consideration is always given first to non-structural measures because they require the least effort (expense) and generally have the least adverse impact on the environment.

Three types of appropriate non-structural measures for the Saipan Lagoon shoreline are described below.

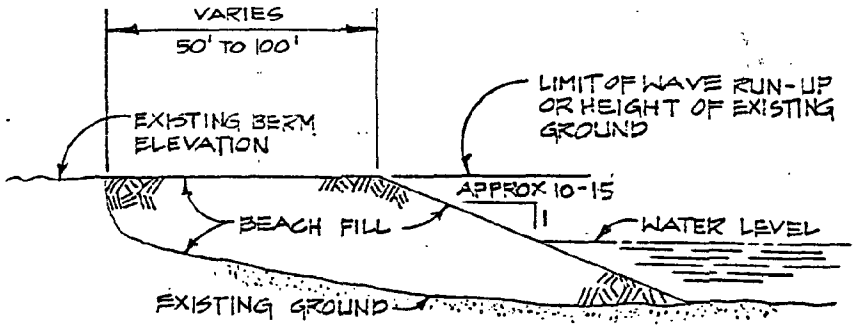
a) Shoreline Management. This is the remedial measure employed most fully. Preserving existing vegetation, strategic planting of erosion-resistant vegetation and requiring buildings and other structures to be located landward of erosion constitute the most effective measures for protecting property from coastal damages. This measure is implemented by virtue of the Seashore Setback Regulations proposed in the Land Use Plan Element of this SAIPAN LAGOON USE MANAGEMENT PLAN.

b) Beach Fill and Nourishment. A sandy beach provides natural protection against wave attack; but continuous erosion will eventually result in the long-term loss of sand. If that loss is replenished with new material, the beach recession can be abated. Such nourishment measures require medium to coarse gravel sand compatible with that being replaced, to be successful. The sand fill can be dumped in a continuous blanket directly upon the eroded area, in stock piles at regular intervals along the beach, or on a feeder beach updrift of the eroding beach, allowing for wave action to distribute the material.

Beach nourishment simulates a natural erosion control measure, and the resulting beaches are

aesthetically pleasing and provide recreation opportunities. However, this may become an expensive measure because the capacity of waves to remove sand could be so great as to preclude economic feasibility. Furthermore, a sand beach without some sort of structural back-up may not provide adequate protection against waves generated by periodic tropical storms and typhoons. Also, the regular displacement of sand from one area to another may be injurious to marine habitats.

See Figure VI-2, Typical Beach Fill, for the cross-section view of this measure.



TYPICAL BEACH FILL

c) Vegetation. Although planting vegetation is most commonly associated with erosion protection of sand dunes (which do not occur along the Saipan Lagoon shoreline) this remedial measure does offer some value to the project area.

Vegetation counteracts erosion because root systems bind the soil and also forms protective mats which resist erosion. Low-growing grasses and coastal shrubs that spread thickly and have extensive root systems are useful, such as Wedelia biflora; Beach Morning Glory, Ipomoea pes-caprae; and Scaevola taccada. Trees such as ironwoods are effective as coastal windbreaks.

Of course, few species of vegetation can survive a constant onslaught of inundation by seawaters; and it takes considerable time to establish a dense growth, even under ideal conditions. Consequently, the vegetation which does exist along the Saipan Lagoon shoreline serves a valuable, time-tested purpose and must be preserved and nurtured.

3. Structural Measures

Four types of structural measures are appropriate for the Saipan Lagoon shoreline. They are stone revetments, masonry gravity walls, bulkheads and sand grabbers.

a) Stone Revetments. A revetment is nothing more than a protective facing which covers a slope from direct erosion by waves. Properly designed, revetments are time-proven measures for shore protection. They can be constructed of various materials, but large coral boulders (armour stones) are the most economical for Saipan. The armour stones must be large enough or interconnected in order to resist dislodging by waves. Also, armour stone revetments require:

* proper filter material to prevent loss of slope material through the voids between stones;
* bedding stone to distribute the weight of the armour stones; and
* protection of the slope's toe and flanks.

Generally the slope of revetments should not be steeper than 30%; and the quarry stones should be clean and free of cracks and cleavages. The largest stone should be not greater in size than three times smallest stone, ruling out the use of broken asphalt or concrete rubble as armour material.

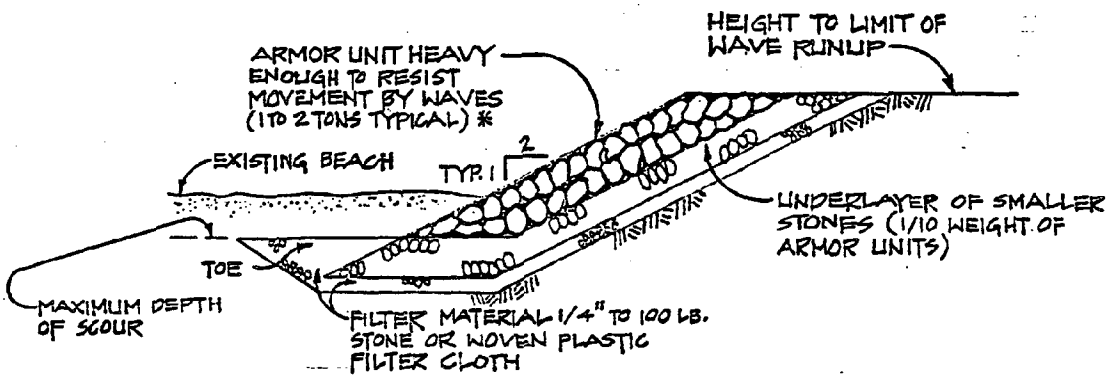
Advantages of revetments as remedial measures for shoreline erosion include:

* high resistance to wave damage;
* flexibility in that they can settle into underlying soils and experience minor damage but still function without major repairs; and
* resistance to wave run-up and overtopping due to their rough surface.

The disadvantages of revetments include:

* the heavy equipment and special skills needed to place armour stones;
* relative expense of quarried coral which is suitable for armour stone; and
* the large area required to construct the structure; and
* unaesthetic appearance compared to non-structural measures.

See Figure VI-3 for a typical revetment section.



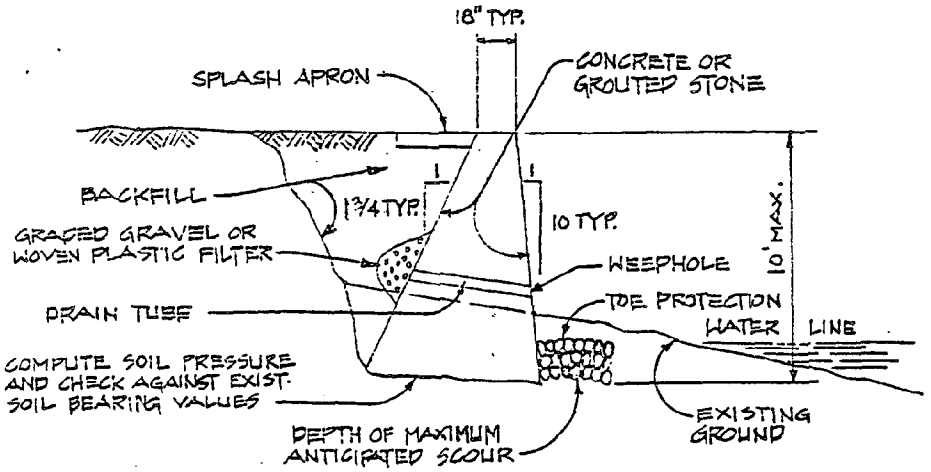
TYPICAL REVETMENT SECTION

b) Masonry Gravity Walls. Masonry gravity walls are common shoreline protection structures along coastal beaches. The wall must be designed so as

to resist the pressures of the retained saturated soil that tends to topple the wall seaward. This normally is accomplished by providing a broad base and by battering the backface of the wall away from the shore (See typical cross section in Plate VI-4).

An engineering design analysis is needed to assure that the wall is structurally stable. The base of the wall must be well below the maximum anticipated scour on its seaward side; and adequate toe protection is required to prevent undermining by waves reflected off the wall. An aggregate backfill and weepholes are required for draining saturated soils. A splash apron behind the wall's crest will prevent overtopping waves from washing-out the backfill.

The masonry gravity wall is a proven, moderately-priced, long-lasting, relatively maintenance free remedial measure. However, these walls do require an experienced mason, and structural failures are difficult to repair.



TYPICAL CONCRETE OR GROUTED MASONARY GRAVITY WALL

c) Bulkheads. A bulkhead is a vertical seawall, constructed of sheetpiles that are driven into the ground or seabed, and stabilized by tie-backs. Sheetpiles are normally constructed of either

steel, concrete or timber. The length of the sheets are determined by a ratio of being embedded to a depth of 1.5 to 2.0 times the height of the wall above the scour depth. A tie-back is needed to anchor the top of the bulkhead against soil pressures tending to topple the wall seaward, although free-standing alternatives, requiring significantly deeper penetration of the piles, can be designed. Bulkheads require substantial toe protection, usually provided by graded quarried stones. Bulkhead seawalls also require considerable soils analysis and engineering design work.

While they provide longterm, maintenance-free protection of uniform appearance, especially for industrial and shoreline-dependent areas where land base is scarce, bulkheads do posses some disadvantages. The long tie-back feature does not adapt well where a building is situated close to the shoreline. Steel sheetpiles have a limited life because of salt water corrosion.

Timber piles are prone to biological decay. The smooth vertical face does not absorb wave energy; and reflected wave energy may result in loss of sand that is seaward of the bulkhead. Repairs can be expensive, and pile-driving is a noisy, objectionable operation. See Figure VI-5.

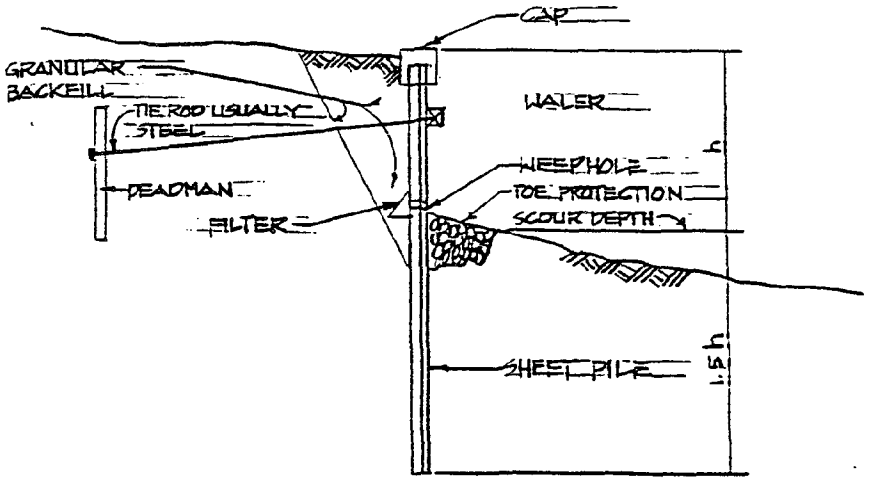


FIGURE VI-5
TYPICAL BULKHEAD-TIED-BACK CONSTRUCTION

d) Sand Grabber. The Sand Grabber is a patented device constructed of concrete building blocks that are hooked together with steel rods. The devices trap sand behind them as wave action carries water over and through the structure. The slower return-flow of the water that penetrates through the blocks allows the sand to deposit behind the structure. The blocks can also be placed along the shore to form a revetment.

This structure is inexpensive and allows easy access to the beach. However, the steel rods will eventually rust away, thereby allowing the blocks to disassemble. This remedial measure has not been proven functionally effective or structurally adequate over a period of time long enough to judge its life expectancy and maintenance requirements. Therefore, it should be considered as appropriate for a short-term solution only.

Also, without adequate protection, the seaward row of blocks may be undermined by toe scour. These installations must also be protected to prevent flanking failure.

Figure VI-6, below, depicts sectional views of this measure.

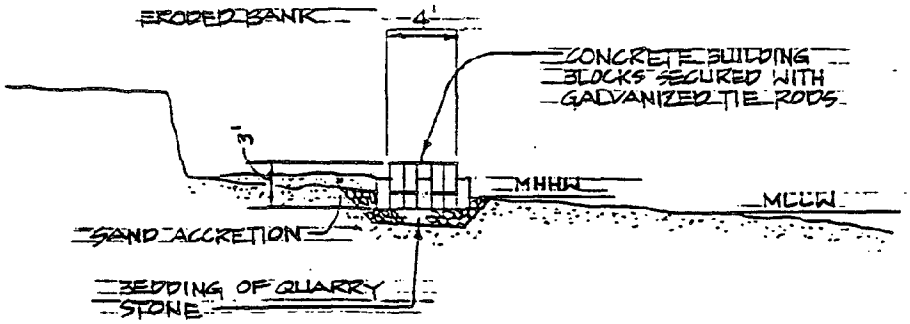


FIGURE VI-6
TYPICAL SAND GRABBER SECTION

F. RECOMMENDED SHORELINE EROSION CONTROL STRUCTURES AND ESTIMATED COST OF STRUCTURES AND PROMULGATING REGULATIONS FOR COASTAL AREAS

Construction of erosion-control works can have both favorable and unfavorable impacts on the Saipan Lagoon coastline: shoreline uses, adjacent properties, plants and wildlife are all affected. Shoreline protection control structures may hamper the natural littoral transport regime by creating a beach on the updrift side while inducing erosion on the downdrift side. A revetment may protect an eroding shoreline, but the material that is being protected no longer becomes available to supply the erosion occurring at downdrift beaches. Construction operations may create temporary turbidity and water quality degradation.

The following erosion control structures (see Table VI-1) are recommended for correcting the shoreline erosion which now occurs at five locations along the Saipan Lagoon shoreline (refer to Figure VI-1).

Additionally, a budget cost estimate is enclosed for the engineering design, plans and construction specifications.

TABLE VI-1
RECOMMENDED SHORELINE EROSION CONTROL STRUCTURES
AND COST ESTIMATES

LOCATION	LENGTH OF EROSION (LF)	RECOMMENDED STRUCTURES	ESTIMATED COST OF STRUCTURE
N.E. American Memorial Park	± 300	Sand Grabber Beach Fill	$ 196/L.F. $ 25/Cu.Yd.
W. American Memorial Park	± 300	Sand Grabber Beach Fill	$ 196/L.F. $ 25/Cu.Yd.
Micro Beach/ Hafa Adai Hotel	± 520	Sand Grabber Beach fill	$ 196/L.F. $ 25/Cu.Yd.
North of Garapan Wharf	± 800	Masonry Gravity Wall Stone Revetment	$ 330/L.F. $ 40/Cu.Yd.
North of San Jose	± 2,190	Stone Revetment	$ 360/L.F.
		Subtotal (approx.)	$1,500,000
Plans and specifications for construction			$ 100,000
		TOTAL COST ESTIMATE	$1,600,000

The cost of promulgating the three sets of proposed regulations is similar to other regulation promulgation activities recommended by this PLAN. The estimated cost by CRMO staff is $1,000 for public hearings, promulgation and printing of the three sets of regulations.

CHAPTER VII - INFRASTRUCTURE PLAN

A. STATEMENT OF INTENT

This SAIPAN LAGOON USE MANAGEMENT PLAN establishes, among other things, the preferable development pattern for the Saipan Lagoon project area by virtue of the proposed zones and land uses, regulations, and management policies. Second only to this PLAN achieving those desired uses and growth pattern is the importance of assuring sufficient, reliable infrastructure throughout the project area; because available capacity for water, wastewater and power are determinant forces for managing any development plan.

Infrastructure planning for the Saipan Lagoon project area can occur in either of two forms:

* that of determination where development will (and will not) take place by providing for excess carrying capacity which can accommodate new growth, or, similarly, by extending utilities to areas where new projects have already been announced; or

* a preferred development pattern: that of supporting preconceived regional development plans by providing for excess capacity in accordance with land use projections and, conversely, by not upgrading capacity in those areas where development has reached it determined saturation point.

In the absence of an adopted, enforced land use plan for Saipan and its western shoreline corridor, infrastructure planning has basically taken the course of the first form: excess capacity being provided in the absence of land use planning or in reaction to proposed major projects which require extending and enlarging of utilities in order to service water, wastewater and power requirements. This results in land use planning at its worst because the public facilities are reactionary to private development decisions.

The Government's existing water and wastewater facilities plans are based on several sources of land use development and population projections. They have relied on the best (only) data available to date. With the adoption of this SAIPAN LAGOON USE MANAGEMENT PLAN, however, a realistic land use growth and development pattern will be established for the Saipan Lagoon shoreline geographical area; and infrastructure planning should be revised to account for this

information. Otherwise, the existing water and wastewater facilities plans will be fostering public investment in infrastructure which is out-of-step, and in some cases contradictory to, the land use development which is adopted by this PLAN.

Another aspect of infrastructure development, stormwater drainage and disposal, also suffers from inadequate planning and technical adaptation for Saipan. As with proper planning for water and sewer utilities, stormwater drainage facilities should be properly sized and designed to efficiently handle the intensity, volume and quality of the Island's stormwater runoff. Presently, however, the CNMI government has not adopted design criteria and construction standards to guide the placement of stormwater drainage and disposal facilities. A design criteria manual is necessary to standardize these facilities (which become the responsibility of Public Works to maintain) and to assure that the design parameters reflect Saipan's climatological and hydrological characteristics.

The intent of this Infrastructure Plan, therefore, is to recommend detailed scopes of work for updating the Saipan water and wastewater facilities plans for the Saipan Lagoon project area, to recommend a scope of work for developing a storm drainage criteria manual for guiding the design of Saipan drainage works in order to handle the runoff into the Lagoon in an environmentally acceptable manner; and to develop infrastructure planning criteria to assess the impact of future development within the established land use zones that are recommended for the PLAN's project area. In addition to these new recommendations this Plan also endorses many existing recommendations for on going programs and for infrastructure improvements which are presented in other reports.

B. WATER FACILITIES PLANNING FOR FUTURE SHORELINE USES

The primary purposes of this section are: 1) to update and revise the existing water facilities planning to reflect the newly established land use and development plans established for the Saipan Lagoon project area as well as to correct the water consumption demands used as a basis for design in the 1982 Saipan Water System Study; and, 2) to endorse the Government's existing plans for establishing a Groundwater Management Plan Task Force. This water system planning shall determine the necessary water production and transmission system to support the overall development objectives and plan elements for the SAIPAN LAGOON USE MANAGEMENT PLAN.

1. Scope of Work

In the Volume I, Chapter VIII, Section B.1.a "Problems associated with the Water System", it was disclosed that the planned water system improvements are under-designed by the year 1988. The following Scope of Work is recommended to correct that projection by upgrading the systemwide plans to accommodate the future Lagoon shoreline development based on current planning data.

This projection deficiency in the 1982 Saipan Water System Study does not discount the many other recommendations for both system upgrading and operations/maintenance improvements, which are still appropriate. It is unnecessary to repeat all of those recommendations (many of which are now being implemented by the Government) in this PLAN; however, their overall importance to implementing this PLAN certainly justifies inclusion by this reference.

The specific tasks embodied by the scope of work for this Facilities Plan Amendment are listed below.

a) Description and characteristics of the project area

- Topography
- Geology
- Land use development pattern
- Population projections
- Economic projections

b) Existing water facilities

- Water production facilities
- Water distribution facilities
- Water system evaluation
  - Management
  - Operations
  - Maintenance
  - Sanitary survey requirements

c) Water consumption requirements

- Historical production and demands
- Unaccounted-for water
- Per capita use
- Future public requirements
- Future commercial requirements
- Islandwide future water requirements

d) Design criteria

Design period
System pressures
System demands
Pipelines
Storages
Supply
Treatment

e) Water Quality

Water quality criteria for domestic uses
Water quality criteria for industry uses
Water quality monitoring program

f) Water supply and treatment alternatives

Groundwater quality management
Water reclamation
Desalination
Saltwater plumbing systems
Recommendations

g) Proposed water distribution and system improvements

General
Storage
Distribution
Hydraulic analysis
Proposed improvements
Cost estimates

2. Groundwater Management Task Force

Inherent to this PLAN's focus on water facilities planning is the assumption that an adequate quality and acceptable supply of potable water is available to the project area. The CNMI Government has embarked on a program to protect its groundwater resources and to plan for their future use on a sustainable yield basis. This PLAN endorses those efforts and specifically proposes that a Groundwater Resources Manager position be established to implement objectives of the Task Force.

3. Estimated Cost and Project Schedule

The estimated cost of the Water Facilities Planning is $85,000 and is not eligible for US EPA funding. This project will take approximately six months to complete.

The annual salary of a Groundwater Resources Manager is $30,000, plus an additional $10,000 for office administrative support, not including office space itself.

C. WASTEWATER FACILITIES PLANNING FOR FUTURE SHORELINE USES

The primary purpose of this section is to update and revise the existing wastewater facilities planning to reflect the newly established land use and development plans established for the Saipan Lagoon project area as well as to correct the wasteload projections used as a basis for design in the 1977 Wastewater Facilities Plan. This wastewater facilities planning shall determine the necessary wastewater collection, transmission, treatment and disposal system to support the overall objectives and plan elements of the SAIPAN LAGOON USE MANAGEMENT PLAN for the island's southern wastewater system, which data analysis from Volume I showed to be under-designed by the year 1988. There is no intent to amend Saipan's Wastewater Facilities Plan but, rather, to address the southern system's service area, which does not provide for the capacity that must be accommodated for additional tourist facilities now under construction and proposed.

Aside from the necessity to adjust future wastewater planning projections so as to reflect the land use development pattern and development proposals presented in Volumes I and II of the PLAN, the most pressing need for this utility is its general upgrading, in consonance with other existing plans and recommendations. Improvements to the physical system, as presented by the 1977 Wastewater Facilities Plan, and, particularly, improvements to operations and maintenance of the system as presented by both that Facilities Plan as well as by supplementary studies, rank as two of the Commonwealth's most urgent problems. It would be redundant for this PLAN to repeat those Wastewater Facility Plan recommendations; however, they are incorporated by reference as prerequisites to the full implementation of this lagoon use management PLAN.

The need for these operators and maintenance improvements are well understood by the Government, of course; and much

effort, but not enough funds, are already invested towards remedial action. The Saipan Lagoon and its planned shoreline uses cannot develop to their economic potential without the basic infrastructure improvements that is now budgeted in the Commonwealth's CIP and O&M requests.

1. Scope of Work

The specific tasks embodied by the scope of work for this Facilities Plan Amendment are listed below.

a) Description of the project area and wastewater system service areas

b) Environmental inventory of the project area

- Natural environment
- Land and lagoon
- Plants and animals
- Areas of particular concern and critical habitats
- Manmade environment
- Demographic projections
- Land use development patterns
- Economic development

c) Water quality criteria

- Water quality objectives
  - Water quality standards for lagoon and reef margin
  - Wastewater system parameters
  - Wastewater treatment requirements
  - Sources of pollution

d) Existing wastewater loadings and facilities

- Identification and characterization of wastewater loadings
  - Flows
  - Loadings
  - Characteristics
- Existing wastewater facilities
  - Collection systems
  - Transmission systems
  - Treatment and disposal systems
  - Maintenance and operations

e) Planning factors and wastewater design criteria

- Demography, land use and zoning
- Environmental and water quality considerations

Historical and archaeological considerations
Identification and characterization of future wastewater loadings
Identification of potential wastewater treatment and disposal sites

f) Wastewater system alternatives

Collection system alternatives
Transmission system alternatives
Treatment and disposal system alternatives
Efficient disposal alternatives
Innovative/alternative system approaches
Sewage sludge disposal

g) Evaluation of alternatives

Preliminary screening for methodology, technical application and selection of alternatives
Construction impacts
- Natural environment
- Manmade environment

Operational impacts
- Natural environment
- Manmade environment

Operational and maintenance manpower, skills and availability of supplies
Cost for capital replacement, O & M and life cycle costing
Final Evaluation
- Environment impacts
- Social impacts
- Present-worth costs
- Cost effectiveness

Prioritized ranking of alternatives

h) Review by CNMI Government and incorporation of appropriate comments

i) Final evaluation and recommendation of selected wastewater systems plan

j) Implementation plan and schedule

Sub-projects schedule
Capital improvements schedule
Phased development for systemwide operations

k) User charge rates

Operational costs
Capital costs
User statistics
Cost per user

2. Estimated Cost and Project Schedule

This wastewater facilities plan for the shoreline area of the southern wastewater system will cost approximately $40,000 and take about four months to complete by a professional engineering firm that is familiar with Saipan. This work is not eligible for US. EPA funding.

D. STORM DRAINAGE DESIGN CRITERIA MANUAL

The purpose of such a Storm Drainage Design Criteria Manual is to technically guide storm drainage planning and design throughout Saipan. General hydrologic and hydraulic practices as well as drainage design problems in Saipan must be addressed in detail. The primary thrust of the Manual is be to treat storm drainage as an infrastructure subsystem of the total urban infrastructure system. Likewise, drainage management should be considered as an integral part of Saipan's entire water resources management effort. Planning for interdisciplinary resources and other community infrastructure must be related to drainage policies wherever possible in order to achieve an overall, better environment.

The contemplated use of this Manual will be for Commonwealth of the Northern Mariana Islands designers, engineers and planners, consulting engineering firms, and other agencies or organizations having development responsibilities in the Commonwealth. The Department of Public Works shall have the design criteria adopted by Legislative resolution as CNMI policy.

1. Scope of Work

The Scope of Work to prepare this Manual must stress three primary purposes.

* Give direction to the Commonwealth Government agencies in order to support and assist private decisions about drainage, plans and improvements.

* Give direction to the Commonwealth Government agencies for guiding and regulating private developers in regards to drainage matters.

* Provide a framework for all public agencies in the Commonwealth to manage flooding and drainage problems.

The specific tasks embodied by the Scope of Work for this Manual are listed below.

a) Establish storm drainage policies and planning principles adopted by the Commonwealth and recommend amendments or additions as necessary.

b) Compile all applicable Commonwealth and Saipan laws, ordinances and regulations which relate to storm drainage.

c) Conduct a rainfall data analysis to determine:
general characteristics of frequency;
basic precipitation data; and frequency-intensity-duration analyses.

d) Recommend methods to improve the availability and reliability of precipitation data.

e) Describe the use of the Rational Method of statistical analysis for determining runoff and its application to Saipan-specific precipitation.

f) Recommend appropriate design procedures for storm drains on Saipan, including:

sizing of storm drain systems;
hydraulic design of storm drains;
design standards and criteria; and
sample problems for storm drain design calculations.

g) Recommend appropriate design procedures for storm water drainage from streets, including:

design criteria for urban streets;
design criteria for rural streets; and
design criteria for intersections.

h) Establish policies for street drainage and facilities maintenance.

i) Determine types and sizes of appropriate storm drainage inlets, including:

procedures for selection and use of various types of inlets;
design of curb opening inlets; and
design of grated and combination inlets.

j) Determine appropriate design procedures for major drainage works including:

open channels;
box culverts;
large pipe culverts;
riprap; and
sediment control.

k) Determine appropriate design criteria for hydraulic structures, including:

energy dissipaters;
channel drops;
bridges;
acceleration chutes;
bends; and
baffle chutes.

l) Determine appropriate design criteria, capacity charts and nomographs for inlets and culverts, including:

concrete box culvert inlets;
long conduct inlets; and
trash racks.

m) Determine appropriate design criteria for upstream and downstream storage facilities, including maintenance procedures.

n) Determine appropriate design criteria for storm water disposal alternatives including:

discharge to streams;
discharge to lagoons;
discharge to the ocean; and
discharge by means of infiltration.

o) Recommend appropriate means of floodproofing against storm water drainage, including:

non-structural alternatives;
structural alternatives; and
construction procedures.

2. Estimated Cost and Project Schedule

A project of this scope will require up to twelve months to complete complete and cost between $45,000 to $60,000 (depending on the amount of data available or furnished by the Government) by a professional engineering consultant.

E. PLANNING CRITERIA FOR EVALUATING DEVELOPMENT IMPACTS ON INFRASTRUCTURE

New development and changing uses along the Lagoon's shoreline will exact certain impacts on the project area. These impacts vary in nature and degree with the types of new development and uses that are introduced. Hotels, multi-unit residential complexes, industrial facilities and energy-related facilities can be expected to create the most significant shoreline and lagoon impacts. Park and recreation areas, conservation areas, commercial sales and services, and single-family residences generally create less severe and more easily manageable impacts.

The targets of such impacts also vary with respect to the types of new development and uses that are introduced. Impacts from people-intensive activities, such as hotels and apartments or condominiums, will strain the Commonwealth's water, sewer, power and telecommunications systems. Commercial establishments of the types most typically found in the PLAN's project area, on the other hand, contribute more heavily to the congestion of Saipan's transportation facilities than to community utilities. Industrial and energy-related facilities are most likely to impact on air quality and on the Lagoon's water quality.

It is important to understand the impacts that can be reasonably anticipated by new development and uses within the Saipan Lagoon project area. By intelligently anticipating the cumulative effects of these impacts it is possible to invoke mitigating measures where appropriate and/or plan for additional community infrastructure to accommodate the eventual need for increased demands. The purpose of this Section is to develop criteria and an impact rating system to evaluate the impact of large-scale proposed development within the project area.

The most likely type of new, large-scale coastline developments are hotels and multi-unit residential complexes. The most significant impacts of such projects affect the following infrastructure.

* Water service
* Sewer service
* Electrical power
* Storm drainage system
* Telecommunications
* Roads and parking

1. Water Service

The Saipan Water System Study calculated average residential water consumption at 130 gallons per capita per day (gcd). This is a projected rate, based on 24-hour water service. While apartment houses and condominiums are not particularly profilic on Saipan, the typical multi-family unit has two bedrooms and is occupied by 4 people (2 adults and 2 children). The water demand for each such typical unit is, therefore, 520 gallons per day.

The demand for water by hotels must be calculated somewhat differently, however. On the whole tourists are more mobile than residents; and their demand for water is more distributed throughout the island such as at parks, shopping areas and other tourist attractions.

Additionally, tourists do not generate all of the typical water uses of residents such as for laundry, car washing, irrigation, etc. For purposes of this analysis, therefore, a tourist is assigned a water use factor of 80% that of a resident, or 104 gcd. Since the average occupancy of a hotel room is 2 guests, the average water demand, per guest room, is calculated as 208 gallons per day. It must be remembered that these calculations for water demand are based on consumption and, therefore cannot be translated into water production requirements without accounting for water loss in the system due to leakage. Consumption plus leakage equals water production that is necessary.

An ancillary water demand by hotels and multi-unit residences is required for fire fighting capacity (fire flow). According to the Saipan Water System Study, the fire flow capacities are calculated by population. For communities the size of Chalan Kanoa and Garapan, for example, the flow in gpm is 1750 for a duration of seven hours. For the smaller villages such as San Roque, Tanapag and Susupe the fire flow is 100 gpm for a duration of four hours.

2. Sewer Service

Assuming mandatory connection to a public sewer system (a reasonable assumption for large scale developments) the demand generated for sewer service is computed as a factor of water usage. It can be reasonably assumed that water consumption and sewage flow are equal since non-sewered water such as for landscaping, irrigation, car washing, exterior maintenance of building and walk-ways are negligible. In short, then, average daily

generated sewage flows are 216 gallons per hotel guest room and 520 gallons per apartment/condominium unit. However, demand analysis of a sanitary sewer system must take in account the peak flows which are likely to occur. Peak flows reflect the day-to-day living patterns of residents and tourist and result in a multiplier effect of 3.5 over the average flow quantities.

3. Electrical Power Service

A standard basis for design to provide electrical power for hotels and multi-unit residential complexes is 13.8 KV distribution and

* 30 amps for a 200 room hotel
* 10 amps for a 50 unit residential building

4. Telecommunications

A standard basis for design to provide telephone service for hotels and multi-unit residential complexes is:

* one private line per 10 hotel guest rooms, plus 10 additional lines
* one private line per residential unit.

5. Roads and Parking

Only a small percentage of Saipan tourists rent vehicles or mopeds. Consequently, the major traffic generators by hotels are buses, delivery vehicles, employee vehicles, and local guests.

Because few activities are available to Saipan tourists by walking, tour buses are used for sightseeing tours, shopping, airport transportation, entertainment and eating. It is likely that, on the average, each tourist uses a bus once a day. Of course, not every 40-passenger bus is fully occupied, because the trips are pre-arranged as optional transportation services. Based on 50% ridership on each bus, each 200 room hotel would generate 10 primary round trips (once leaving the hotel and once returning); but that trip generation can be doubled to account for shuttling the empty buses to and from the hotels. For planning purposes, therefore, each 200-room hotel can be expected to generate approximately 40 vehicle traffic counts at a hotel each day.

Delivery vehicular traffic is a function of goods and services purchased by the hotel.

Employee traffic can be calculated at two vehicle trips per employee per day, based on the average hotel employment ratio of one employee per room.

Minimum parking requirements for commercial and resort developments have been established in the "Zones and Land Use Districts Act" within Section 9, subsection c(5) and subsection d(5), respectively. For commercial developments, minimum parking space requirements are one space for every 200 square feet of commercial floor area and for restaurants and bars the requirement is one parking space for every four customer seats. For resort developments the minimum parking requirements are one space for every five guest rooms, plus one parking space for every four customers seats in a hotel's restaurant and bar.

F. IMPACT EVALUATION BY MATRIX

While it is important to accurately judge the anticipated impact to infrastructure from hotels and multi-unit residential complexes, other types of impacts (and other types of projects) must also be included when evaluating any proposed project's overall impact.

Many types of methods are available for evaluating impacts. Because the environmental assessment process often produces a large volume of unorganized new, data, impact evaluation methodologies should achieve the following results.

* organize a heterogeneous mass of data
* summarize the data
* aggregate the data into smaller sets (with minimum loss of data)
* extract salient features
* display both the new data and the derived information in a meaningful way.

Of the 70 or so data evaluation techniques in use today, some of the most popular ones include averaging, correlation, cost/benefit analysis, curve-fitting from benchmarks, Delphi technique, factors analyses, flow charting, indices and indicators, mapping, matrices, networks, overlay techniques, preferential ordering, public meetings, regression techniques, trend extrapolation/projection, and utility assessment.

Because of inherent limitations in manpower and data collection techniques within the Coastal Resources Management Office, the most appropriate assessment methodology at this time appears to be the matrix. Matrices can be structured to build on data which are generally obtainable by CRMO from sources such as:

* a project report describing the proposed development;
* a visit by the site investigator; and
* a review of existing plans and studies dealing with the site in question.

The more sensitive type of matrix will record not only the types of impacts that can be anticipated but also the intensity of those impacts. Most matrices, however, emphasize the inescapability of the need for impressionistic ratings because:

* many criteria do not lend themselves to numerical or other forms of objective analysis;
* even where numerical data or indices are readily available, they are often relevant to only a part of the particular rating; and
* the very large number of matrix cells usually required will preclude extensive data acquisition and analysis for each cell, any one of which might be expandable into a complex study of its own.

Such weighting schemes must be recognized as solely judgmental, because it is impossible to assess any multicriteria issue without such subjective analysis. Initial judgments can generally be made about a proposed project, and then the final conclusion can be tested for sensitivity over the full range of value weights. Obviously, this method encourages (and relies on) the use of expert judgment.

Table VII-1 depicts the matrix recommended for use by the Coastal Resources Management Office. This cause-effect matrix is adapted from the U.S. Geological Survey's Circular 645.

This matrix method includes an "importance value" for each impact in addition to the "magnitude value". The importance value is intended to encompass the subjective evaluation assigned to each criterion by CRMO. For example, in evaluating a proposed beachfront project on Saipan, CRMO would probably consider the Lagoon's quality (impact "Lagoon, d") to be more important, relatively, than the value of beach sand at the project site (impact "On-shore, a"). Thus, CRMO can determine a numerical weighting to establish the relative difference in importance between these two (and the other) particular impacts. The magnitude value, of course, represents the severity of the impact as a result of a specific proposed development and alteration to the existing environment.

The list of actions can, of course, be expanded as experience and circumstances dictate; although it is now comprehensive enough to indicate the general type of actions to consider and to stimulate further discussion. The first step in this procedure is to check each column corresponding to an action that is associated with a particular project. For each column that is marked, the boxes corresponding to the impacts are examined. For each box, a magnitude and importance are specified on a scale of 1 to 10. These two numbers are placed in the box and separated by a slash. Each project would have a separate matrix, and the basis for assessing the activities and the values associated with the project are based on the professional judgment of the Coastal Resource Management Office planners and/or of other designated staff.

TABLE VII-1

IMPACT EVALUATION MATRIX

		PHYSICAL AND CHEMICAL CHARACTERISTICS — ONSHORE							LAGOON								ATMOSPHERE				PROCEEDS										INFRA-STRUCTURE						BIOLOGICAL CONDITIONS — FLORA										FAUNA							
	PROPOSED ACTIONS	a. MINERAL RESOURCES	b. SOILS	c. LAND FORM	d. WETLANDS	e. MANGROVES	f. BEACH	g. OTHER	a. SURFACE	b. SUBMARINE	c. SUB-BED	d. QUALITY	e. TEMPERATURE	f. RECHARGE	g. CURRENTS	h. OTHER	a. QUALITY	b. MICRO-CLIMATE	c. TEMPERATURE	d. OTHER	a. FLOODING	b. EROSION	c. DEPOSITION (SED./PRECIP.)	d. SOLUTION	e. SORPTION (ION EXCHANGE, COMPLEXING)	f. COMPACTION AND SETTLING	g. STABILITY (SLIDES)	h. STRESS-STRAIN (EARTHQUAKE)	i. AIR MOVEMENTS	j. OTHER	a. WATER SYSTEM	b. SEWER SYSTEM	c. STORM DRAINAGE	d. TELECOMMUNICATION	e. POWER	f. ACCESS	a. TREES	b. SHRUBS	c. GRASSES	d. CROPS	e. MICROFLORA	f. AQUATIC PLANTS	g. ENDANGERED SPECIES	h. BARRIERS	i. CORRIDORS	j. OTHER	a. BIRDS	b. LAND ANIMALS INCLUDING REPTILES	c. FISH, SHELLFISH	d. BENTHIC ORGANISMS	e. INSECTS	f. MICROFAUNA	g. ENDANGERED SPECIES	h. OTHER
MODIFICATION OF ECOLOGICAL ZONE	a. EXOTIC FLORA OR FAUNA INTRODUCTION																																																					
	b. BIOLOGICAL CONTROLS																																																					
	c. MODIFICATION OF HABITAT																																																					
	d. ALTERATION OF GROUND COVER																																																					
	e. ALT. OF GROUND WATER HYDROLOGY																																																					
	f. ALTERATION OF DRAINAGE																																																					
	g. IRRIGATION																																																					
	h. BURNING																																																					
	i. SURFACING OR PAVING																																																					
	j. NOISE AND VIBRATION																																																					
	k. OTHER																																																					
	l. OTHER																																																					
TRANSFORMATION OF ECOLOGICAL ZONES	a. HOTELS OR MULTI-UNIT RESIDENCES																																																					
	b. INDUSTRIAL SITES AND BUILDINGS																																																					
	c. SINGLE-FAMILY RESIDENCES																																																					
	d. COMMERCIAL																																																					
	e. ROADS																																																					
	f. TRAILS																																																					
	g. TRANSMISSION LINES, PIPELINES																																																					
	h. BARRIERS, INCLUDING FENCING																																																					
	i. DREDGING																																																					
	j. CHANNEL REVETMENTS																																																					
	k. CANALS																																																					
	l. PIPES, SEAWALLS																																																					
	m. OFFSHORE STRUCTURES																																																					
	n. RECREATIONAL STRUCTURES																																																					
	o. BLASTING AND DRILLING																																																					
	p. CUT AND FILL																																																					
	q. OTHER																																																					
	r. OTHER																																																					
RESOURCE EXTRACTION	a. BLASTING AND DRILLING																																																					
	b. SURFACE EXCAVATION (SAND OR CORAL)																																																					
	c. SUBSURFACE EXCAVATION																																																					
	d. WELL DRILLING & FLUID REMOVAL																																																					
	e. DREDGING																																																					
	f. COMMERCIAL FISHING & HUNTING																																																					
	g. OTHER																																																					
	h. OTHER																																																					

PART THREE
LAGOON WATERS USE PLAN ELEMENT

CHAPTER VIII - LAGOON WATERS USE PLAN

A. SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS

Visual observations and analysis of data gathered through questionnaire interviews indicated that existing recreational uses within the lagoon are numerous, particularly in view of the growing tourist industry on Saipan. The Saipan Lagoon represents a substantial recreation arena and major recreational uses within it include the following:

* Swimming
* Snorkeling
* Scuba Diving
* Boating (power and sail)
* Water Skiing
* Surfing
* Spear Fishing
* Gathering

The Lagoon's massive expanse of water spans the entire west coast of Saipan and represents a vast open space. Its constant change of color and texture creates unlimited visual attractions and sets the stage for one of Saipan's more exciting recreational activities: to face the challenge of wind and waves or to submerge into an underwater world of tranquillity and mystery. It is the promise of the unspoiled experience of these qualities which attracts visitors to the Saipan Lagoon.

These waters also contain great economic resources: fish, shell-fish, crustaceans, algae and seagrass and other valuable marine organisms which are collected for daily subsistence and retail sale.

The survival of these activities and resources is in jeopardy. Lagoon resources adjacent to population centers are being endangered or destroyed because of insufficient environmental planning and forethought. Sedimentation in estuaries, bays and lagoons from accelerated man-induced erosion and surface runoff related to construction, land clearing and landfilling have always been a problem in developing areas. It is probably the greatest environmental threat to all emerging Pacific nations today. The impact of

suspended silt and deposited sediments on the reef flat and near-shore coral reef communities are potentially devastating and can be irreversible.

Ocean and lagoon conservation measures cannot focus solely on the marine environment to the exclusion of the terrestrial or coastal environment. Since the ratio of coastline to land is high on a small island, uncontrolled land use or poor land management practices can directly impact nearshore and lagoon marine resources. Thus, conservation measures directed at the marine environment must necessarily address potential developmental problems associated with adjacent shoreline areas.

The physiographic transition from terrestrial to coastal to the marine environment must not be viewed as separate zones but rather as a continuum, with an interchange of physical and biological attributes occurring between the various habitat areas. The assault against any one of these three physiographic environments may be expected to produce accompanying changes in the remaining two and, ultimately, on the entire marine environment.

The Saipan lagoon and, in particular, the Tanapag Harbor area have been extensively modified by dredging and shoreline construction activities. All this has, no doubt, produced impacts to benthic flora and fauna. Fish dynamiting and cloroxing have also damaged extensive areas of patch reefs.

Saipan has the largest lagoon of the entire Northern Marianas Archipelago. Seaward from the long west-coast beach is a shallow lagoon of approximately 20 square miles which is walled-off from the Philippine Sea by a barrier reef that lies approximately two miles offshore at the harbor entrance but approaches the shore with a fringing reef at its northern and southern ends. Just north of the harbor entrance is the small islet of Managaha, consisting of loose limestone that extends to only eight or ten feet above mean tide level. Excellent reefs are found along the south and west sides.

Some of Saipan's "fringing reefs" are actually sealevel benches composed of volcanic material with an appreciable organic component at the submerged face. At the south end of Saipan, however, are " true" fringing reefs with depressed reef flats that support extensive growth in a typical lagoon environment.

Access between the lagoon and deep oceanic water is by several natural and a few manmade channels. The main channel is the Tanapag Harbor entrance at mid-island. Two

small boat channels have been built into the boat docks at Garapan and Chalan Kanoa. There are also two natural surge channels located at the south end of the reef and near San Jose Village. These latter channels are used by boats in emergencies only and are generally navigated only during daylight and under very calm conditions.

With such diverse natural and man-made resources, excellent accessibility and scenic beauty, the Saipan Lagoon becomes a focal point for recreation within the CNMI and particularly to Saipan. It is a valuable resource in itself as noted in Volume I and apart from daily use by local residents, tourism accounts for the largest single use of the beaches and lagoon recreational resources. All tourists spend time on the beaches and swim in the near-shore lagoon waters of both Saipan and Managaha. Tourist related boating activity accounts for a larger part of daily water borne traffic flow in the Saipan lagoon. The majority of this activity occurs near-shore between the Hafa Adai and Hyatt Hotels, on the west coast of Managaha and on a rather direct line between these points. Larger boats dock in Smiling Cove and operate in the channel to Managaha. Water-borne traffic on these routes is composed of five types of craft:

* Small to large ships
* Glass Bottom Boats (25-40 ft)
* Motorboats (16-25 ft)
* Sailboats (14-80 ft)
* Wind Surfers

Adequate facilities do not exist for the safe operation of boats in proximity to swimmers or other lagoon users. For example, of the six docking/loading facilities on Saipan four do nothing to discourage swimming in the same general area and two of these (Hafa Adai Hotel, Hyatt Regency Hotel) are in direct conflict with tourist swimming beaches. The prime concern here is boating traffic patterns around waters where swimmers congregate. Such conflicts exist in three separate areas: Managaha Island, Micro Beach and in the vicinity of Puntan Susupe. Recent deaths of tourists due to motorboating accidents indicate a serious problem.

Boating traffic patterns in the Saipan Lagoon reflect general congestion in the central Tanapag Harbor area. Glass bottom boats take passengers to and from Managaha Island on a regular schedule and usually stop to view underwater wrecks on their morning runs. These boats position themselves over the submerged wreck and sit idle for a few minutes before moving on. Small sailboats, Hobie Cats and other small catamarans sail between Saipan and Managaha Island regularly. An 80 ft catamaran sails regularly

between Saipan and Tinian. Wind surfers use the shallow lagoon just off Micro Beach and Managaha Island. Motorboats operate between a few docks on Saipan and Managaha Island carrying passengers. Other small motor boats pull water skiers in the lagoon near Micro Beach and in shallow water of Managaha Island. Jet skiers and other small motorized, single-person speed boats operate in an oval area just off the main hotel beaches. Large ships (cargo and passenger) operate in the main Tanapag Channel between the harbor entrance and Charlie Dock. Small to medium sized fishing and pleasure boats operate in the vicinity of Charlie Dock and Smiling Cove, moving across to the harbor and harbor entrance.

Numerous areas within the lagoon are considered excellent diving spots either for fishing, gathering or just exploring. These include shallow patch reefs near the lighthouse, Paupau Beach and near Managaha Island. Underwater wrecks are dived regularly in the outer lagoon, particularly near Managaha Island.

B. OBJECTIVES FOR LAGOON USE PLAN ELEMENT

The objectives for this PLAN element follow those objectives identified in the SALAPAT planning sessions. They are summarized as follows:

* Water Recreation Zone Plan
  a. Recreational use zones for Saipan Lagoon
  b. Water safety information program
  c. Water Recreation Advisory Board

* Water Hazards and Marine Nuisance Abatement Plan
  a. Removal of lagoon hazards
  b. Abatement of marine nuisances

CHAPTER IX - WATER RECREATION ZONES PLAN

A. STATEMENT OF INTENT

The various recreational uses and port traffic patterns in the Saipan Lagoon (Figure IX-1) suggest a complex use pattern that requires serious evaluation in order to protect individual users from accidents. This is obvious from recent accidents where tourists were seriously injured or killed by boats. The intent of this water recreational zone plan is to design a water recreation zoning scheme that will allow all acceptable water uses in specific areas where they are compatible.

B. RECREATION USE ZONES FOR SAIPAN LAGOON

Recreational zones are established to eliminate the congestion of multi-uses in specific areas of the Saipan Lagoon. These areas, noted in Figure IX-2 involve shallow lagoon water in front of Micro Beach, Puntan Susupe and Managaha Island. It is not possible to zone all lagoon uses such as diving, sailing or surfing. However, it is possible to zone swimming areas and the various motorboating activities like parasail operation, general motorboat travel, jet skies and waterskiing. The following section identifies the various lagoon recreational uses and establishes standards to insure the concurrent safety of all uses.

1. Swimming Zones

Swimming zones should be established by hotel policy and roped-off from other uses in the following areas, as depicted in Figure IX-3.

* Royal Taga/Grand Hotel
* Hafa Adai Hotel
* Intercontinental Hotel
* Hyatt Hotel
* Paupau Beach
* Managaha Island

These areas do not have to be large: they can be 100x100 feet. However, they must be roped-off with buoys in order to keep all other uses out of the area. Swimmers who venture outside of this area swim at their own risk. Boaters who operate boats in the vicinity of these swimming areas must do so cautiously, move not greater than 5 mph and keep a watchful eye for swimmers. Swimming zones should be marked as such and, if possible, patrolled by a qualified lifeguard.

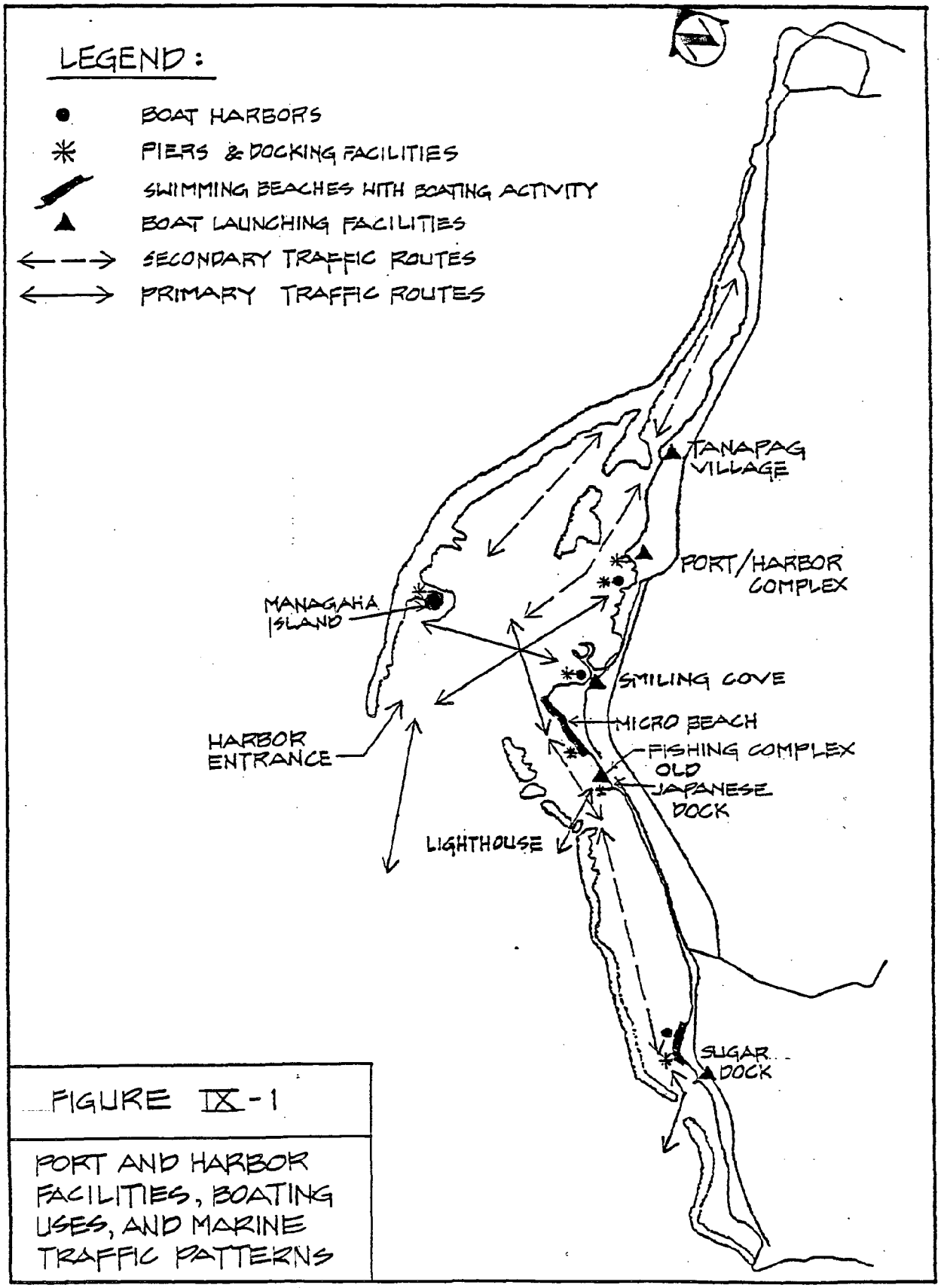


FIGURE IX-1

PORT AND HARBOR FACILITIES, BOATING USES, AND MARINE TRAFFIC PATTERNS

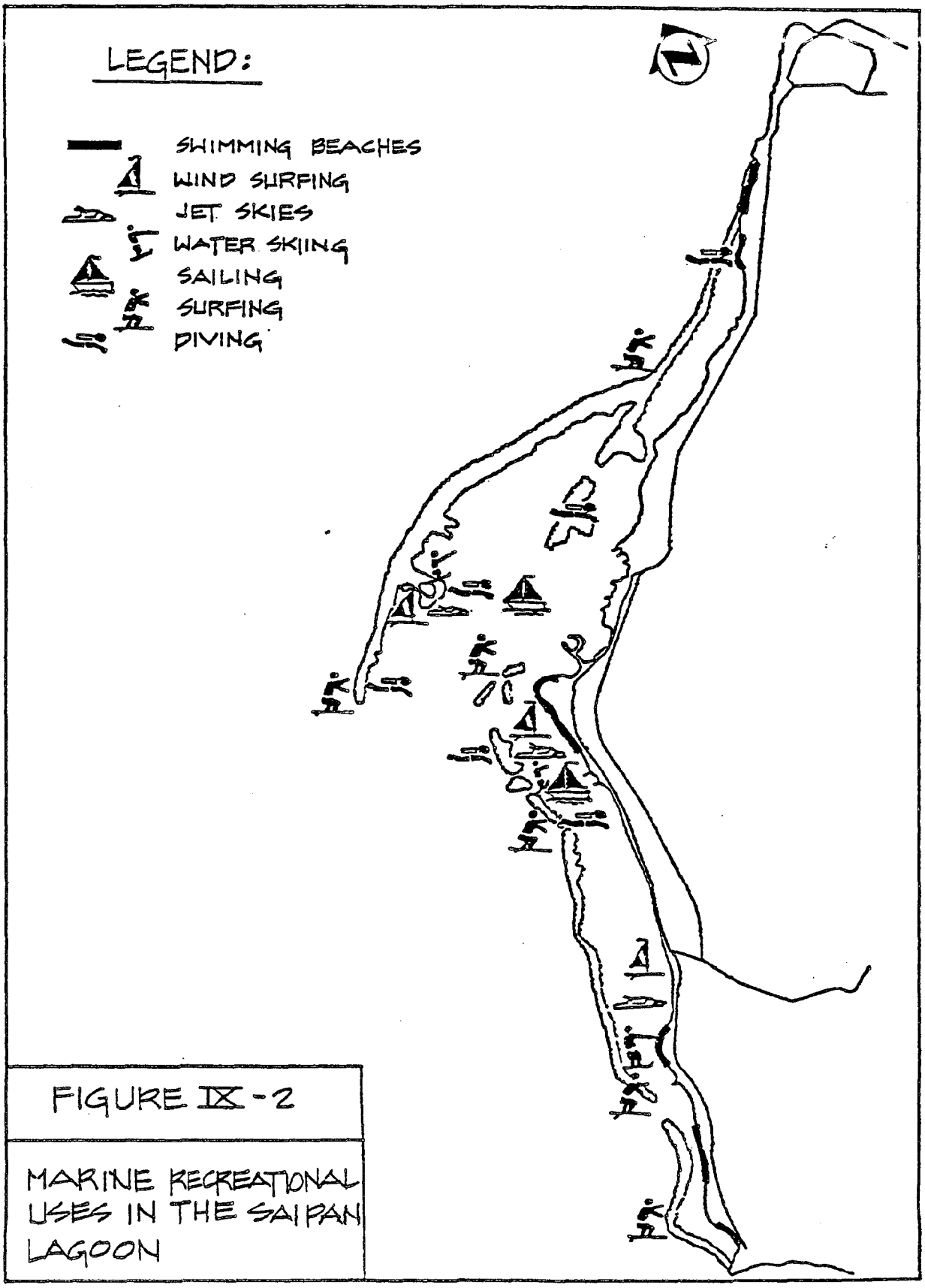


FIGURE IX-2

MARINE RECREATIONAL USES IN THE SAIPAN LAGOON

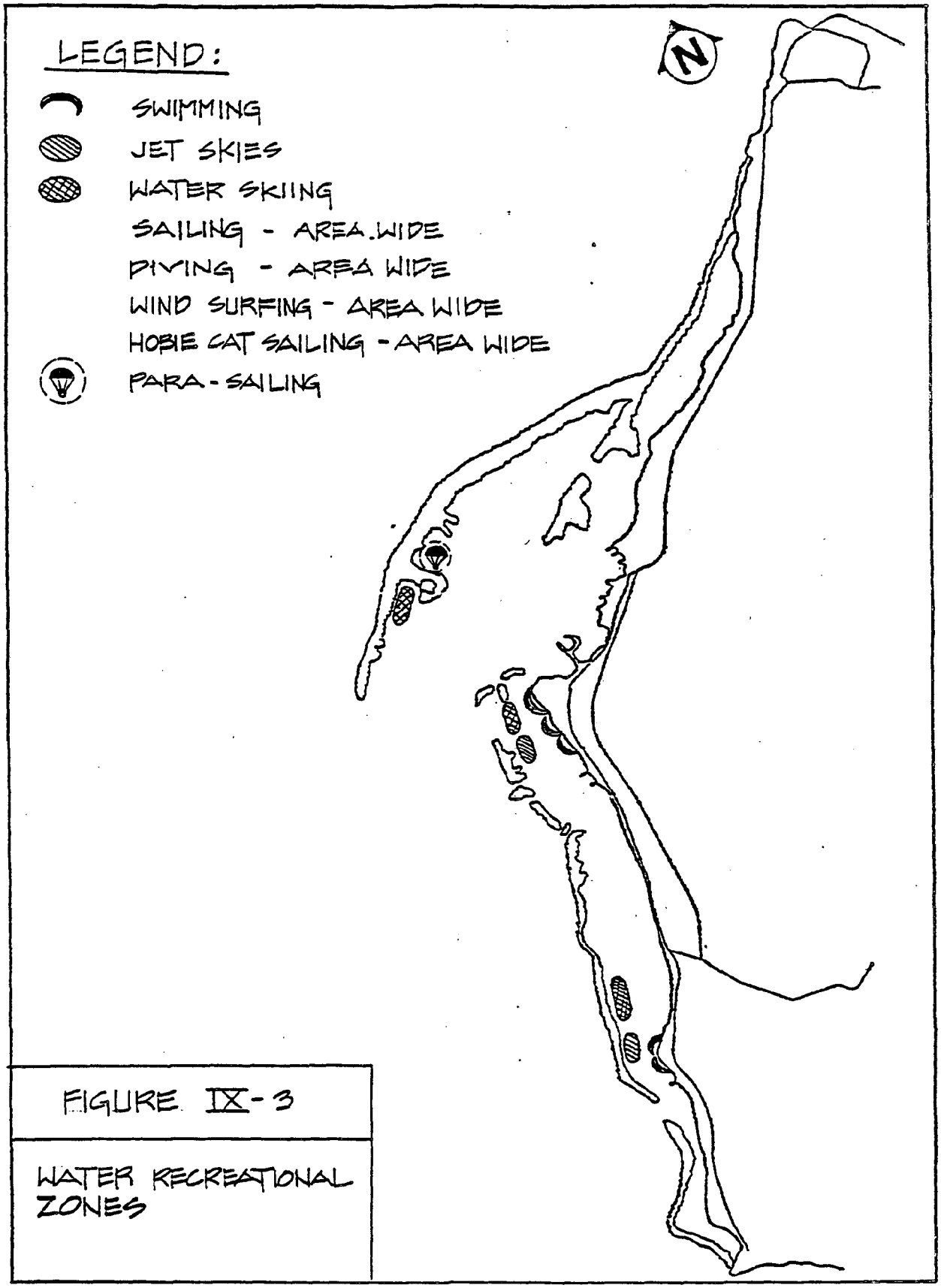


FIGURE IX-3

WATER RECREATIONAL ZONES

2. Diving Zones

Skin and scuba diving usually occurs on off shore reefs or reefs and wrecks within the lagoon, (Figure IX-3). It is not practical to establish diving zones except where marine parks exist such as the proposed underwater trail at the Managaha Island Marine Park. However, for the sake of safety, divers should comply with established safe diving techniques.

The major safety technique for divers involves the use of a "Diver Down" flag, either towed behind the diver on a tube or displayed on the dive boat.

3. Boating Zones

Boating involves numerous kinds of watercraft. This plan does not include a boating zone for the movement of large ships in and out of the main Tanapag channel to the commercial pier at Charlie Dock. Commercial craft including foreign vessels (particularly large ships) are presently controlled by the Coast Guard through the International Shipping Rules and Regulations. Local protection would be redundant and unnecessary. Therefore, this plan deals with smaller boats which utilize the lagoon waters.

a. Jet Skiis. Although jet skiis do not have propellers, they move sufficiently fast to cause serious damage upon collision, and there are some small (single engine) power boats which operates like jet skiis that do have propellers. These craft should be operated only in specific areas. Each hotel or beach concession should define the boundary for their use sufficiently far enough off-shore so as to not pose a threat to swimmers. There is intense competitiveness among the hotels for beach and lagoon recreational uses. As successful ideas are generated by one hotel other hotels usually follow suit. In the same light, if successful safety practices are initiated by one hotel, others will follow. It is best to leave the initiation of such safety precautions to hotel owners, unless a specific problem can be identified and solved by the government in harmony with the hotel owners or hotel association.

An access channel from the beach to the operating area should be defined. The access channel should be roped- off and marked accordingly on the beach.

An offshore jet ski-operational area should be buoyed-off at either end and near the middle to adequately define the area. Swimmers should be aware of these operation areas through warning signs placed at convenient locations on the beach.

b. Water Skiing. Water skiing can be a dangerous sport to both the skier and others in the water if precautions are not taken.

Like jet skiis, water skiing should occur far enough from shore to be completely away from swimming areas. Skiing should take place away from coral or rocks and in deep enough water to prevent injury to the skiers, should they fall. Skiing areas should be designated on beach maps and posted so that all swimmers and other lagoon users know their location. Water skiers should not start their runs from the beach. Ski boats should move safely away from the beach area and begin their run in the designated skiing areas offshore. The Boating Safety Act states that "boats should be 200 yards from shore for more than 5 mph speed." Ski areas are noted on Figure IX-3 for hotels and tourist oriented operations. The CRMO, through the seminar suggestion below, can work with the hotel association to designate these areas and operate within them.

c. Sailing. Sailing encompasses two distinct categories of vessels. The greatest number of sailing vessels involve wind surfers, while the other category involve true sailboats, like small monohulls, Hobie Cats or similar craft.

Sailing is considered an area-wide Lagoon water sport and there is no particular zone for sailing in the Lagoon (Figure IX-3). It is important for the sailor to stay out of and away from swimming zones and away from zones used for other craft like jet skiis or water skiboats. Although this is not possible at all times, it should be stressed that being in the wrong zones will create a risk to the operator of both vessels. Operators of all vessels must understand that sailing craft, under sail power alone, have the right-of-way under International Rules of the Road, except in a confined channel.

The responsibility for boating safety must start somewhere. The Coast Guard already has responsibility. However, with their limited

budget they, like the CNMI government, can only do so much. In this case it is suggested that a seminar be set up between the CNMI government, Coast Guard and Hotels in order to establish safe water craft operational areas.

4. Surfing

There are six surfing sites along the west coast of Saipan. All but one of these are located on the reef. Only one area within the Lagoon offers quality waves for surfing. This is on patch reefs off Micro Beach. Surf does not occur frequently on the fringing and barrier reef but depends on swell patterns usually associated with tropical depressions, storms or typhoons. Given these conditions, however, both locations have excellent surf conditions. Surf zones are not commonly established anywhere, although in heavily populated areas, like California, surfers do have particular spots that swimmers must avoid. Most often, however, surfers must avoid established swimming areas. It is not realistic to establish surfing zones within the Saipan Lagoon. However, it is important for all lagoon users to know where popular surfing areas are located (Figure IX-3) in order to use or avoid them.

5. Water Recreation Advisory Board

There are a number of concerned organization on Saipan that can help to improve the safety of lagoon users. These include: Department of Public Safety through the Boating Law, Marianas Visitors Bureau, Coastal Resources Management Office through their permitting authority, Port Authority and the Hotel Association through their concern for hotel guests. Each element shares a common element, safety of those who use the Saipan Lagoon.

Because of the number of concerned organizations an organized Advisory Board could do much to promote safety of all lagoon users. The board should be comprised of one representative from each of the five aforementioned organizations. Meetings can be held monthly or at a convenient schedule based on necessity. A lead agency can be decided by active members. Tasks can be assigned based on a realistic division of labor and costs can be shared based on level of responsibility.

6. Cost Estimates for Establishing Recreation Use Zones through an Advisory Board.

These costs amount to the following.

Administrative	
Rules and Regulations	$1,000
Zoning Maps	250
Public Education	5,000
Materials	
Beach Signs (Public Works)	1,500
Handouts	500
Maps	500
TOTAL	$8,750

Proposed here is a set of signs designating swimming zones, ski zones, parasail zones and other uses in the water. These could be placed at the appropriate beach sites. In addition, public information handouts designating the areas (zone) on a map with brief explanations should be proposed.

C. WATER SAFETY INFORMATION PROGRAM

A comprehensive Water Safety Information Program is an essential element for water oriented developments along the Saipan Lagoon coastline. Saipanese and Carolinians use the marine environment for subsistence purposes and for recreation. Boating plays an important role with in island environments. The number and type of boats operating in the Saipan Lagoon are quite varied and increasing annually. The number of passengers carried by the larger vessels are also increasing annually, especially those carrying passengers to and from Managaha Island and on sunset/dinner cruises.

Boating safety is not the only important element in a Water Safety Information Program. Residents and visitors alike use the lagoon for a number of other purposes, including swimming, diving and beach combing. Each of these uses carries certain risks that pose hazards to the users. Specific water recreation use zones do much to protect lagoon users from inherent dangers. This section of the Plan deals with some basic water safety information concepts designed to improve user awareness and safety.

The CRMO, as a permitting agency of the CNMI government, has the responsibility to protect coastal resources. Recreational uses are essential resources within the coastal zone. However, this does not necessarily mean that the CRMO should get involved in regulating recreational uses. It is

more important that they help other regulatory agencies like the Department of Parks and Recreation or the Department of Public Safety deal with these problems more effectively. In addition, specific issues like swimming areas and other hotel related recreational areas should be regulated by the hotels. It is the hotel's responsibility to provide safe recreational areas for their visitors.

1. Boating

The U.S. Coast Guard is the basic element of a boating safety information and education program in all U.S. waters. The Coast Guard does have legal jurisdiction within Saipan waters and throughout the CNMI. However, because of a lack of personnel only infrequent visits to Saipan are made by Guam-based Coast Guard personnel. Duties additional to regular station activities include safety inspections and documentation of vessels. These personnel have all jurisdiction to cite vessels for infractions of U.S. Coast Guard Rules and Regulations, inspect boats, license skippers, observe for infractions and monitor for oil spills.

The lack of adequate personnel to patrol these waters poses serious problems in light of the increased boating activity in the area and in regards to the groups of Japanese tourists that utilize water-borne vessels for sightseeing and transportation to and from Managaha Island and throughout the Saipan Lagoon. A boating safety program is essential, particularly on Saipan where various forms of waterborne activities prevail. The Coast Guard is no longer meeting this responsibility regularly. It is now being provided by the local CNMI government through the Department of Public Safety which has a limited budget and cannot meet the demands of the program. However, this does not relieve them of their responsibility, and an emphasis should be set on essential elements of a boating safety program for the Department of Public Safety.

In this light the primary thrust of a boating safety program should be aimed at vessels carrying passengers-for-hire, especially those which move between Saipan Island and other islands like Managaha and Tinian. The essential elements of such a boating safety program are as follows.

Licensing

* Rules of the Road
* Seamanship
* First Aid

* Navigation
* Mechanical Knowledge
* Life Saving
* Fueling
* Knowledge of Local Waters

Inspections

* Equipment
* Certificate of Numbers

Sign Posting

* 5 mph speed limit in selected channels and recreation areas

By making a 5 mph speedlimit in selected channels and recreation areas a requirement for vessels carrying passengers-for-hire to be licensed, private sector support businesses may emerge. These might include services such as teaching courses on basic boat handling, navigation, first aid and other aspects of of boating safety.

2. Swimming

This Plan calls for specific swimming areas to be roped-off, particularly in the vicinity of hotels. This precaution will be a major step toward the prevention of those accidents caused to swimmers by boats. Such swimming zones will not necessarily prevent swimming accidents caused by dangerous marine life such as stone fish, jellyfish or sea urchins or related to hazardous conditions, such as strong currents or riptides. Whatever the hazard, users of the Lagoon need to be informed as to where they occur, how to avoid them, and what to do if they are affected.

One of the most effective methods to generate awareness is a public information program aimed at a large percentage of lagoon users. Presently, the CRM office publishes a newsletter on various aspects of the environment including a section about the Saipan Lagoon. The newsletter is written in English/Chamorro and intended for local residents. This is obviously a beneficial activity. However, much can be done to improve residents' and tourists' knowledge of water safety. Following are some of the most important concepts of a Public Awareness Information Program that CRMO should implement as a part of their program.

* Radio - Initiate public service announcements devoted to basic water safety awareness, using case histories as examples of the right and wrong ways to handle oneself in and around the water.

* Television - 30-second to one-minute spots covering lagoon uses and potential hazards.

Site specific examples, documented cases of injury, explore why these accidents occurred and how they could have been prevented.

* Newspaper - Following current practices, continue to relate stories of importance regarding lagoon hazards and the consequences of misuses. Call attention to other information about water safety.

* Posters - Develop a series of posters depiciting various water safety hazards, consequences of misuse and methods of proper handling or treatment. These should be trilingual English/Chamorro/Japanese and should be posted in hotels and other places where tourists/residents will see them. This could be an annual high school project sponsored by CRMO, with prizes for the winners.

* Brochures - Develop a short brochure that describes lagoon uses, use zones, hazards, consequences of misuse and what can be done for the prevention or treatment in the case of accidents. This document could be placed in each hotel room and/or distributed to each potential user of the lagoon.

* Signs - Post signs along the beach where particular uses are allowed or prohibited. These would include swimming zones, boat docking zones, strong currents, surf, riptide or other such hazards. These signs should be written in English/Chamorro and Japanese.

3. Cost Estimates for Water Safety Information Program

* Media Campaign
  Develop 30 second & 60 second public service announcements on Radio, and TV $1,000

*	Develop Education Articles For Newspaper	500
*	Develop Posters (20)	500
*	Construct and erect signs (10)	1,000
*	Develop Brochure (1000)	3,000
	TOTAL	$6,000

CHAPTER X - WATER HAZARDS AND MARINE NUISANCE ABATEMENT PLAN

A. STATEMENT OF INTENT

The intent of this Plan is twofold. First, it will help to abate the problems of jellyfish, Ancanthaster and other nuisance animals in the Lagoon. Second, it will provide for the removal of water hazards in the Lagoon.

As a result of analyzing personal interviews and field investigations there is a need to establish abatement measures for eliminating common or cyclic nuisances found within the Saipan Lagoon. These nuisances were identified in SALAPAT I & II. The most common nuisances are those that affect lagoon users, particularly swimmers or divers, like jelly fish as well as those nuisances that indirectly affect everyone through the destruction of coral reefs, like the Crown of Thorns starfish.

The proposed Plan also seeks to identify reasonable abatement methods to enhance the safety of lagoon users from hazards such as scrap metal on the beaches and in the water, stinging jelly fish, (particularly the Portuguese man-of-war) and protect the coral reefs from destruction by the Crown of Thorns starfish. The Plan identifies the need for protection from these hazards and nuisances and details a plan of action in the form of lead agencies to carry-out appropriate abatement measures.

B. REMOVAL OF LAGOON HAZARDS

Hazards to lagoon users are found primarily along the beaches and in near-shore waters. These hazards include a substantial amount of scrap metal, classified here as junk, most of which remains from World War II. The impact on the environment from scrap (junk) metal cannot go unmentioned. Besides the aesthetic element, scrap metal rusts and begins to break apart littering the shoreline and water offshore with loose debris. Large rusting hulks discolor the sand and leach metal into the near-shore environment changing ambient conditions to less desirable conditions. Some plants cannot survive in heavy iron situations. Scrap metal on beaches trap sediments and sand which can build into mounds, covering the entire structure. Although the junk may be out-of-sight, this is usually temporary in nature. Large storms can clear these sand deposits in a matter of hours leaving the junk visible and hazardous. Most importantly, scrap metal on beaches is dangerous to beach users, particularly children who like to climb around on the debris. Numerous cuts, often quite bad, result from these

objects. Not only is this junk a hazard to all lagoon users, it is also unsightly and a visual blight on what is otherwise an extremely beautiful beach and lagoon setting.

War-related junk is found along the entire west coast of Saipan. However, the quantity and location a scrap metal at a few areas pose particularly serious problems. Such junk should be removed from the following areas.

North and south of Sugar Dock.
In the vicinity of Garapan Dock.
In the vicinity of the Puerto Rico Dump.
In the vicinity of the Seaplane Ramp and Puntan Flores.

C. LOCATION AND EXTENT OF MARINE NUISANCE ANIMALS

The crown-of-thorns starfish was sighted in water 20 feet deep along the entire outer reef. Numbers were highest in the south and decreased towards the north. Unusually high numbers were observed just inside the harbor entrance at various shallow patch reefs to the southwest of Managaha Island. Very few starfish were observed in shallow lagoon water.

The crown-of-thorns starfish is a pest of major concern. Thomas F. Goreau, noted ecologist, witnessed over 90 percent coral destruction by the starfish on the patch reefs west of Managaha Island in 1969 (Goreau, 1969). Regrowth has been excellent, particularly in light of the 1973 starfish infestation. In only 15 years the majority of the patch reef area has been completely restored.

However, the destruction of the corals within the proposed underwater trail is a threat now. Birkeland's 1983 starfish infestation prediction was extremely accurate, and the animal is well established along Saipan's western reef system (Birkeland, 1982). From the south, the starfish has moved into the Lagoon through the Tanapag Harbor Channel entrance and through depressions in the barrier reef and is making its way north along the inside of the barrier reef directly toward the reefs and a proposed site for the underwater trail.

Preliminary counts estimated the starfish at 250 for the 18 acre (73,000 m2) site. This is a significant and recent increase. Removal of these starfish is especially needed on selected reefs in the vicinity of Managaha Island, specifically at the proposed underwater trail site and nearby reefs. This should be an on-going process to ensure protection of the area.

An Acanthaster removal program, even though limited in scope to only cover the reefs within the proposed Managaha underwater trail area, will likely be labor intensive and and costly. If volunteer help from a local dive club and other concerned citizen groups are not feasible, then the program will require a considerable amount of operational funding. Realistic cost estimates should be calculated after all donated resources can be determined.

This starfish removal program is not designed to eliminate all the starfish in the Saipan Lagoon or even all the animals within the proposed underwater trail area. It is merely a protective measure to ensure healthy coral communities on the patch reefs within the vicinity of the underwater trail. Although the corals eventually regrow in a damaged area, and the species diversity often increases, when the percent of damage is high the beauty and attraction of the underwater trail will be seriously degraded and create a negative impact on the numbers of tourists who want to visit the park.

It is now generally accepted by most contemporary biologists that Acanthaster infestations are cyclic phenomena triggered by periods of drought followed by heavy rainfalls and subsequent runoff from the land. Increased nutrients enter the water and result in a higher survival rate for the starfish, which drift about and filter feed on planktonic organisms during their larval stage. The end result is much greater numbers of adult starfish approximately three years following such an event. Observations support the belief that the Acanthaster outbreaks eventually "run their course" and return to normal populations on the reefs. Since Acanthaster is a natural part of Pacific coral reefs and, therefore, plays a role in the ecosystem as a whole, a credible argument can be made for ignoring the starfish over-population, even if it enters a sensitive area like a marine park. The starfish then become a dynamic part of the coral reef community and, as such, are an "attraction". If they do enter the park area and it becomes obvious that a substantial quantity of corals will be lost, control measures within the park should be considered.

The Stinging Jellyfish and Portuguese Man-of-War are animals with little or no mobility of their own. Although most jellyfish can swim, they usually ride on ocean currents and winds, like the Man-of-War, until reaching shallow water where they wash-up on a beach or rocky coastline.

These animals are a nuisance, since some have powerful stinging cells. They are most dangerous while still in the water where the stinging tentacles are extended into the water column. Swimmers do not usually see these animals and

become draped with the stinging tentacles on virtually any part of their bodies. These animals can also remain dangerous after washing-up on the beach. Children have been stung by sand that carries the remains of stinging cells left from a jellyfish or Man-of-War. Others have been stung on the foot or ankle as they step on these animals during a stroll on the beach.

Stinging Jellyfish or the Portuguese Man-of-War were observed on a number of beaches from Wing Beach south to Micro Beach. Prevailing northeast winds and currents drive these animals to the closest point of land. Very few were observed in the water or on beaches south of Micro Beach.

D. MARINE NUISANCE ABATEMENT PLAN

The objectives here are fourfold.

* Determine the extent of the reef killing threat of the crown-of-thorns starfish.
* Determine whether infestation is a cyclical phenomenon or the result of environmental imbalance.
* Determine what benefits, if any, result from infestation. Determine the ecological significance of the crown-of-thorns starfish.
* Provide ongoing monitoring.

The Plan of Action is as follows.

* The Department of Natural Resources will act as the lead agency for nuisance abatement.
* Through the Division of Fish and Wildlife the Department of Natural Resources will establish a Nuisance Abatement Program.
* Personnel of the Division of Fish and Wildlife will monitor the lagoon and beaches to determine whether the area is experiencing any nuisance like the crown-of-thorns starfish or jellyfish.
* When identified, the Division of Fish and Wildlife will notify the Director of Natural Resources.
* The Department of Natural Resources will then implement the following plan to abate the problem as follows

1. Crown-of-thorns Starfish Nuisance Abatement Plan
   a) Personnel from the Department of Fish and Wildlife having identified areas for potential destruction shall:

* Organize diving teams to remove the starfish from selected areas
* Diving teams should include regular personnel from the Division and special interest groups like dive clubs and other concerned citizens.

b) Abatement methods involve the use of Formalin injection, cutting the central organs from the body or removal of the animal from the water. The best method depends on available funding, equipment and personnel.

c) Abatement will continue only as long as the immediate problem persists in areas where coral destruction is deemed detrimental by CNMI officials.

2. Jellyfish Nuisance Abatement Plan

a) Personnel from the Department of Natural Resources, Division of Fish and Wildlife and the Coastal Resources Management Office will be responsible for identifying the threat of this nuisance during regular monitoring and work activities in near-shore water and on the beaches of the Saipan Lagoon.

b) When a potential nuisance poses a significant health hazard Directors of Natural Resources and CRMO shall be notified.

c) Methods for removal of high concentrations only work when the animal is beached. Crews must shovel or rake the animals into piles and then remove them in containers. While concentrations are high in the water, officials should notify people to stay-out of the water and post warning signs accordingly.

d) Notices shall be displayed in appropriate places so that the potential Lagoon users will be aware of the danger. Notices shall be in bilingual Japanese/English and displayed or announced on:

* Sign posts along the beaches that are affected.
* Radio and TV announcements
* Newspaper articles
* CRMO Newsletter articles

3. Monitoring Program

The Department of Natural Resources through the Division of Fish and Wildlife, monitors marine waters in the CNMI. The monitoring strategy is basic and only weekly supported with personal and budget. The aim is to monitor the marine environment and its changes over time. The strategy should meet the objective. Possibly the program need revision to down-scope the weekly and monthly tasks to fit available personal and budget.

A monitoring program for marine nuisances shall include the following steps:

* Establish six transects along the outer reef, each one mile long.
* Establish six transects along the inner reef, each one mile long.
* Establish at least two transects along the west and southwest side of Managaha Island.
* Monitor these transects at least every 60 days.

E. BUDGET ESTIMATE FOR MARINE NUISANCE ABATEMENT AND HAZARDS REMOVAL PLAN

Nuisance abatement plans and measures require the allocation of time on the part of the Division of Fish and Wildlife through the Department of Natural Resources for monitoring on a regular basis. Monitoring of the entire lagoon from the beaches seaward to the 60 foot contour should be a regular part of the Division of Fish and Wildlife routine.

Monitoring activities for the Crown of Thorns starfish will take approximately 2-3 days for each 60-day period. Similar monitoring activities for other nuisance animals in near-shore water and on beaches will take 1-2 days each 15-day period. Cumulative time for both activities amounts to approximately 2.5 mandays per working month.

Equipment required for monitoring the Crown of Thorns starfish includes a boat, towing sled and scuba equipment. At least two individuals are needed to survey in this manner. Other equipment includes air fills, truck and boat trailer. Monitoring for other nuisance animals near shore and on the beaches involves one person and a vehicle.

Cost of labor would amount to approximately $150 for two workers per month for 2.5 days. Cost of equipment to monitor for the Crown of Thorns starfish would cost approximately $50. Total budget for one month's monitoring

would cost approximately $325 and require no more than two workers and no more than 20 cumulative hours. Total annual cost is approximately $4,000.

Junk Removal for the specified location shall be accomplished as follows:

* Personnel from the CRMO aided by the Historic Preservation Officer will survey areas identified in this PLAN and other areas where scrap metal and other junk exists on the beach or in shallow water.
* Determine which pieces should be removed.
* Findings shall be turned over to the Department of Public Works who will contract for this service.
* The contracted cost of removing this scrap metal is approximately $100,000.

PART FOUR
BEACH PARKS AND RECREATION PLAN ELEMENT

CHAPTER XI - BEACH PARKS AND RECREATION PLAN

A. SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS

Opportunity abounds for public recreation within the Saipan Lagoon and along its shoreline. From the project area's most northern tip at Wing Beach in the Magpi Planning Area to the most southern extremity at Agingan Point in the Puntan Afetna Planning Area, seventeen beach areas are formally recognized as public recreation sites along the Lagoon's shoreline. Additionally, Managaha Island is a very popular recreation destination for residents and tourists. This balanced distribution of shoreline sites averages slightly more than one recreation area per mile: a very favorable ratio.

Table XI-1 depicts the Planning Areas and public beach recreation sites in each Area.

TABLE XI-1
BEACH RECREATION SITES BY PLANNING AREA

Planning Area	Beach Recreation Site
Magpi	Wing Beach
	Unai Matuis Dikike
	Unai Paupau
	Unai Achugua
Tanapag Harbor	Unai Tanapag
	DPW Beach
Managaha	Managaha Island
Puntan Muchot	American Memorial Park
	Micro Beach
Garapan Lagoon	Unai Garapan
	Unai Chalan Laulam

Puntan Susupe	San Jose Beach Civic Center Beach Royal Taga Beach Unai Susupe Unai Chalan Kanoa
Puntan Afetna	Unai Afetna

While beach-oriented public recreation sites are relatively abundant, basic park-type improvements are either non-existent, too few, or substandard at most sites. Consequently, insufficient passive and active recreation opportunities are presently available to the public, despite the ample amount of beach strand and backshore land now designated for these pursuits. An inventory of all parks and beach recreation sites is presented in Volume I. The type of facilities and improvements determined to be most needed generally include:

* Maintained access from Beach Road or some other improved, nearby right-of-way for vehicles and for bicycles.
* Parking areas, large enough to accommodate anticipated requirements but located away from the beach and barricaded to prevent vehicular access to the beaches.
* Maintained, operational restrooms.
* Picnicking facilities, including tables, benches, barbecue pits, trash receptacles and potable water service.
* Permanent pavilions of varying sizes.
* Permanent park benches.
* General recreation areas and playfields for unorganized sports and games.
* Sports facilities such as courts and fields for volley ball, basketball, tennis, softball and touch football.
* Launching facilities for small boats.
* Playground apparatus for pre-school and elementary school-age children.

B. OBJECTIVES

The eight specific objectives that were developed for the public recreation and beach park element of this SAIPAN LAGOON USE MANAGEMENT PLAN, are consolidated into the following four general objectives.

1) Outdooor Recreation Plan.

An Outdoor Recreation Plan for Saipan will provide for

an acceptable level of outdoor public recreation opportunities to serve Saipan's resident and tourist population. (Conceivably, such a Plan should be part of an overall CNMI Outdoor Recreation Plan encompassing Saipan, Tinian and Rota). At least three classifications of parks and recreation sites should be addressed for Saipan.

a) Commonwealth Parks and Forests which commemorate sites and events of historical and/or natural importance and serve all residents of Saipan. The American Memorial Park and the Marpi Commonwealth Forest are examples.

b) Community Parks which primarily serve nearby community and village residents with a full array of passive and active recreation opportunities, although not all types of facilities are located at each site. The size, facilities and proximity of these sites are basically established by the needs and preferences of the village to be served. Unai Paupau is an example of a Community Park for the village of San Roque.

c) Village Parks and Playgrounds which provide special purpose recreation opportunities and are generally smaller in size. Playgrounds and athletic facilities at public schools are typical examples of recreation resources in this category, as well as tot lots and other isolated sports facilities (i.e, public tennis courts and track and field). These types of parks and facilities are sometimes incorporated within Community Parks and the Commonwealth Park, especially along shorelines in conjunction with beach parks. However, playgrounds must be site-dependent on walking distance to residential areas, therefore they will often occur near to housing, independent of other types of parks.

2) Upgrade Beach Parks

Upgrading beach parks and shoreline recreation facilities within the project area must be accomplished to conform to the proposed Saipan Outdoor Recreation Plan. This objective includes designating the seventeen existing sites into an islandwide park and recreation system and, accordingly, to determine the necessary improvements including access and parking, picnicking

facilities, additional trees, more and better maintained restrooms, and upgrading of boat launching facilities, etc.

3) Establish New Beach Park

Establishing a new beach park in the southern region of the project area, in the Puntan Susupe/Puntan Afetna Planning Areas is necessary. This site should become a well developed community Beach Park.

4) Bicycle Route

Providing for a Bicycle Route which links the Saipan Lagoon shoreline recreation sites with a safe corridor for bicycle riding is desirable for both local and tourist recreational use.

CHAPTER XII - SAIPAN OUTDOOR RECREATION PLAN

A. STATEMENT OF INTENT

An Outdoor Recreation Plan for Saipan has been established as an objective of the SAIPAN LAGOON USE MANAGEMENT PLAN and as a prerequisite to providing for an acceptable level of islandwide passive and active outdoor public recreation opportunities for residents and tourists. The extent of accomplishing this objective involves:

* Establishing a Scope of Work to guide the formulation of a Saipan Outdoor Recreation Plan; and
* Estimating the cost of such Plan if it was prepared through professional consultant services.

B. SCOPE OF WORK FOR SAIPAN OUTDOOR RECREATION PLAN

The following scope of work highlights the basic tasks to be covered during the formulation of a Saipan Outdoor Recreation Plan.

* Inventory islandwide public outdoor recreation resources.

* Conduct a survey of recreation preferences by residents and tourists.

* Develop a needs assessment to compare the availability of recreation resources with the public's preferences and the established recreation facility standards for Saipan.

* Establish goals and objectives for development of Saipan's outdoor recreation resources.

* Establish a classification of park and recreation area development which addresses:

  Federal/Commonwealth Parks and Forests;
  Community Parks and Recreation Areas; and
  Playgrounds and Sports Facilities

* Prepare a comprehensive development plan for each park and recreation area classification

  Site specific physical improvements
  Site specific program improvements

Cost estimates for improvements, operations and maintenance Cost estimates for necessary land acquisition or/other appropriate development rights

* Prepare a comprehensive management plan for administering and financing the islandwide park and recreation system.

  Managerial responsibility for each classification of area
  Rules and regulations
  Legislation
  Operating and CIP budget forecast
  Opportunities for financial support from the Federal government and other sources

* Present plan alternatives and proposed regulations, administrative guidelines and managerial policies to affected agencies and groups.

* Present proposed Plan to public

* Prepare final Plan for official adoption

C. COST ESTIMATE AND PROJECT SCHEDULE

The cost for such a Plan will range between $30,000 to $50,000 by a private consultant, depending on the amount of basic data collection that is required or provided by the Commonwealth Government. A reasonable project schedule is approximately eight months.

CHAPTER XIII - BEACH PARKS AND SHORELINE RECREATION FACILITIES IMPROVEMENTS PLAN

A. STATEMENT OF INTENT

The existing beach park and shoreline recreation facilities along the Saipan Lagoon need upgrading in order to provide an acceptable level of recreation opportunities to residents and tourists. Physical improvements, new facilities and better maintenance all fall within the scope of upgrading.

The extent of accomplishing this objective involves:

* Designating the existing beach parks and recreation areas into the three classifications of Parks to be established by the proposed Saipan Outdoor Recreation Plan.

* Determining the full complement of facilities and improvements that should be provided at each of the parks.

* Assessing the inventory of existing facilities and improvements now available at each site, as presented in Volume I.

* Establishing the scope of facilities and improvements upgrading that are necessary at each park, including design and construction budget estimates.

B. CLASSIFICATION OF SAIPAN LAGOON BEACH PARKS AND RECREATION AREAS

The general criteria for park classification are outlined in Section C of this Chapter; and more articulate criteria will be developed as part of the proposed Saipan Outdoor Recreation Plan which encompasses islandwide recreation resources. Nevertheless, it is necessary to preliminarily classify the beach parks and shoreline recreation areas within this project area in order to establish the level of improvements and facilities to be provided at each site.

Table XIII-1 presents the classification of beach park and shoreline recreation areas. Those parks which overlap into two classifications must provide recreation opportunities that will serve the intended purposes of each classification. Each classification of parks is also presented on Figure XIII-1.

TABLE XIII-1

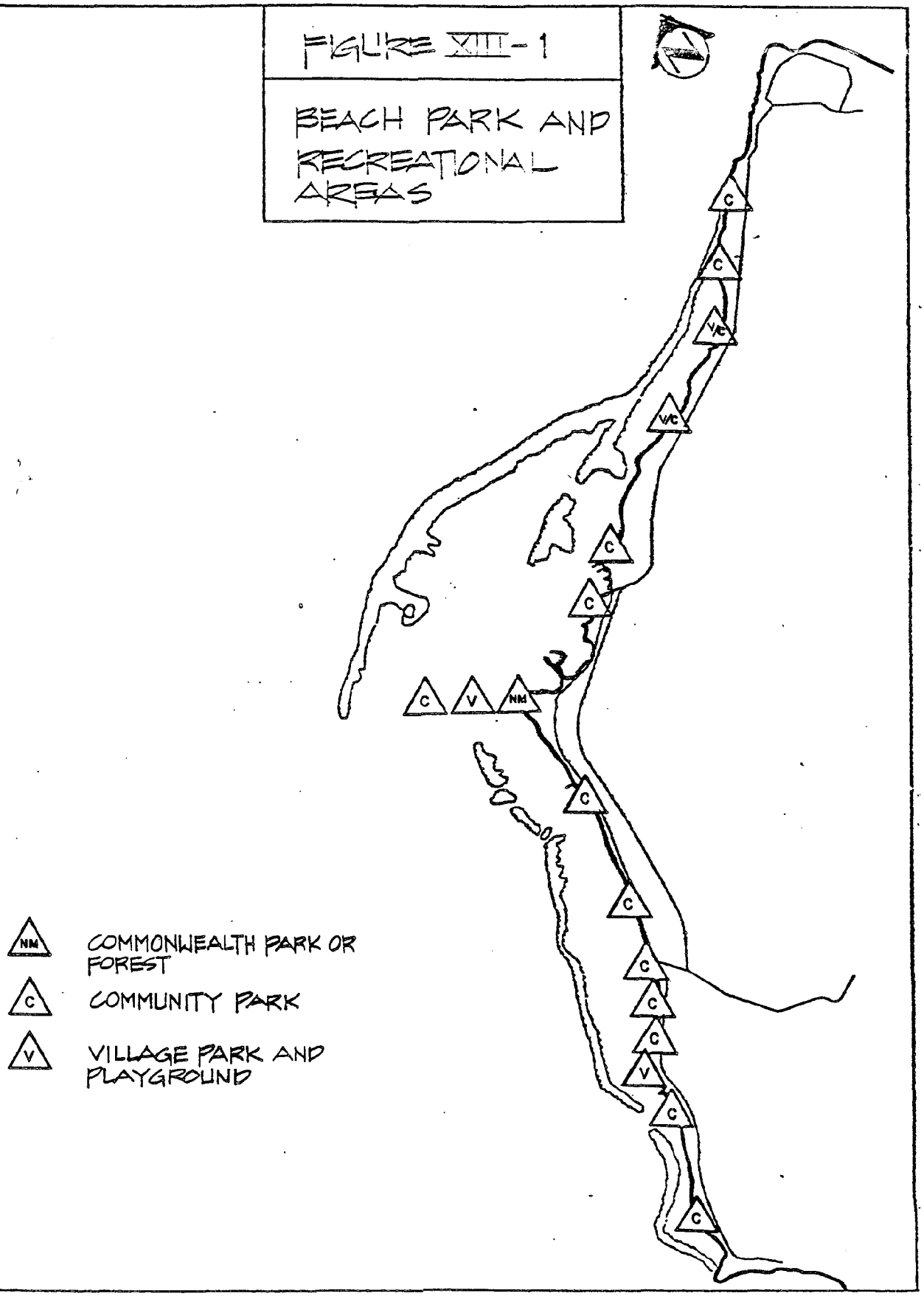
CLASSIFICATION OF BEACH PARKS AND SHORELINE RECREATION AREAS

PARK CLASSIFICATIONS

Planning Area	Village Parks and Playgrounds	Community Park	Commonwealth Park or Forest
Magpi	Unai Paupau Unai Achugau	Wing Beach Boomtown Beach Unai Paupau Unai Achugau	Marpi Commonwealth Forest
Managaha			Managaha Island Park
Tanapag Harbor		Unai Tanapag DPW Beach	
Puntan Muchot	American Memorial Park	American Memorial Park Micro Beach	American Memorial Park
Garapan Lagoon		Unai Garapan Unai Chalan Laulau	
Puntan Susupe	Civic Center Beach Unai Susupe Unai Susupe	San Jose Beach Civic Center Beach Royal Taga Beach Unai Chalan Unai Chalan Kanoa	
Puntan Afetna		Unai Afetna	

FIGURE XIII-1

BEACH PARK AND RECREATIONAL AREAS



C. PRELIMINARY NEEDS ASSESSMENT AND IMPROVEMENTS PLAN FOR VILLAGE PARKS AND PLAYGROUNDS

Four Village Parks and Playgrounds are associated with beach parks within the project area. They are at:

* Unai Paupau, serving San Roque
* Unai Achugau, serving Tanapag
* American Memorial Park, serving Garapan
* Unai Susupe, serving Susupe

Understandably, these four areas are also parts of other parks within Saipan's islandwide park system, and those uses will be addressed later in this Chapter under improvements for Community Parks and for Commonwealth Parks. Further, these four areas are not necessarily the only Village Parks and Playgrounds to be designated for the respective villages they serve but, rather, the only village parks and playgrounds within the PLAN's project area. Other such village-level parks are likely to be designated by the proposed Saipan Outdoor Recreation Plan and accompanied by site specific improvement plans and budgets.

A Needs Assessment for Village Parks and Playgrounds is generally computed in ratios of standards such as park areas/population or facilities/population, where the population is determined by walking distance from the park. Contemporary standards range from 1.0 to 2.5 acres/1,000 population for "neighborhood" parks, with such typical facilities as playground equipment, multi-purpose court, multi-purpose fields, benches and landscaping. In Saipan villages, as in most residential areas, these types of facilities are usually developed in conjunction with elementary schools. More specialized athletic and sports facilities are usually found on the campus of a junior and senior high school.

While some playground equipment is already available near Unai Paupau (at the San Roque Elementary School) near Unai Achugau (at Tanapag Elementary School) and near the American Memorial Park (at Garapan Elementary School) these facilities are, in whole, inadequate for two reasons:

* The existing facilities are insufficient to meet the needs of the walking distance population at San Roque and at Tanapag; and
* In consonance with one of this Plan's primary goals, "to retain traditional uses and values of the island", recreation areas should have an orientation with the sea; therefore, all parks, including these proposed Village Park and Playground improvements, these should be developed

at the Unai Paupau and Unai Achugua beach parks so that the traditional environment is captured as part of the recreation experience.

The following improvements are recommended at the four sites in order to provide for Village Park and Playground recreation opportunities. Due to the linear, beach strand configuration of Unai Paupau, Unai Achugua, and Unai Susupe, improvements at these three sites must be limited to equipment facilities rather than space-occupying fields and courts.

TABLE XIII-2
VILLAGE PARKS AND PLAYGROUND IMPROVEMENTS

Parks	Improvements
Unai Paupau	Benches, 4-6 Enclosed tot-lot play area, 20'x 30' Playground apparatus, 2-3 types
Unai Achugua	Benches, 4-6 Enclosed tot-lot play areas, 20'x 30' Playground apparatus, 4-6 types
American Memorial Park	Benches, 4-6 Enclosed tot-lot play area, 30'x 30' Playground apparatus, 4-6 types
Unai Susupe	Benches, 4-6 Enclosed tot-lot play area, 20'x 30' Playground apparatus, 2-3 types

D. PRELIMINARY NEEDS ASSESSMENT AND IMPROVEMENTS PLAN FOR COMMUNITY BEACH PARKS

The Saipan Lagoon Shoreline creates some of the most outstanding community park resources in Micronesia. While Community Parks can take on various forms and purposes depending on their size, proximity to residents and tourists, and natural amenities, the 16 community parks within this project area are all properly sub-classified as "beach parks".

It is unnecessary to plan for identical improvements at each beach park inasmuch as a formal needs assessment

conducted as part of the Saipan Outdoor Recreation Plan would reveal that some of these parks should be extensively developed while others should be left, more or less, in their natural state.

For purposes of this Saipan Lagoon Use Management Plan, therefore, these beach parks are divided into two subclassifications: Beach - Park Natural (to be retained basically in its natural state); and Beach Park - Developed (to be improved for more intensive uses). These two sub-classifications are presented in Table XIII-3 as depicted on Figure XIII-2.

TABLE XIII-3
COMMUNITY PARK SUB-CLASSIFICATIONS AS
BEACH PARKS - NATURAL AND BEACH PARKS - DEVELOPED

Beaches Parks - Natural	Beach Parks - Developed
Wing Beach	Unai Paupau
Unai Matuis Dikike	Unai Achagua
Unai Tanapag	DPW Beach
	Micro Beach
Unai Garapan	Civic Center Beach
Unai Chalan Laulau	Unai Chalan Kanoa
San Jose Beach	Unai Susupe
Royal Taga Beach	Unai Afetna

E. DESCRIPTION OF RECOMMENDED IMPROVEMENTS AT BEACH PARKS

The basic character of Beach Parks - Natural is one of low-intensity development, natural environment and passive recreation opportunities. Unimproved (without asphalt) access roads and parking areas, no public restrooms or picnic facilities and little or no beach maintenance are typical of this category of beach parks.

Table XIII-4 lists the improvements recommended for each Beach Park - Natural.

Table XIII-5 lists the improvements recommended for each Beach Park - Developed

FIGURE XIII-2

COMMUNITY PARKS
BEACH PARKS - NATURAL
BEACH PARK - DEVELOPED

NATURAL
COMMUNITY BEACH PARK - NATURAL

DEVELOPED
COMMUNITY BEACH PARK - DEVELOPED

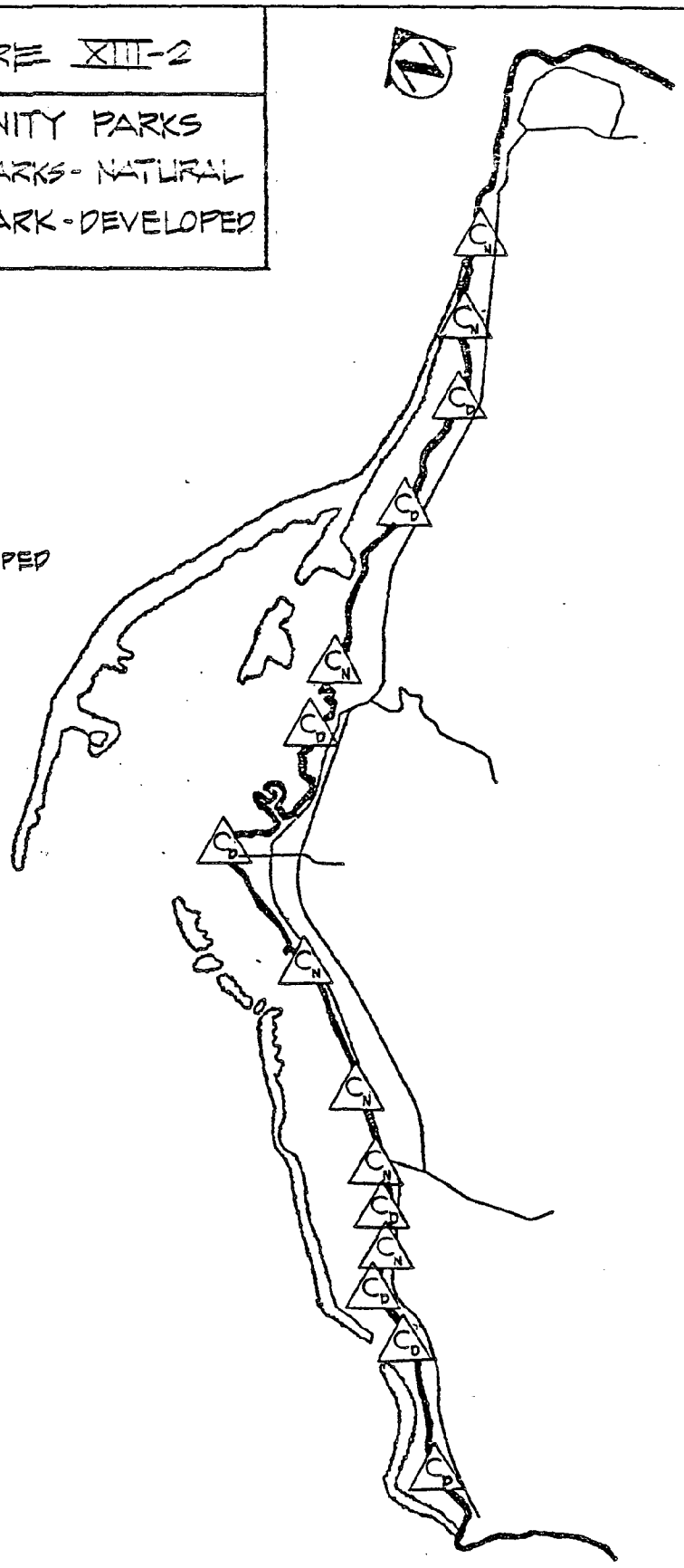


TABLE XIII-4

IMPROVEMENTS FOR BEACH PARKS - NATURAL

Park	Existing Facilities	Public Improvements Needed
Wing Beach	Access road, compacted coral, 1500 linear feet (lf)	Road maintenance, semi-annually, where needed Mowing and trash clean-up Trees Parking, compacted, coral, for 10 vehicles, with barriers
Unai Matius Dikike	Access road, coral, 1200 lf	None
Unai Tanapag	Pedestrian accesses, two at 300 lf each	Clearing of path for access to beach
	Parking along access road, (back road between Public Works and Tanapag)	Trees Widening of road shoulder to accommodate parking for 10 vehicles
Unai Chalan Laulau	None	None
San Jose Beach	Picnic tables, 3 Playfield	Repair existing tables and add 3 more Barbecue pits, 2 Tables Trash containers
		Trees Parking, compacted coral for 10 vehicles
Royal Taga	None	None, except as may be provided by adjacent resort

TABLE XIII-5
IMPROVEMENTS FOR BEACH PARKS - DEVELOPED

Park	Existing Facilities	Public Improvements Needed
Unai Paupau	Access road, compacted coral, 600 lf Picnic tables, 6 Camping area	Road maintenance semi-annually, where needed Parking, compacted coral for 20 vehicles, with barriers Add 6 picnic tables, Add 6 trash containers Public restrooms at pavilion Trees Benches, 8-10
Unai Achugua	Access road, coral, 200 lf	Picnic tables, 6 Barbecue pits, 4 Benches, 6
DPW Beach	Access road, coral, 400 lf Pavilion	Semi-annually road maintenance where needed Parking, clear for 10 vehicles Picnic tables, 2 Barbecue pits, 2 Benches, 2 Trash containers, 1
Micro Beach	Access road, paved and compacted coral, 1600 lf Public restroom Pavilion Picnic tables, 5 Volley ball court Playground	Pave portion which is presently compacted coral Enlarge parking area to accommodate 40 cars and barricade parking lot boundary Picnic tables, 6 Barbecue pits, 6 Benches, 10
Unai Garapan	Access road, compacted coral, 300 lf	Dock and channel as recommended

	Launching ramp Fishing dock Parking for 6 vehicles and boat trailors	by USACOE Parking, paved for 25 vehicles Picnic tables, 4 Trees
	Play field	Barbecue pits, 2 Benches, 6 Trash containers, 3 Upgrade playfield Public restroom
Civic Center Beach Park	Access road, coral, 50 lf Parking for 15 vehicles at north end and for 15 vehicles at south end Picnic tables, 6 Public Restrooms Tennis court	Picnic tables, 12 Benches, 10 Barbecue pits, 12 Upgrade restrooms Trees
Unai Chalan Kanoa	Access road, paved, 150 lf	Parking, compacted coral for 10 vehicles Picnic tables, 5 Barbecue pits, 4 Benches, 5

F. COMMONWEALTH PARKS

The only park of this classification in this PLAN's project area is the American Memorial Park. This park's site improvements are already planned and presented in the September 1983 "American Memorial Park - General Management and Comprehensive Design".

G. ESTIMATED COST OF PARK IMPROVEMENTS

Park improvements budgets are presented in Table XIII-6 for each Park. These budgets were prepared on the basis of unit costs for the various facilities being recommended. Inasmuch as unit costs can vary depending on such factors as field conditions that may be encountered, the number of contractors involved with the improvements and other design-dictated requirements, a lump sum budget estimate is presented for each park. It is recommended, however, to let-out one design contract for all improvements in order to reduce the cost of plan preparation for similar facilities at different parks and for standardizing the design details and construction methodology of the improvements.

The estimated cost of design for all recommended Park improvements is $10,000.

The budget estimate of $90,600 for construction of park improvements is summarized below.

TABLE XIII-6
BUDGET ESTIMATES FOR PARK IMPROVEMENTS

Location	Village Park	Natural Beach Park	Developed Beach Park
Wing Beach	na	$3,000	na
Unai Paupau	$3,400	na	$10,000
Unai Achugua	$4,800	na	$ 3,500
Unai Tanapag	na	$2,000	na
DPW Beach	na	na	$ 3,500
American Memorial Park	$5,200	na	na
Micro Beach	na	na	$15,000
Unai Garapan*	na	na	$18,000
Civic Center Beach Park	na	na	$11,000
San Jose Beach	na	$2,800	na
Unai Chalan Kanoa	na	na	$5,000
Unai Susupe	$3,400	na	na
	$16,800	$7,800	$66,000

* Not including USACOE recommended dock and channel

CHAPTER XIV - AFETNA BEACH PARK PLAN

A. STATEMENT OF INTENT

The southern Saipan Lagoon shoreline has but a dearth of park and recreation improvements. The growing population of southern villages need more park and recreation areas. Such a need, coupled with an overall objective of geographically balancing the Island's developed Beach Parks, have resulted in this Plan for the Afetna Beach Park, located in the Puntan Afetna Planning Area.

The elements of a plan for Afetna Beach Park include improvements and new facilities necessary to design and construct a well developed Community Park along Afetna Beach, at the former US Coast Guard LORAN Station site (now CNMI public land). Because this site holds substantial value for other public or commercial leasehold uses, the Beach Park Plan is concentrated in the southern portion of the property, thereby reserving the remaining northern area for other future uses.

The intent of this SAIPAN LAGOON USE MANAGEMENT PLAN is to recommend a site development plan for the Afetna Beach Park, complete with design and construction costs.

B. AFETNA BEACH PARK IMPROVEMENTS

Presently the Afetna Beach Park area is unimproved, with the exception of two picnic tables and shelters at the beach's southern end, near Agingan Point.

As a well-developed Community Beach Park, the following improvements and facilities should be provided.

* Access road, compacted coral, 1200 lf
* Parking, compacted coral for 20 vehicles
* Picnic tables, 10
* Barbecue pits, 6
* Benches, 8
* Trash containers, 10
* Restrooms
* Outdoor Showers
* Pavilion, 30'x 40'
* Playground apparatus, 3-4 types
* Playfield for soft ball, volleyball
* A general recreation area
* Additional trees

C. COST OF IMPROVEMENTS

Table XIV-1, below, itemizes the cost estimates for Afetna Beach Park Improvements.

TABLE XIV-1

COST OF IMPROVEMENTS
AFETNA BEACH PARK

Facility	Amount	Estimated Cost
Access road, compacted coral	1200 lf	$22,000
Parking, compacted coral	20 vehicles	3,000
Picnic Tables	10	3,000
Barbecue Pits	6	1,000
Benches	8	1,000
Trash containers	10	500
Restrooms with outdoor showers	LS	10,000
Pavilion	30'x 40'	20,000
Playground apparatus	3-4 types	1,500
Playfield for soft ball, volleyball and general recreation area	LS	3,000
Additional trees	50	500
		$65,500
	Contingency	4,500
		$70,000

The surveying costs and engineering design fee should be budgeted at $10,000.

CHAPTER XV - SAIPAN LAGOON SHORELINE BICYCLE ROUTE PLAN

A. STATEMENT OF INTENT

Due in part to the increasing interest being demonstrated by residents and tourists in bicycling on Saipan, a bicycle route is recommended to connect the Lagoon beach parks.

Such a plan must include a defined corridor stretching from Wing Beach to Unai Afetna, along with appropriate improvements and traffic safety features that cater exclusively to the cyclists. This Shoreline Bicycle Route Plan presents the site-specific improvements and their associated costs for implementing the objective.

It is understood that Saipan has more to offer bicyclist`s than only a route linking the Lagoon's beach parks. Those other, islandwide, recreation opportunities for bicycling would be explored and developed as part of the proposed Saipan Outdoor Recreation Plan.

Bicycling offers three types of benefits to Saipan. First, its primary economic return is in providing for a popular pursuit to those tourists who want to rent bikes and peddle their way along the Saipan Lagoon shoreline. Biking is, of course, very common in Japan and represents the the country's most basic means of transportation on a one-person-one vehicle basis. Because nearly every Japanese tourist is so familiar with bicycling, the implementation of a safe and convenient Bicycle Route System creates a significant market for additional tourism industry development.

Second, and of only minor economic importance, are the increased public recreation opportunities provided by using bicycles as the primary means of access to remote or less developed recreation areas. Developing "bike trail" access rather than "auto roadway" access to public recreation sites is considerably less expensive and much more quickly implemented. Even when cost is not a consideration, bike paths require much less right-of-way to construct and, therefore, encourage the possibilities for access easements across privately owned lands instead of the typical requirement of acquiring right-of-way for two auto travel lanes.

The third, and most insignificant economic benefit, is the potential reduction in vehicle traffic as a result of bike ways. It cannot be argued that more people, on fair-weather days, will be inclined to make bike trips rather than auto trips for their transportation needs. This tendency will

yield an occasional net reduction in vehicular traffic flow, but in too few numbers and too inconsistently for factoring into the design of future street and highway facilities.

B. PLANNING CRITERIA FOR THE BICYCLE ROUTE

In general, the bicycle is emerging in western, developed regions as an alternative mode of urban transportation. While very few on Saipanese commute to work by bike or conduct other forms of business in this manner, cycling is becoming increasingly popular among tourists and among local residents as a form of recreation and exercise. Consequently, this aspect of the SAIPAN LAGOON USE MANAGEMENT PLAN provides for "recreational riding" opportunities as a leisure time activity for all ages.

It is well understood that the bicycle does not blend well with other types of pedestrian or vehicular traffic, due mainly to the differential in speeds as well as the contrasting sizes. Consequently, special precautions are necessary in planning and designing bicycle routes so that they are both safe and convenient. Of the four basic types of bicycling (neighborhood, recreational, community, and sport or touring), routes for recreational riding are characterized by a minimum of conflict with vehicular traffic. Also, visual experiences are particularly important; and special attention must be given to providing pleasing visual impressions whenever possible.

The three basic forms of bicycle paths that are planned for this Shoreline Bicycle Route include:

* Class I (Bike Path or Protected Lane)
  A completely separated right-of-way designated for the exclusive use of bicycles.

* Class II (Bike Lane)
  A restricted right-of-way designated for the exclusive or semi-exclusive use of bicycles; through-vehicles are not permitted. Vehicle parking and access to property, as well as pedestrian access to parked vehicles, are allowed.

* Class III (Bike Routes)
  A shared right-of-way designated as such by signs placed on vertical posts or stenciled on the roadway pavement.

C. TYPICAL PROFILES OF BIKE ROUTES

Within the three basic bike path classes variations exist for adapting to field conditions, budget constraints and safety factors. Combinations of all three classes, as well as two variations within each class, are required to implement the Saipan Lagoon Shoreline Bicycle Route.

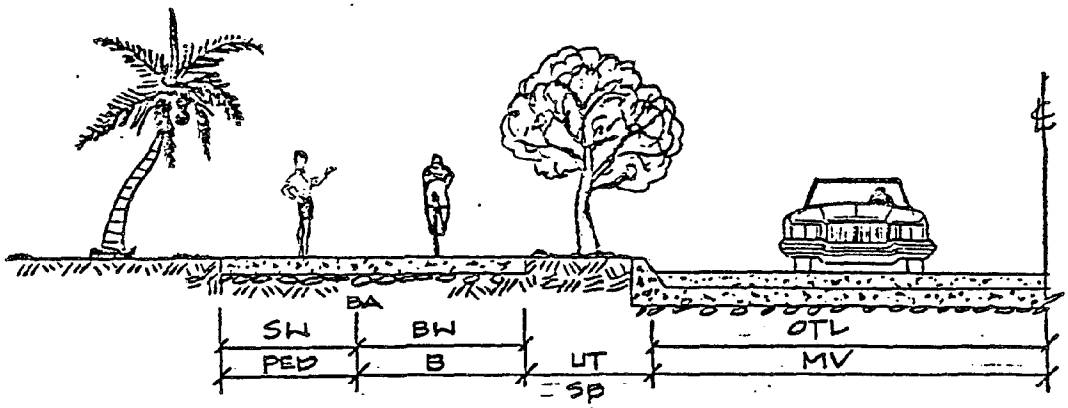
This section presents typical profiles that are incorporated into the proposed Bike Route, along with a brief description of the advantages and disadvantages associated with each class variation. The following code is used to designate various features of the typical profile.

SW -	Sidewalk	BW -	Bikeway
UT -	Utility	OTL -	Outside Travel Lane
SB -	Setback	B -	Bicycle Right-of-Way
BA -	Barrier	PED -	Pedestrian Right-of-Way
PC -	Parking	MV -	Motor Vehicle Right-of-Way

1. Class I Bikeways

These are completely separated right-of-way designated for exclusive use of bicycles. Two variations of Class I Bikeways, Variation A and Variation B, are employed in the Saipan Lagoon Shoreline Bike Route.

FIGURE XV-1
CLASS I BIKEWAY - VARIATION A



a) Bikeway designated exclusively for bicycle use.
b) Striping recommended.
c) Continuous low berm applicable.
d) Minimum two-lane bikeway.

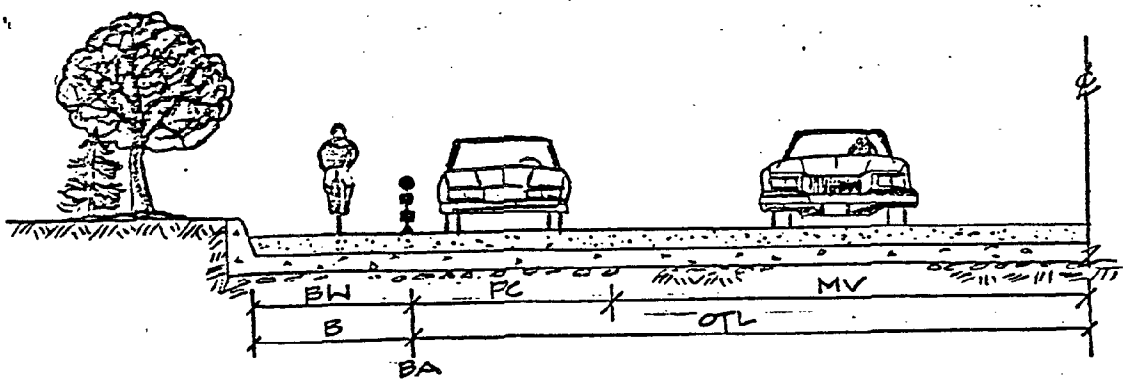
Advantages:

a) Provides horizontal and vertical separation from motorized traffic, thereby eliminating conflicts with an overtaking vehicle, autos parking or entering the traffic stream from their parking positions, and conflicts caused by open cardoors.
b) A barrier is provided to separate pedestrians and bicyclists.
c) Minimum of two-lanes one-way provides adequate passing room for cyclists.

Disadvantages:

a) Bicycle crosses pedestrian traffic-flow and conflicts are generated.
b) Since bicyclists are removed from the traffic pattern, intersection and driveway conflicts become critical because of the reduced cautionary attitudes in both motorists and bicyclists.
c) Driveways pose other problems such as stopped vehicles within the bicyclist's path awaiting to enter the traffic pattern.
d) Motorists are likely to back their vehicles into the bike lane rather than into the roadway, which is potentially dangerous for bicyclists.

FIGURE XV-2
CLASS I BIKEWAY - VARIATION B



a) Barrier to be provided between bike lane and parked cars to prevent encroachment from cars which are parking.
b) Potential bicycle/opened cardoor conflicts.
c) Recommended for areas with high parking/low turnover rates.
d) Minimum two lanes for bikes.

Advantages:

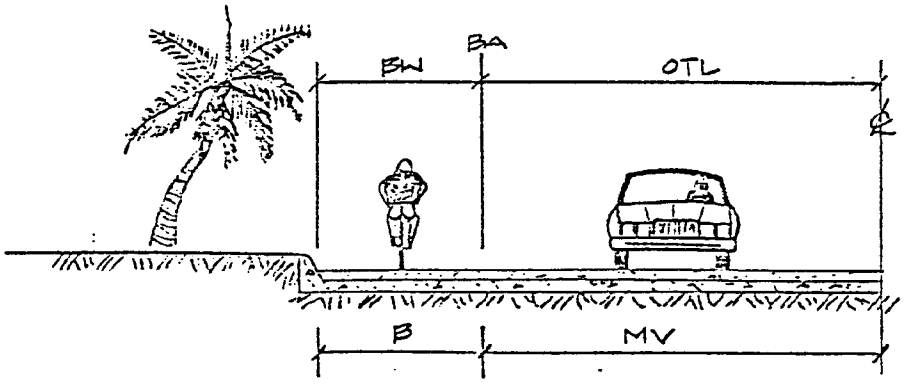
a) Providing a horizontal separation by using parked cars effectively eliminates auto/bicycle conflicts with the addition of protection from out-of-control vehicles.
b) A curb barrier between the parked cars and the bikelane will prevent encroachment by autos attempting to park.
c) Maneuvering room may be inadequate with the minimum recommendation of two lanes for the bikeway.

Disadvantages:

a) Not only does the motorist know the bicyclist cannot drift into the traffic pattern, he will not be able to see the bicyclist, and this aggravates the severity of intersection and driveway conflicts.
b) When the parking lane is ended the bicyclist is exposed to the hazards inherent with motorized traffic and both bicyclists and motorists are unaware of the presence of the other.
c) Motorists entering a driveway or exiting from one effectively "box" the bicyclist within the lane.
d) Bicyclist may drift into the parked cars with the possibilities of injuries.
e) Opened cardoor conflicts are not adequately resolved.
f) Potential conflicts with passengers exiting from parked cars are not resolved.
g) Pedestrians crossing to parked cars create other conflicts with bicyclists.

2. Class II Bikeways
These are restricted rights-of-way designated for the exclusive or semi-exclusive use of bicycles. Through-travel by motor vehicles is not allowed; however, parking may be allowed.

PLATE XV-3
CLASS II BIKEWAY - VARIATION A



a) Pavement markers are the recommended barrier between bikes and autos.
b) When curbs are to be used, access across bike lanes must be prohibited.
c) Minimum of two lanes with a curb barrier.
d) No parking permitted when pavement markers are the barriers used.

Advantages:

a) Providing pavement markers can be deterrent to motorists encroaching upon the bike lane.
b) Relative to curbs and pylons as physical barriers, pavement markers are more desirable barriers since the possibility of a bicyclist spilling from his bike when riding over the markers is reduced.
c) A curb barrier provides the best horizontal separation in terms of eliminating encroachment by motorists altogether. The minimum two-lane requirement for bike lanes provided with curbs is designed to allow maneuvering room for bicyclists.
d) Prohibiting access into driveways alleviates the problem of cross-auto-flow into the bike lane, thereby eliminating these conflicts for bicyclists.

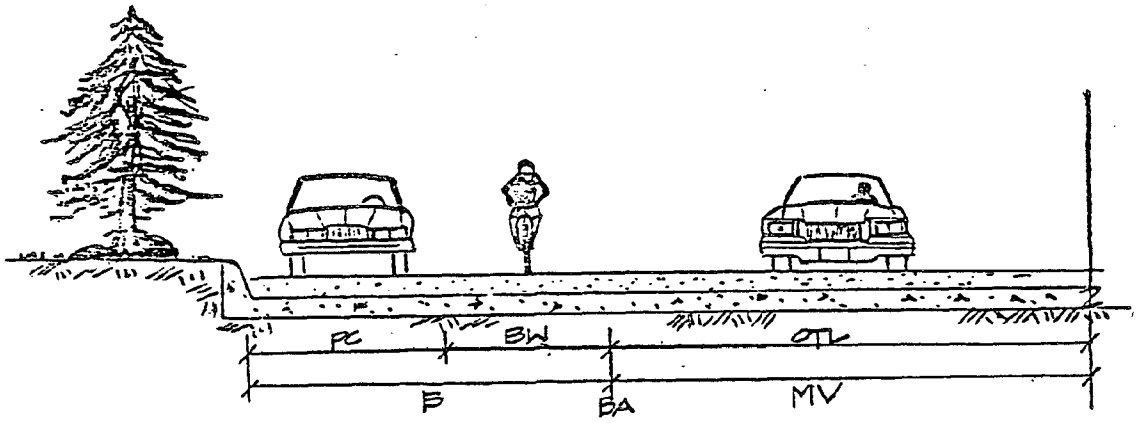
Disadvantages:

a) Possibility exists for bicyclists to drift over or into the barriers with serious consequences.
b) Especially with respect to a curb barrier provided between the outside travel lane and

the bike lane, the motorist is encouraged to think the bicyclist cannot cross into his path and may be caught unaware if this actually occurs.

c) Providing curb barriers intensifies the possibilities of conflicts at intersections where the barriers may be ended.

FIGURE XV-4
CLASS II - BIKEWAY - VARIATION B



a) Striping or pavement markers.
b) Parking restricted during peak bicycle travel hours.
c) One-lane bikeway only.
d) Clearance to outside travel lane and for opened cardoors must be provided.

Advantages:

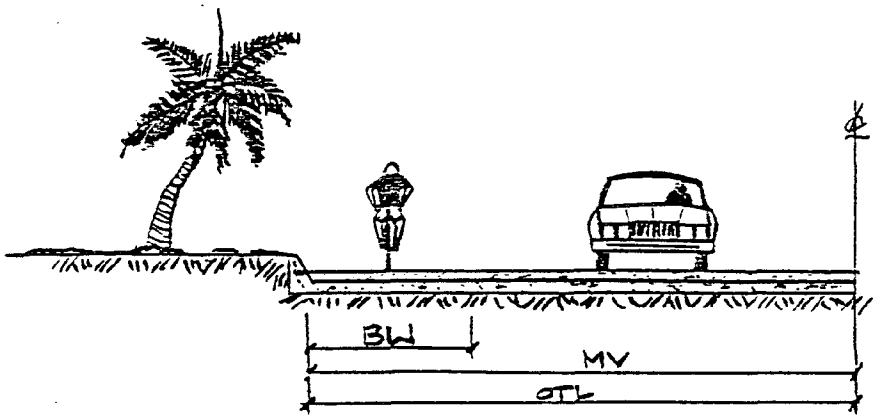
a) Restricted parking during peak bicycle travel hours allows greater room for passing cyclists and adequate maneuvering space.
b) There are no physical barriers such as curbs or pylons which tend to lead motorists and bicyclists to be less cautious.
c) Maneuvering room is provided with clearances from the traffic lanes and parked cars.

Disadvantages:

a) Cross-auto-flow by parking cars generates potential conflicts.
b) Potential pedestrian/bicycle conflicts caused by passengers exiting from parked cars.
c) Cars improperly parked may detract from maneuvering room for bicyclists.

d) Cars entering the traffic stream from their parking positions create further conflicts especially if they wait to enter the stream within the bicyclists' path.

FIGURE XV-5
CLASS III - BIKEWAYS - VARIATION A



a) Signed, shared right-of-way
b) Signs only to designate route.
c) No parking permitted.

Advantages:

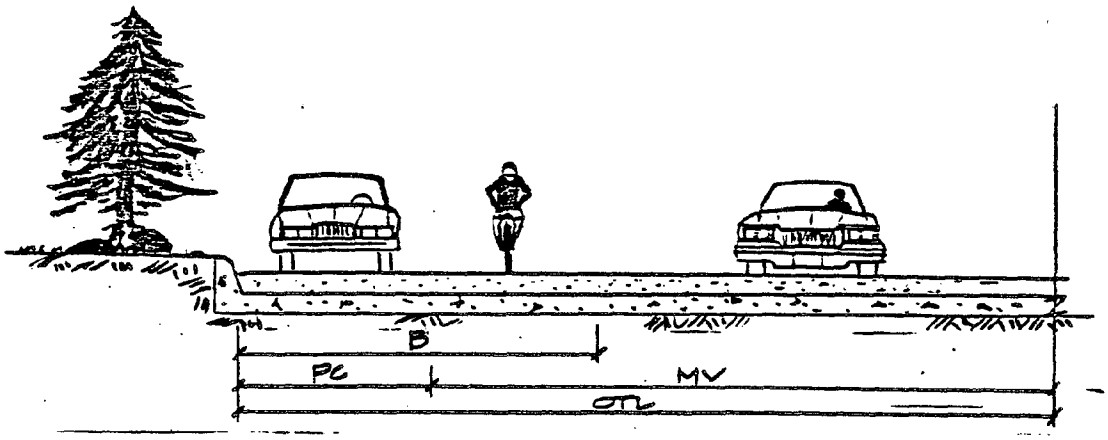
a) The implementation of the Class III route alternative is relatively inexpensive as signing is the only necessary designation.
b) Bicyclists ride within the traffic pattern; consequently, motorists and bicyclists are well aware of the presence of each other.
c) Maneuvering space is only restricted by the presence of other traffic.
d) Since bicyclists are already part of the traffic stream, intersection conflicts and driveway conflicts are less critical.
e) Prohibiting parking can decrease the volume of intentional cross-auto-flow, thereby decreasing the potential for auto/bicycle conflicts.

Disadvantages:

a) Bicyclists within the traffic pattern are vulnerable to serious accidents and injuries; and large volumes of traffic increase the likelihood of serious or fatal accidents.

b) Inherently restricted in speed, the bicyclist may slow traffic and increase traffic tie-ups.
c) Overtaking vehicles and weaving autos are hazardous to bicyclists, especially to inexperienced ones.
d) Bicyclists may be forced by the presence of traffic to ride at relatively high speeds which affect their ability to control their bikes.

FIGURE XV-6
CLASS III BIKEWAYS - VARIATION B



a) Signed, shared right-of-way.
b) Parking permitted.
c) No striping or barrier.

Advantages:

a) Relatively inexpensive to implement requiring only the signing of existing routes.
b) Motorist awareness of the presence of bicyclists is enhanced.
c) Bicyclists are not restricted to the "bikelane", allowing maneuvering space for any necessary evasive actions.
d) Intersection and driveway conflicts are still less critical, as maneuvering space is not restricted.

Disadvantages:

a) Pedestrian/bicycle conflicts are increased.
b) Again, the motorists is not aware of the presence of bicyclists and, therefore, intersection and driveway conflicts become critical.

c) Maneuverability is somewhat restricted, which may be critical especially with the presence of pedestrians.

Table XV-1 presents the minimum space requirements for the Class I,II and III bikeway variations.

D. BICYCLE ROUTE IMPROVEMENTS

Figure XV-7 depicts the types of Bicycle Route improvements that are recommended for the Saipan Lagoon Shoreline Bicycle Route Plan.

Before the construction costs can be established for these bikeway improvements, considerable surveying and preliminary engineering are necessary to determine the exact scope of reconstruction along the route. Anticipating that the total cost for all improvements will be prohibitively expensive, it is recommended that the next step be restricted to a preliminary engineering study which establishes reliable cost budgets for each type of improvement, the extent of cadastral work necessary to accommodate the bikeway and other project aspects such as utility relocations, intersection re-designs and specifying cost-efficient barriers for the Class I, Variation B, bikeway. The cost of such a preliminary study is approximately $25,000.

TABLE XV-1
MINIMUM SPACE REQUIREMENTS FOR
BIKEWAY VARIATIONS

Bikeway Variation	Minimum Bikeway Width	Recommended Minimum Space Required	Remarks
Class I Variation A	3.3'	5.8'	5.8'paved
Class I Variation B	6.8'	7.5'	Type B-3 curb barrier; no door opening allowance given.
Class II Variation A	6.8'	7.5' Including curb barrier; outside traffic lane should provide 1.0' minimum clearance.	Type B-3 curb barrier; 2-lane minimum to allow for passing cyclists.
Class II Variation B	3.3' to 5.3'	13.3' from curb to outer edge of bikeway 13.3' from curb to outer edge of bikeway	Medium to high parking density; off peak; low turnover. Low parking density; off peak.
Class III Variation A	NA	14.1' for outside traffic	Low motor venicle volumes and speeds.
Class III Variation B	NA	14.1' for outside traffic lane 22.1' for outside traffic lane	Low parking density; through motor vehicle traffic restricted. Medium to high density parking.

CHAPTER XVI - BEACH FACILITIES MAINTENANCE PROGRAM

A. STATEMENT OF INTENT

The Commonwealth Government now maintains many beach park facilities along the Saipan Lagoon shoreline. These facilities range from access roads and parking areas to pavilions, toilets, picnic tables and boat launching ramps. Despite periodic efforts by the Department of Public Works, many of these facilities are not maintained to standards that are acceptable to either the public or the tourists.

The intent of this Chapter is to prescribe a maintenance program for the PLAN area's beach facilities so as to assist Public Works in budgeting and implementing a repair and maintenance program. The Department of Public Works must concern itself with two aspects of its maintenance program for these facilities: periodic maintenance; and as-needed repairs. Since as-needed repairs are scheduled whenever required, such as to repair broken waterlines or acts of vandalism, they are not subject to the regularly scheduled maintenance and up-keep described in this Plan.

B. FACILITY INVENTORY AND MAINTENANCE SCHEDULE

Table XVI-1, below, summarizes the various types of recreation facilities along the Saipan Lagoon shoreline parks which are to be programmed for maintenance.

TABLE XVI-1
SUMMARY OF RECREATION FACILITIES
AND MAINTENANCE SCHEDULE

Facility	Scope of Maintenance (minimum)	Schedule
Access road, compacted coral	Re-grading and compaction where necessary	Biannual: once during mid-rainy season and once at end of rainy season
Access road, paved	Maintenance of roadside drainage	Annual, prior to rainy season
Pavilion, open air, and picnic shelters	Painting, exterior	Every two years

	Concrete roof Seal cracks	Every two years
	Roof, corrugated Check for loose sheets	Annual
	Electrical system Inspect and repair as necessary	Annual
	Plumbing system Inspect and repair pipes as necessary	Annual
	Inspect and repair leaking faucets and showers	Monthly
Restrooms	Paint, exterior	Every two years
	Paint, interior	Annual
	Concrete roof Seal cracks	Every two years
	Electrical system Inspect and repair as necessary	Annual
	Plumbing system Inspect and repair as necessary	Annual
	Inspect and repair leaking toilets and faucets	Monthly
Picnic Tables and Barbecue Pits	Inspect and repair where necessary	Annual
Parking and other paved areas such as multi-purpose athletic courts and ramps	Inspect and repair drainage system as required	Annual, prior to rainy season
	Re-paint lines	Annual, shortly after rainy season
Playfield equipment	Inspect, lubricate and repair as necessary	Annual

CHAPTER XVII - SOILS EROSION AND SEDIMENTATION CONTROL TECHNICAL MANUAL

A. STATEMENT OF INTENT

The intent of this Plan is to prepare a technical manual of soil erosion and sedimentation control techniques and procedures which are appropriate for the Commonwealth. Such a manual will serve as a technical reference for implementing Erosion Plans as now required by permitees under the Commonwealth "Earthmoving and Erosion Control Regulations", promulgated in April 1984. Section 4 of these Regulations outline the requirements for a permit to engage in earthmoving activities. One such requirement is an Erosion and Sediment Control Plan which must present specific measures and practices to control erosion and sedimentation resulting from the proposed project's earthmoving activities.

A technical manual which describes various erosion and sediment control measures appropriate for the Commonwealth is not now available. Such a manual would be useful as a primary reference for Government-approved structural and non-structural erosion/sediment control devices as well as for those vegetative measures which have proven to be successful for different soil types and terrains on Saipan.

This Technical Manual should be prepared under the Government's guidance and be made available to all contractors, designers and other potential Earthmoving permitees.

The following Scope of Work is appropriate for directing the preparation of a Technical Manual for Soil Erosion and Sediment Control in the CNMI.

B. SCOPE OF WORK

1. Outline the Basic Principles of Erosion and Sedimentation

   Definition of Erosion and Sedimentation

   Causes of Accelerated Erosion

   Influencing Factors to Erosion

   Causes of Sedimentation

   Sediment Transportation and Deposition

2. Describe Erosion and Sedimentation Control Planning

Principles for Erosion and Sedimentation Control Planning

Planning Step #1 - Preliminary Evaluation of Site

Planning Step #2 - Preliminary Design

Planning Step #3 - Sub-surface Investigations

Planning Step #4 - Final Design

3. Describe Appropriate Erosion Control Measures

Functions of Erosion Control Measures

Types of Erosion Control Measures

- Surface Roughening
- Interception and Diversion Practices
- Vegetative Stabilization
- Non-vegetative Soil Stabilization

4. Describe Appropriate Vegetative Measures for Controlling Sedimentation

- Planning for Establishment of Vegetation
- Minimum Slope and Surface Requirements
- Soil Testing
- Clay and Sand and Organic Matter Intermixing
- Topsoiling
- Liming and Fertilizing
- Permanent Seeding
- Temporary Seeding
- Mulching
- Sodding
- Maintenance

Planning Guidelines for Preventing Sediment Runoff by the Use of Vegetation

Vegetative Control Measures

- Natural Buffers
- Installed Vegetative Buffer
- Contour Strips
- Sod Inlet Filter

Temporary and Permanent Stabilization Through Vegetation

5. Describe Appropriate Structural Measures for Controlling Sedimentation

   Pre-Sediment Pond Techniques

   Sediment Basin Techniques

   Post-Sediment Basin Measures

6. Describe Construction of Erosion and Sediment Control Measures

   Roadway Construction

   Underground Utility Construction

   Building Construction

7. Describe Maintenance of Erosion and Sedimentation Control Measures

   Maintaining Vegetative Measures

   Maintaining Structural Measures

   Removal and Disposal of Sediment from Detention Ponds

C. COST ESTIMATE AND PROJECT SCHEDULE

The cost for such a Technical Manual will be approximately $15,000, including printing. A reasonable project schedule is four months, including review time.

PART FIVE
IMPORTANT HABITATS MANAGEMENT
ELEMENT

CHAPTER XVIII - IMPORTANT HABITATS MANAGEMENT PLAN

A. SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS

During the data collection phase of this study important habitats such as mangrove stands selected coral reefs in the lagoon, turtle nesting sites and seagrass beds were identified and a general assessment of the condition of each species was made. Literature related to these habitats was obtained and reviewed in order to determine their relative change over time. This was necessary in order to determine the impact of development on these habitats and to determine the level of protection needed. In general, very little hard data are available for these habitats; and, therefore, a picture of historical change is difficult to compose. Without such data it is impossible to determine what effect development has had on these habitats. Field investigations alone do not give such an insight.

During field investigations no evidence was found regarding specific areas used for shelling or any other purpose other than what is identified in Volume I.

1. Mangrove Stands Habitats

Mangrove stands were surveyed from land and by boat. This resource on Saipan is very small for a tropical island (Figure XVIII-1). However, it is common to find limited mangroves on islands with few small rivers and limited estuaries, such as on Saipan. The extent of mangroves on Saipan is limited to three extremely small stands.

The first stand is in a small tidal estuary at the mouth of a storm drainage basin at Lower Base toward the northern extreme of Puntan Tanapag. The area of tidal influence extends to the road, through a culvert and north along the road approximately 20 meters (65 ft). This area continues along the road another 50 meters (165 ft) as a depressed wetland fed by a natural spring and rainwater runoff. It is only remotely affected by the tides. It has been reported

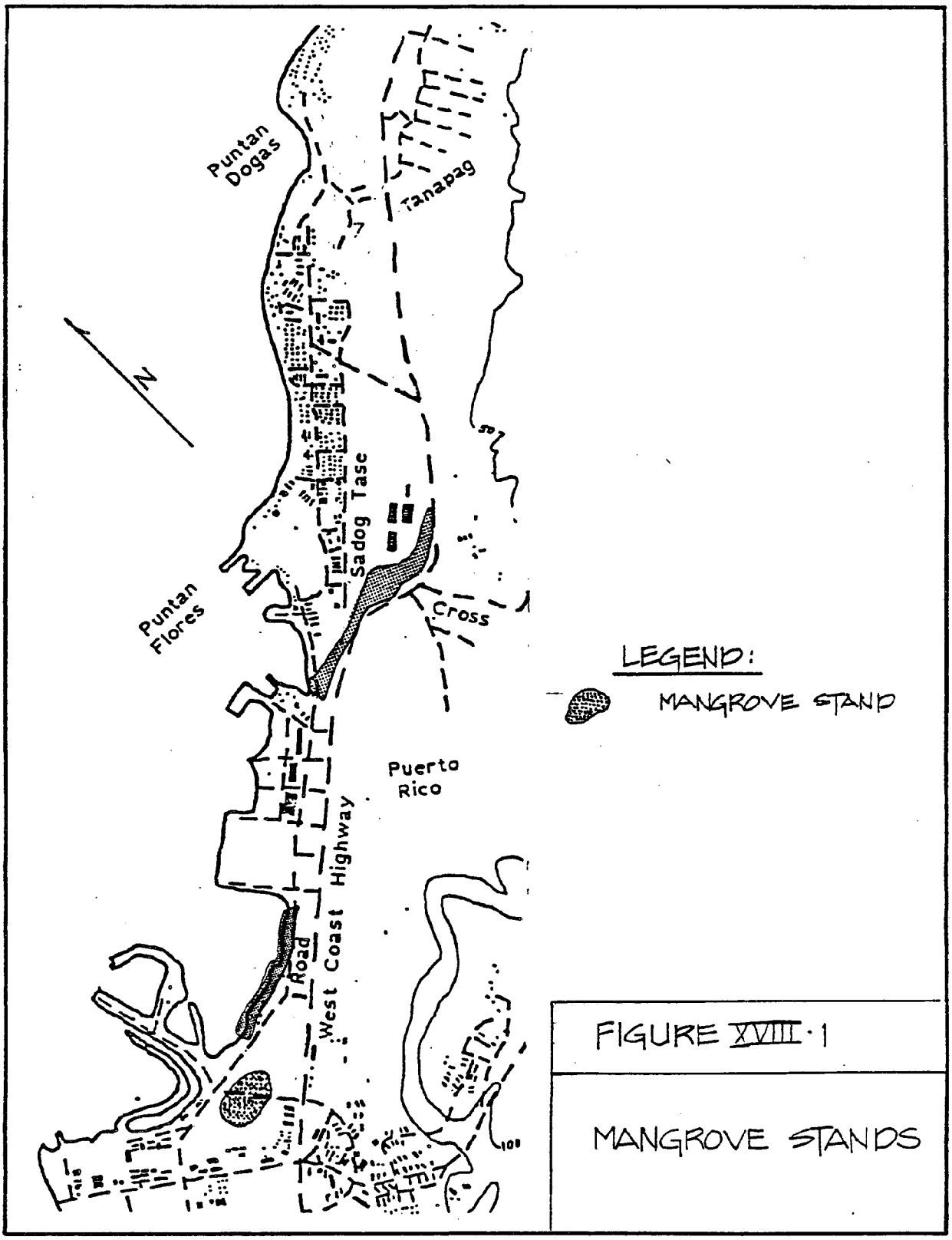


FIGURE XVIII-1

MANGROVE STANDS

that at one time the entire wetland was probably a small bay open to the harbor. However, with the extensive filling from wartime activities and development over the years the outlet has been reduced to a narrow streambed. One estimation puts the mouth of this stream approximately 600 meters (2000 ft) from the harbor. Most likely, the stream drained a large lowland area presently covered by fill and supporting buildings in the vicinity of Puntan Flores.

Only one species of mangrove exists in this limited area, Bruguiera gymnorrhiza. This species extends from the mouth of this estuary along both sides to the bridge. A few mangrove trees can be seen on the opposite side of the road but they dissipate rapidly. Other wetland-type plants in the area are Phragmites karka (Kariso), Hibiscus tilaceus (Pago) Acrostichum aureum (Langayao), Cyperus alternifolius (umbrella sedge), a number of grasses common to these islands like Pennisetum purpureum (elephant grass) and Sporobolus virginius (salt grass). A few small trees exist in the area, such as Pandanus tectorius (Aggak), Pithecellobium dulce (Kamachile) and the common Leucaena leucocephala (Tangan-Tangan). A few small weeds, vine and bushes like Bidens pilosa (Beggars tick), Pluchea indica and Ipomoea pes/caprae (Beach morning glory) round out species composition.

The second small mangrove stand is found just south of the Puerto Rico Dump along a short segment of coastline. The extent of the mangrove area is a patch measuring 300 meters long by 10 meters wide. Bruguiera gymnorrhiza is the only mangrove species in this area. This site is fed by fresh water along the shoreline from a small wetland directly east of Beach Road and to the south 100 meters across from Smiling Cove. Mangroves are also found at this site. Data suggest that the area was likely a poorly-drained marsh. The area is now filling in, a process which is facilitated by expansion of the dump.

The third mangrove stand is located on the east side of Beach Road directly across from Smiling Cove. Bruguiera gymnorrhiza is the only species of mangrove living here and only in isolated stands. It appears that the area was once connected to the ocean because of the wetland appearance. However, no direct connection now exists. The water is definitely estuarine and likely affected by the tides.

Associated vegetation in the vicinity of these sites include the following: Hibiscus tiliaceus (Pago),

Leucaena leucoephala (tangan-tangan), Pluchea indica, Ipomoea pes-caprae (Beach morning glory) and a few weeds like Bidens pilosa (Beggars tick).

2. Coral Patch Reefs Habitats

The Saipan Lagoon is rich in resources particularly those associated with coral reefs. The barrier and fringing reefs form a contiguous reef zone from north to south along most of the West Coast of Saipan. This reef is an important habitat in itself since it provides the homes for all other reef-associated marine biota. This particular habitat is not addressed in detail in this PLAN since it is already protected by existing regulations such as those regarding the taking of coral, trochus and a few other marine species. Promulgated by the Department of National Resources and carried out by the Division of Fish and Wildlife, however, much could be done to improve efficiency in operation.

Three patch reefs within the lagoon, represent a rich resource that require protection. Two of these patch reefs are comprised of one dominant coral, Acropora formosa know as staghorn coral. The largest of these patch reefs is located just inside the reef at the Japanese lighthouse. The second and smallest of these Acropora patch reefs is located at the northern extreme of Paupau beach.

A third patch reef is quite different than the other two with much greater coral diversity. Numerous species of corals can be found here supporting a much greater variety of marine life. This area is located in the central lagoon just north of Tanapag Harbor. Fishermen can often be seen using various fishing techniques around this reef.

These three patch reefs are excellent fishing grounds for spearfishermen and should be protected from illegal activities like cloroxing or blasting. Local spear-fishermen use these areas constantly because of their proximity to shore and abundance of resources. The upper portion of the Acropora patch is mostly dead coral with associated incrusting sponge and algae. The lower portions of the reef is alive and teeming with life. However, the patch reef north of Tanapag Harbor is mostly live coral throughout.

3. Managaha Island Underwater Trail Plan

A natural spinoff of the PLAN is the development of a marine park in the vicinity of Managaha Island. One of

the primary interpretative aspects of this park is an underwater trail. This trail involves two coral arcs located in shallow water to the northwest of Managaha Island. The area is characterized as a group of diverse coral heads with a few unique sights.

At this time a Marine Park Management Plan is being developed for this site. An underwater trail has been layed-out, and a management plan with interpretation features is nearly completed. Because of the positive tourist attraction this trail will provide, its protection is essential; although protective legislation is not in place at this time. Before the Marine Park Management Plan is accepted and adopted, a public hearing and legislative action must be taken.

4. Seagrass Beds Habitats

Three species of seagrass exist in the Saipan Lagoon. These are Enhalis accoroides, Halodule uninervis and Halophylla minor. Each of these species has its own geographical range. However, all three live in close proximity in the Garapan Lagoon Planning Area.

Seagrass beds are an important resource in the Saipan Lagoon since they provide protection for juvenile fishes. Thick mats of seagrass are found in shallow waters in the Garapan Lagoon from Puntan Muchot to Puntan Susupe. These beds exist along the shoreline approximately 5 meters from the mean tide line into the lagoon and approximately 200 meters from the shoreline.

Rich coral on the outside barrier reef provides a habitat for adult stages of the various reef fishes. Seagrass beds in shallow near-shore waters provide the habitat for the juvenile stage of the same fishes. Adults bear their young in these thick seagrass beds in order to provide them protection. When the juveniles grow to adult size they migrate to the coral habitat at the edge of the barrier reef and eventually into deeper water.

B. OBJECTIVES FOR IMPORTANT HABITATS MANAGEMENT PLAN ELEMENT

The intent of this PLAN is to prepare a management plan for mangrove stands and selected patch reefs and to prepare legislation which protects these specific areas.

Mangrove forests, selected patch reefs, seagrass beds and the coral reefs designated for this purpose represent important habitats in that they are breeding grounds for a variety of marine and terrestrial wildlife. For this unique reason, these habitats need protection to prevent their destruction. This is particularly true in the Saipan Lagoon which has only three small mangrove stands (two located at the American Memorial Park and one near the Commercial Port), limited patch reefs, seagrass beds and coral reefs in close proximity to land.

The proposed Plan identifies the need to protect these resources through legislation, preserve the resource through a management plan and monitor the resource through an on-going monitoring program within the framework of existing CNMI government agencies.

The specific parts of legislation for protecting important habitats are listed below:

* Develop an act to protect Mangrove stands and patch reefs.
* Identify the lead agency in conjunction with supporting agencies (DEQ, CRMO, and Division of Fish and Wildlife) to provide supporting evidence in the legislative process.
* Obtain the support of Federal Government Agencies (ACOE, US Fish and Wildlife Service, US EPA and others).
* Develop memorandums of understanding between governmental concerns.

Important habitats within the PLAN area are depicted on Figure XVIII-2.

Mangrove forests, selected patch reefs, seagrass beds and the coral reefs designated for this purpose represent critical habitats in that they are breeding grounds for a variety of marine and terrestrial wildlife. For this unique reason, these habitats need protection to prevent their destruction. This is particularly true in the Saipan Lagoon which has only three small mangrove stands (two located at the American Memorial Park and one near the Commercial Port), limited patch reefs, seagrass beds and coral reefs in close approximately to land for tourists to dive at.

The proposed Plan identifies the need to protect these resources through legislation, preserve the resource through a management plan and monitor the resource through an on-going monitoring program within the framework of existing CNMI government agencies.

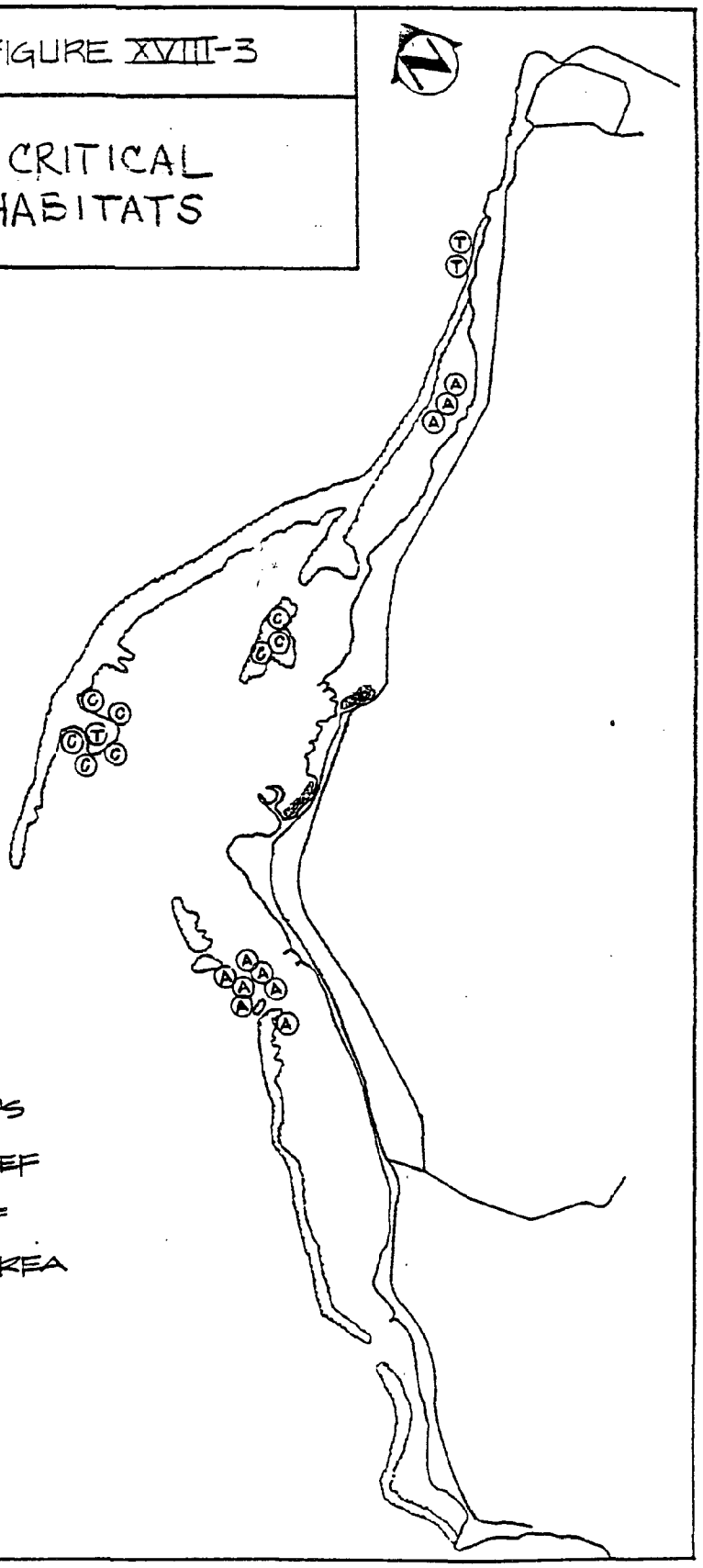
The specific parts of legislation for protecting critical habitats are listed below:

* Develop an act to protect Mangrove stands and patch reefs as rare, threatened and endangered habitats.
* Identify the lead agency in conjunction with supporting agencies (DEQ, CRMO, and Division of Fish and Wildlife) to provide supporting evidence in the legislative process of declaring these areas as critical habitats.
* Obtain the support of Federal Government Agencies (ACOE, US Fish and Wildlife Service, US EPA and others).
* Develop memorandums of understanding between governmental concerns.

Critical habitats within the PLAN area are depicted on Figure XVIII-3.

FIGURE XVIII-3

CRITICAL HABITATS



LEGEND:

- MANGROVE STANDS
- (A) Acropora PATCH REEF
- (C) CORAL PATCH REEF
- (T) TURTLE NESTING AREA

CHAPTER XIX - IMPORTANT HABITATS MANAGEMENT PLAN

A. LEGISLATION FOR THE PROTECTION OF IMPORTANT HABITATS

Exhibit XIX-1 presents proposed legislation to protect important habitats.

EXHIBIT XIX-1
AN ACT TO PROTECT IMPORTANT HABITATS

Commonwealth of the Northern Mariana Islands
Department of Natural Resources

The Department of Natural Resources in conformity with and pursuant to CNMI statutes, and every other law hereunto enabling does hereby adopt the following act for the establishment, protection and regulation of important habitats, Saipan Lagoon CNMI.

PART I

Section 1. Establishment of Important Habitats. Department of Natural Resources does hereby declare and establish the Important Habitats Zone (described in detail in Section 3 of this part).

Section 2. Purpose. It is the purpose of this regulation to preserve, protect and conserve the marine and terrestrial resources and geological factors associated within the boundaries of the zones identied in Section 3 of this part.

Section 3. Important Habitats Zone. These habitats shall include those zones, identified in the siting map (Figure XXI-1) and referenced as follows:

a. Mangrove stands at Lower Base and along Unai Sadog Tasi in the Tanapag Harbor region.

b. Potential Managaha Island Marine Park

c. Acropora Patch reef at the light house in Garapan Lagoon

d. Acropora patch reef in the vicinity of Paupau Beach.

e. Diverse coral patch reef in Central Lagoon north of Tanapag Harbor.

f. Seagrass beds, Halodule uninervis particularly, in the vicinity of Garapan Lagoon near-shore.

g. Turtle nesting sites at Wing Beach and San Antonio Beach.

PART II

Section 1. Activities prohibited. It shall be unlawful for any person to:

a. Fish for, take, process or remove any fish, mollusk, crustacea, or other marine or terrestrial animal within mangrove stands and associated marine environment except for subsistence purposes.

b. Take, alter, deface, destroy, possess or remove any rocks, coral, sand or other geological features or specimens.

c. Contaminate or otherwise alter the physical, chemical or biological properties of the waters, including change in temperature, taste, color, turbidity or odor thereof, or to discharge, directly or indirectly waste materials of any kind, whether treated or not and whether animal, mineral, or vegetable, and whether liquid gaseous, radioactive or solid including sewage and agriculture and industrial wastes, so as to cause said waters of these habitat zones to be reduced in quality below the established Water Quality Standards as established and amended by the Department of Environmental Quality and any amendments thereto, which are hereby incorporated herein and made a part of these regulations.

d. Construct, install, erect, or place piers, jetties, moorings, utilities or structures of any kind, or sink any type of water craft or other sizable object, or abandon any type of water craft or other sizable object, sunk

or unsunk without permission of proper governmental authority.

e. Operate, anchor or move any vessel in a manner contrary to the Rules and Regulations Governing Boating of the Dept. of Transportation, U.S. Coast Guard, and any amendments thereto, which by reference are hereby incorporated in this Regulation and made a part hereof as though fully recited herein.

Section 2. Exceptions. Notwithstanding any provision of this regulation to the contrary and except as prohibited by any other rules, regulation or law, it shall be lawful for any person to:

a. To fish for, take, possess or remove any marine life by the use of hook and line, spearfishing or trapping except for subsistance purposes. There shall be absolutely no dynamiting or cloroxing as a method for fishing.

b. Take, for scientific, propagation, or other purposes except as approved by the Department of Natural Resources, Division of Fish and Wildlife thereof any fish, corals, mollusks, crustacea and other form of marine animal.

Section 3. Penalty. Any person violating the provision of this regulation shall be fined not more than $500 or imprisoned not more than 90 days or both.

B. IMPORTANT HABITATS MANAGEMENT PLANS

Concurrent with establishing legislation for the protection of mangrove stands and selected patch reefs, it is necessary to develop a Management Plan to ensure their protection in the future. The purposes of this Management Plan are to:

* Maintain the ecological balance;
* Protect fish nursery and stock;
* Provide habitat for selected species;
* Provide protection of Saipan's only Mangrove stands for the sake of education and research;

* Establish standards for the protection and further propagation of mangrove stands in the Saipan Lagoon; and
* Maintain selected patch reefs and seagrass beds for the propagation of such species.

The Plan to manage important habitats for coral patch reefs, mangrove stands and seagrass beds, follows.

* Designate these habitats by legislation
* Designate the Department of Natural Resources as the lead agency, with the Department of Fish and Wildlife as the subordinate agency for monitoring purposes.
* Monitor these habitats on a regular basis to to ensure their protection.
* Levy a penalty for any violations or infractions.

PART SIX
ENERGY FACILITIES PLAN ELEMENT

CHAPTER XX - SITING CRITERIA FOR ENERGY FACILITIES

A. SYNOPSIS OF DATA ANALYSES FROM VOLUME I AND IDENTIFICATION OF PROBLEMS

Volume I of the PLAN outlines the general and specific energy related facilities on Saipan, all of which are located within the Tanapag Harbor Planning Area except for privately owned, back-up equipment (Refer to Volume I, Part B, Chapters II. 2a and VIII. 4). Within this planning area is the 28.8 MW power plant with 10.3 MW back-up generators, pipelines between the Mobil Bulk Oil Plant and DPW Fuel Storage area at Charlie Dock, and the power plant shop bunkering pipelines at Charlie and Baker Docks.

Electrical generating equipment on Saipan barely meets current energy demand. In 1981 peak load was estimated at 15.4 MW and the baseload at 11.6 MW. Old and inefficient equipment and breakdowns account for the short-comings.

Energy users on Saipan have been enjoying a substantial energy subsidy over the years and do not pay their share for energy consumption. The 1982 production cost of electricity (most recent accurate data available) was $.12/kwh. Until 1976, only $.03/kwh was charged to all consumers. Since then, rates have been charged at $.06/kwh for 0-2000 kwh/month, $.07/kwh for 2001-25,000kwh/month, and $.08/kwh for more than 25,000 kwh/month. This rate structure does not meet the $.12/kwh cost of production. In addition, the CNMI Government does not pay for its consumption, and the old TTPI Government pays a flat rate of $400,000 per year. The effective net result of revenue derived from energy consumers in the CNMI is $.02/kwh, or nearly six times less than the 1982 estimated cost of production.

Rising energy costs are also a problem in the CNMI. Continued, increased federal funding is the only way in which the CNMI Government can keep pace with the rising cost of energy production in its oil-based energy dependent society. Besides the economic problems inherent in this situation, other special problems exist, especially if the oil supply were to be depleted or if prices rise dramatically. Both of these situations would stress an already fragile relationship between the energy suppliers and users.

B. OBJECTIVES FOR ENERGY FACILITIES SITING CRITERIA

The primary objective of the energy facilities siting criteria is to determine the elements that should be examined for expansion of existing as well as the development of new energy facilities. Primary elements include physical/environmental as well as social aspects, such as proximity of generating and distributing facilities to residences.

C. SITING CRITERIA

It is important to understand the impacts that can be reasonably anticipated by new or expanding energy development in the PLAN area so that it is possible to invoke mitigation measures by intelligently anticipating the cumulative effects of these impacts. These mitigating measures will lead to more appropriate siting of the facilities and result in less impact on the physical and social environment.

Siting criteria require that the following elements be examined closely.

Physical/Environmental

* Resource requirements
* Water, land and air pollution

Social

* Proximity to residences
* Visual and noise pollution

Within these elements the siting criteria are divided into general and specific aspects for two energy sources: conventional oil and alternate sources (i.e. coal, biomass, and solar salt-gradient ponds).

1. Conventional Oil Fired Energy Facilities Siting Criteria

   * Locate in proximity to a water source (ocean, lagoon) for cooling water supply.

     - Development of a surface cooling water source.
     - Development of a deep water (60 ft. minimum) disposal site for heated effluent.

* Locate in proximity to commercial port for easy transmission of fuel.

* Locate in central proximity to consumers.

* Minimize pollution (air, water, noise, land) on the environment.

2. Coal Fired Energy Facilities Siting Criteria

* Adequate, adjacent land to existing power plant for

  - Expansion of existing facility to accommodate a coal fired plant.

  - Coal stockpiling

* Locate in proximity to commercial port for coal transshipment to energy facility.

* All other issues stated for conventional oil fired energy facility.

3. Biomass Fueled Energy Facilities Siting Criteria

* Adequate, adjacent land to existing energy facility for a biomass conversion plant.

* Proximity to biomass source (residential or business customers) or adequate transportation of fuel feedstock to energy facility.

4. Solar Salt Gradient Energy Facilities Siting Criteria

* Adequate land (2 ha plots), flat and none permeable.

* Shallow lagoon (2 ha plots) which can be bermed for protection.

* Proximity to distribution system for easy connection.

* Protection from inundation by extreme tidal fluctuation or heavy rains.

PART SEVEN
IMPLEMENTATION PLAN ELEMENT

CHAPTER XXI - SUMMARY OF PLAN RECOMMENDATIONS

The purposes of Plan Element Seven are to recap the recommended Plans presented in Plan Elements Two through Six and to present the administrative, financial and legal requirements for implementing each Plan. Also, this Plan Element identifies issues of national significance that relate to the implementation of this SAIPAN LAGOON USE MANAGEMENT PLAN as well as a general assessment of the proposed PLAN's impact on the Saipan community.

Table XXI-1 categories the PLAN recommendations with respect to the following implementation requirements.

Agency with administrative purview over recommendations
- Coastal Resources Management Office
- Zoning Administration Office
- Department of Public Works
- Department of Natural Resources
- Department of Public Health and Environmental Services
- Department of Parks and Recreation

Financial
- Executive Branch Operating Budget
- Capital Improvements Project Budget

Legal
- Public Law for Enactment
- Public Law for Appropriation
- Regulations

TABLE XXI-1
IMPLEMENTATION REQUIREMENTS FOR
PLAN RECOMMENDATIONS

REFERENCE EXHIBIT (E) No. FIGURE (F) No. SECTIONS (S)		PLAN RECOMMENDATIONS (SHORT TITLE)	ADMINISTRATIVE (LEAD AGENCY)	FINANCIAL	LEGAL
(S)	IV.B	Zones and Land Use District Act of CNMI	Zoning Administration Office	Executive Branch Operating Budget	Public Law for Enactment
(S)	IV.B.1	Amendment to Section 9 of Zones and Land Use District	Zoning Administration Office	NA	Public Law to amend Act
(S)	IV.B.2	Expansion of Village Zone of San Antonio-Zones and Land Use District Act	Zoning Administration Office	NA	Public Law to amend Act
(S)	IV.B.3	Paupau Resort Zone in Northern Saipan-Zones and Land Use District Act	Zoning Administration Office	NA	Public Law to amend Act
(E)	V-1	Shoreline Setbacks	Coastal Resources Management Office	NA	Regulations
(T)	V-1	Property Setbacks, Structure Heights and Densities	Zoning Administration Office	NA	Regulations
(E)	V-2	Lot Coverage for Commercial and Resort Zones	Zoning Administration Office	NA	Regulations
(E)	V-3	Setback and Height Regulations for Commercial and Resort Zones	Zoning Administration Office	NA	Regulations
(E)	V-4	Shoreline Fencing Regulations	Coastal Resources Management Office	NA	Regulations
(E)	VI-1	Landscaping Guidelines	Zoning Administration Office	Executive Branch Operating Budget	Approopriation
(E)	VI-1	Regulations for Dredging Diking and Landfilling along Coastal Areas	Coastal Resources Management Office	NA	Regulations

(E)	VI-2	Regulations for Structures located on Near Shore and Beach Strand Ecological Zones	Coastal Resources Management Office	NA	Regulations
(E)	VI-3	Regulations for Mining along Coastal Strand	Coastal Resources Management Office	NA	Regulations
(S)	VI.E	Beach and Shoreline Restoration	Department of Public Works	CIP Budget	Appropriation
(T)	VII.B.1	Shoreline Water Facilities Planning	Department of Public Works	Executive Branch Operating Budget	Appropriation
(S)	VII.B.2	Groundwater Management Task Force	Department of Public Health and Environmental Services	NA	NA
(S)	VII.C.1	Shoreline Wastewater Facilities Planning	Department of Public Works	CIP Budget	Appropriation
(S)	VII.D.1	Storm Drainage Design Criteria	Department of Public Works	Executive Branch Operating Budget	Appropriation
(S)	VII.E	Planning Criteria for Evaluating Development Impacts	Coastal Resources Management Office	NA	NA
(S)	IX.B	Recreation Use Zones for Saipan Lagoon	Department of Parks and Recreation	Executive Branch Operating Budget	Appropriation
(S)	IX.B.5	Water Recreation Advisory Board	Coastal Resources Management Office	NA	NA
(S)	IX.C	Water Safety Information Program	Department of Parks and Recreation	Executive Branch Operating Budget	Appropriation
(S)	X.B	Hazards Removal Plan	Department of Parks and Recreation	CIP Budget	Appropriation
(S)	X.D	Marine Nuisance Abatement Plan	Department of Natural Resources	Executive Branch Operating Budget	Appropriation
(S)	XII.B	Saipan Outdoor Recreation Plan	Department of Parks and Recreation	Executive Branch Operating Budget	Appropriation
(T)	XIII-2	Improvements for Village Parks and Playgrounds	Department of Public Works	CIP Budget	Appropriation
(T)	XIII-4	Improvements for Beach Parks - Natural	Department of Public Works	CIP Budget	Appropriation

(T) XIII-5	Improvements for Beach Parks - Developed	Department of Public Works	CIP Budget	Appropriation
(S) XIV.8	Afetna Beach Park Improvements	Department of Public Works	CIP Budget	Appropriation
(F) XV-7	Bicycle Route Improvements	Department of Public Works	CIP Budget	Appropriation
(T) XVI-1	Recreation Facilities and Maintenance Schedule	Department of Public Works	NA	NA
(S) XIX.8	Soil Erosion and Sedimentation Control Technical Manual	Department of Public Health and Environmental Services	Executive Branch Operating Budget	Appropriation
(E) XIX-1	Critical Habitats Protection Act	Department of Natural Resources	NA	Public Law for Enactment
(S) XIX.8	Critical Habitats Management Plans	Department of Natural	NA	NA

CHAPTER XXII - ADMINISTRATIVE, FINANCIAL AND LEGAL REQUIREMENTS FOR IMPLEMENTATION OF PLANS

The primary responsibilities for implementing this PLAN fall to the following agencies of the Government of the Northern Marianas Islands.

Coastal Resources Management Office
Zoning Administration Office (as proposed by legislation now under consideration by the CNMI Legislature)
Department of Public Works
Department of Natural Resources
Department of Public Health and Environmental Services
Department of Parks and Recreation

Their respective roles for implementing this PLAN are outlined in the following sections of this Chapter.

A. COASTAL RESOURCES MANAGEMENT OFFICE

The responsibilities of CRMO are two-fold with respect to implementing the SAIPAN LAGOON USE MANAGEMENT PLAN. First, as the PLAN's lead agency, CRMO must serve as the Government's primary advocate for implementation. This involves coordinating the various responsibilities for implementation among the respective agencies; helping to resolve the inevitable conflicts that arise among the public, the Executive Branch and the Legislative Branch as implementation takes place; providing financial grant support, wherever possible, to other agencies with administrative responsibilities for implementing aspects of this PLAN; and serving as the spokes-agency for promoting the public benefits and economic growth that evolve from properly managing the Lagoon's resources and from coastal resources planning in general.

The second CRMO responsibility for implementing this PLAN pertains to those particular plans for which the agency has administrative purview to implement. Those plans are extrapolated in Table XXII-1, along with their respective financial and legal requirements for implementation.

The present administrative purview of CRMO could conceivably embrace other PLAN recommendations by virtue of the agency's permitting authority and wide-ranging influence in land use development and lagoon resource management matters. However, this PLAN recommends that only those recommendations pertaining exclusively to shoreline management (e.g., near-shore and beach strand development, etc.) and interagency coordination (e.g., the Water Recreation Agency Board) be assigned to CRMO. Other

agencies with more clearly designated authority for such programs as recreation resources planning, stormwater drainage, erosion control and land use regulations are assigned to those types of plans. One possible exception to this recommended assignment of administrative responsibility involves those plans assigned to the Zoning Administration Office. In the event that such an Office is not yet created by legislation, which is now under consideration by the Legislature, CRMO should assume that proposed Office's responsibilities until such time as the Zoning and Land Use District Act is passed and operational.

TABLE XXI-1

FINANCIAL AND LEGAL REQUIREMENTS
FOR IMPLEMENTING PLANS UNDER THE
ADMINISTRATIVE PURVIEW OF CRMO

Plan (Short Title and Reference)	Financial Requirements	Legal Requirements
1) Shoreline Setbacks (E) V-1	None required	Promulgate the recommended Regulations
2) Shoreline Fencing (E) V-4	None required	Promulgate the recommended Regulations
3) Diking and Landfilling along Coastal Areas (E) VI-2	None required	Promulgate the recommended Regulations
4) Structures located on Near-Shore and Beach Strand Ecological Zones (E) VI-2	None required	Promulgate the recommended Regulations
5) Mining along Coastal Strand (E) VI-3	None required	Promulgate the recommended Regulations
6) Planning Criteria for Evaluating Development Impacts (S) VIII.E	None required	None required
7) Water Recreation Advisory Board (S) IX.B.5	None required	None required

B. ZONING ADMINISTRATION OFFICE

The Zoning Administration Office was proposed in 1983 by the CNMI Zoning and Land Use Districts Act as the agency to administer the Commonwealth's zoning and land use districts program. Several of the PLAN's recommendations are direct adjuncts to that program and, therefore, should be within the administrative purview of that Office for implementation. Those plans are extrapolated in Table XXII - 2.

It should be noted that the proposed organizational and annual operating budget ($150,000) for the office was previously recommended by the Government as part of its zoning and land use districting program. That operational budget is not included as part to this PLAN's implementation requirements.

C. DEPARTMENT OF PUBLIC WORKS

As the Governments' primary contracting and infrastructure maintenance agency, Public Works has a major responsibility for this PLAN's design, construction and maintenance recommendations. Of course, Public Works must rely on the expertise of other agencies, especially CRMO, Natural Resources and the Division of Environmental Quality in making the final determination for planning data analysis, scopes of work, and construction alternatives for many of these projects.

The Public Works PLAN implementation responsibilities are presented in Table XXII-3.

TABLE XXII-2

FINANCIAL AND LEGAL REQUIREMENTS
FOR IMPLEMENTING PLANS UNDER THE
ADMINISTRATIVE PURVIEW OF THE
ZONING ADMINISTRATION OFFICE

Plan (Short Title and Reference)	Financial Requirements	Legal Requirements
1) Zones and Land Use Districts Act of CNMI (S) IV.B	None required (see section B, this chapter)	Enactment of the proposed Act
2) Amendment to Section of Zones and Land Use Districts Act (S) IV.B.1	None required	Public Law to amend Act
3) Expansion of Village Zone, San Antonio-Zones and Land Use Districts Act (S) IV.B.2	None required	Public Law to amend Act
4) Paupau Resort Zone in Northern Saipan-Zones and Land Use Districts Act (S) IV.B.3	None required	Public Law to amend Act
5) Property Setbacks, Structure Heights and Densities (T) V-1	See item #8, below	Promulgate the recommended Regulations
6) Lot Coverage for Commercial and Resort Zones (E) V-2	See item #8, below	Promulgate the recommended Regulations
7) Setback and Height Regulations for Commercial and Resort Zones (E) V-3	See item #8, below	Promulgate the recommended Regulations
8) Landscaping Guidelines	$2,000 for staff expenses and printing costs	None required

TABLE XXII - 3

FINANCIAL AND LEGAL REQUIREMENTS
FOR IMPLEMENTING PLANS UNDER
THE ADMINISTRATIVE PURVIEW OF
PUBLIC WORKS

Plan (Short Title and Reference)		Financial Requirements	Legal Requirements
1)	Beach and Shoreline Restoration Plan (S) VI.E	$1,600,000 for design and construction	CIP Appropriation
2)	Shoreline Water Facilities Planning (T) VII.B.1	$85,000 for consultant services	Executive Branch Operating Budget Appropriation
3)	Shoreline Wastewater Facilities Planning (S) VII.C.1	$40,000 for consultant services	Executive Branch Operating Budget Appropriation
4)	Storm Drainage Design Criteria Manual (S) VII.D.1	$60,000 for consultant services	Executive Branch Operating Budget Appropriation
5)	Hazards Removal Plan (S) X.B	$100,000 for contractual services	Executive Branch Operating Budget Appropriation
6)	Improvements for Village Parks and Playgrounds (T) XIII-2	See item #8, below, plus $16,800 for construction	CIP Appropriation
7)	Improvements for Beach Parks - Natural (T) XIII-4	See item #8 below, plus $7,800 for construction	CIP Appropriation

8)	Improvements for Beach Parks-Developed (T) XIII-5	$10,000 for design of improvements for items #6, #7 and #8, plus $66,000 for construction	CIP Appropriation
9)	Afetna Beach Park Improvements (S) XIV.B	$10,000 for design, plus $70,000 for construction	CIP Appropriation
10)	Bicycle Route (E) XV-7	$25,000 for preliminary engineering	CIP Appropriation
11)	Recreation Facilities and Maintenance Schedule (T) XVI-1	To be determined by Public Works	Executive Branch Operating Budget Appropriation

D. DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources has prime responsibility for urging the enactment of the proposed Act to protects habitats for rare, threatened and endangered species within the Saipan Lagoon project area and for implementing a program for marine nuisance abatement.

The plans are highlighted in Table XXII-4.

E. DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENTAL SERVICES

This Department's responsibilities accrue from the program authority of its Division of Environmental Quality (DEQ). Many of DEQ's programs already affect the Lagoon; however, only two plans have been recommended for DEQ to improve the management of the Lagoon uses. They are support for the recently developed Groundwater Management Task Force and the preparation of technical manual to guide design and construction solutions for complying with Saipan's soil erosion and sedimentation control regulations.

DEQ also has a secondary role in the implementation of the SAIPAN LAGOON USE MANAGEMENT PLAN. As the Government's watchdog over the quality of the Commonwealth's marine waters, fresh waters and terrestrial resources, DEQ must be included as an official advisor to virtually every

recommendation of this PLAN which impacts on the environment.

The primary PLAN implementation responsibilities of DEQ are presented in Table XXII-5.

F. DEPARTMENT OF PARKS AND RECREATION

By virtue of the Lagoon's many recreation resources, this Department has administrative authority over water recreational areas, as highlighted in Table XXII-6.

TABLE XXII - 4

FINANCIAL AND LEGAL REQUIREMENTS
FOR IMPLEMENTING PLANS UNDER
THE ADMINISTRATIVE PURVIEW OF
THE DEPARTMENT OF NATURAL RESOURCES

Plan (Short Title Reference)	Financial Requirements	Legal Requirements
1) Marine Nuisance Abatement Plan (S) X.D	$4,000 for staff, materials and equipment	Executive Branch Operating Budget Appropriation
2) Important Habitats Protection Act (E) XIX-1	None required	Enactment of the proposed Act
3) Important Habitats Management Plan (S) XXI.B	None required	None required

TABLE XXII - 5
FINANCIAL AND LEGAL REQUIREMENTS
FOR IMPLEMENTING PLANS UNDER
THE ADMINISTRATIVE PURVIEW OF
THE DEPARTMENT OF PUBLIC HEALTH AND
ENVIRONMENTAL SERVICES, DIVISION OF
ENVIRONMENTAL QUALITY

Plan (Short Title and Reference)	Financial Requirements	Legal Requirements
1) Groundwater Management Task Force (S) VII.B.2	None required	None required
2) Soil Erosion and Sedimentation Control Technical Manual (S) XIX.B	$15,000 for consultant services	Executive Branch Operating Budget Appropriation

TABLE XXII - 6
FINANCIAL AND LEGAL REQUIREMENTS
FOR IMPLEMENTING PLANS UNDER THE
ADMINISTRATIVE PURVIEW OF
PARKS AND RECREATION

Plan (Short Title and Reference	Financial Requirements	Legal Requirements
1) Water Safety Information Program (S) IX.C	$6,000 for producing materials	Executive Branch Operating Budget Appropriation
2) Recreation Use Zones for Saipan Lagoon (S) IX.B	$8,750 for printing public education materials and erecting signs	Executive Branch Operating Budget Appropriation
3) Saipan Outdoor Recreation Plan (S) IX.B	$50,000 for consultant services	Executive Branch Operating Budget Appropriation

CHAPTER XXIII - IMPACT ASSESSMENT OF SAIPAN LAGOON USE MANAGEMENT PLAN

The recommendations of every proposed plan should be evaluated in order to assess the positive and negative impacts that can be anticipated. Obviously, the positive impacts must be found to outweigh the negative, or else the plan fails to advance the likelihood of resolving those conflicts and problems that it was to address.

The inherent methodology for formulating this SAIPAN LAGOON USE MANAGEMENT PLAN was designed to assure that it would produce predominatly positive impacts. By convening SALAPAT representatives of the public agencies and private organizations who have resource protection and economic development responsibilities for the PLAN area, the thrust of this master planning was directed towards identifying problems and recommending improvement plans which promote positive changes for all concerned.

While it is impossible to predict, in detail, all of the impacts that may occur from this PLAN, the general ramifications can be isolated. On the negative side, there are basically two: slightly increased costs of public and private development as a result of mandatory compliance to certain new design, pre-construction and construction regulations which protect the Lagoon environment; and reasonable, but nonetheless unprecedented, restrictions on some uses of private properties.

More specifically, increased development costs are to be expected when plans for development along the coastline are challenged by regulations which set limits on construction activities and require additional steps of review and approval before permits are issued. Such procedures are generally decried as "red tape" which accomplish nothing but more headaches and unnecessary costs for developers. While the regulations, etc. proposed by this PLAN are deemed reasonable and requisite to protecting that which makes the Saipan Lagoon one of the Commonwealth's most treasured resources, the Government must always be on the watch for signs which may indicate that its protectiveness is too restrictive and, consequently, self-defeating in the end.

The loss of some private property rights as a result of land-use zoning is an inevitable result of increased development pressures of an urbanizing community. This impact is unusually harsh to those traditional and community property rights which have existed for generations on Saipan. In the final analysis, however, when a government is expected to provide for the health and safety of its residents, some means of organizing the various land uses

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 14103 5859

becomes necessary in order to achieve a reasonable scale of economy and efficiency.

Because this PLAN proposes strict controls over development within the Lagoon and along its shoreline in addition to supporting the zoning and land use districting legislation now under consideration by the Government, it is reasonable to anticipate that both increased development costs as well as some restriction of traditional property rights will result.

On the positive side of anticipated impacts, this PLAN will create three primary benefits. First, the PLAN serves to enhance tourism as the Commonwealth's keystone to economic progress. By providing for tourist-oriented recreation opportunities within the lagoon waters and along the beach, tourist satisfaction is fostered. By providing for additional hotel development opportunities and supporting infrastructure plans, positive growth for the tourism industry is accommodated for the future.

Second, the Lagoon's natural resources are given additional protection for enjoyment by future generations. The proposed programs, regulations and laws for protecting marine water quality, beach sand, and critical habitats for rare, threatened and endangered species, collectively insure these resources against the inevitable onslaught of development pressures. Because it is not too late to preserve much of the Lagoon's pristine quality, today's children will be able to pass along this environmental legacy to their progeny.

Third, more public recreation opportunities are provided for Saipan residents. Parks, playgrounds and water recreation sports are enjoyed by the whole of Saipan's population; and the PLAN's recommendations would multiply the existing resources by severalfold. The Lagoon is meant for the people of Saipan: beach parks, fishing, swimming and boating are indigenous activities and amply provided for by this PLAN.