Commonwealth of the Northern Mariana Islands
Water Quality Assessment
305(b) Report

View of Managaha Island, Saipan

Division of Environmental Quality
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I. Abstract

The health and economic wellbeing of the people of the CNMI depend upon good water quality. Tourism is a major driving force behind the CNMI economy. Tourists come to see beautiful sandy beaches, clear blue water, and outstanding coral reefs and other marine environments. The CNMI has over 250 species of coral (Randall, 1995) over 850 species of fish (Myers, 2000), and many other marine invertebrates that make our corals reefs a highly sought after tourist destination. Healthy marine environments require clean water that remains within a narrow range of various water quality parameters. Local residents rely on clean water to support fish stocks and provide recreation. In terms of groundwater, CNMI residents rely on clean, healthy drinking water for domestic use. Under the current development pressure, we are challenged to maintain and improve our water resources.

Both point and non-point source pollution are responsible for lowering the quality of the CNMI's surface and ground waters. Sewage out-falls, sewer system overflows, sedimentation from unpaved roads and development, urban runoff, reverse osmosis discharges, and other nutrient sources are the most significant stressors on the CNMI's surface and marine water quality. The largest ground water problems in the CNMI are high chlorides resulting from over-pumping of this basal aquifer in an effort to keep up with the increasing population demand, and nutrient and bacteria input from septic systems.

Thirty-nine beach locations are monitored weekly for traditional surface water quality parameters. Unsurprisingly, in 2000 and 2001, most microbiological violations occurred in areas with heavy stormwater run-off. Many of these sites are within the highly developed Garapan district (West Takpochau watershed). Other frequent violations occur within Saipan's marinas or in waters surrounding docks. These include; Tanapag Meeting Hall, Seaplane ramp; DPW channel Bridge, Smiling Cove Marina, Garapag Fishing Dock, and Sugar Dock. Almost all of the above noted sites have violated the water quality standard of more than 5 times for the year 2000 and 2001.

In conjunction with water quality concerns, the Division of Environmental Quality (DEQ) has recently initiated a Lagoon Monitoring Program (joint effort between CRM and DEQ). These results describe to the reader what is living in each section of the Saipan Lagoon, and the general health. A healthy lagoon environment should have low abundances of seasonal macro-algae, and large abundances of sand, coral, or seagrass. Inner lagoon habitats have the largest amount of seasonal macro-algae due to their proximity to land and associated nutrient rich runoff. Outer lagoon and back reef habitats have the highest water quality, and are the most diverse regions as a result. Monitoring of the lagoon is important to discover which regions are currently "disturbed", and what is the extent of disturbance.

Similar to the lagoon monitoring program DEQ has initiated a CNMI wide coral reef monitoring program (joint effort with DEQ, CRM, and DFW). For each island a coral reef summary map has been created (Figures 8, 15, and 22) to give the reader an overall understanding of all observed reefs. Our results show that CNMI's coral reefs range from very healthy to disturbed. Reef systems found in Lau Lau Bay (Saipan) and Talakhaya region (Rota) are classified as disturbed reefs mainly due to uncontrolled

upland runoff during storm events. In contrast, reef systems found outside Wing Beach (Saipan) and outside Long Beach (Tinian) are in good health. Data is available for all of the sites regarding "reef health". Reef health has been defined for the purpose of this report as 1) percentage of live coral living on the reef substrate, 2) percentage of turf and coralline algae living on the reef substrate, 3) abundance of grazing herbivorous fish, 4) abundance of grazing sea urchins, and 5) the number of coral and fish species living at any particular site (diversity).

There are several other DEQ programs which deal with water quality and permitting issues. The DEQ Wastewater and Erosion Control Branch administers permitting programs for earthmoving and erosion control, wastewater treatment, land disposal of other wastewater, and Clean Water Act Section 401 Water Quality Certifications. The DEQ Non-Point Source Pollution Branch deals with stormwater runoff concerns at the watershed level. The NPS Branch also administers EPA 319 grants to help teach the community about NPS pollution and all available best management practices. The Safe Drinking Water Branch regulates public drinking water systems, well drilling, and underground injection wells. The DEQ Air and Toxic Management Branch deals with hazardous sources of pollution which may affect CNMI's waters. Finally, the DEQ Above and Underground Fuel Storage and Pesticide Branch also deals with hazardous sources of pollution which may affect CNMI's waters.

It is the goal of this report to present our results not only to EPA, but to our local managers and leaders alike. This report was designed to reach all local government agencies, decision makers, business people, teachers, and others who need to understand the issues regarding water quality of the CNMI.

II. Background

A. Background of 305(b) and CNMI

Section 305(b) of the Federal Water Pollution Control Act (Clean Water Act) requires States and Territories to monitor the quality of their surface and ground waters and produce a report portraying the status of their water quality. This report is referred to as the 305(b) which will be used by the United States Environmental Protection Agency (USEPA), Congress, and the public, to evaluate (1) whether U.S. waters meet water quality standards, (2) the progress made in maintaining and restoring water quality, and (3) the extent of remaining problems. The Division of Environmental Quality under the Office of the Governor is responsible for preparing the Commonwealth of the Northern Mariana Islands (CNMI) 305(b) report.

B. Background of CNMI and its Waters

The Commonwealth of the Northern Mariana Islands (CNMI) is an archipelago of fourteen (14) islands in the Western Pacific Ocean (Figure 1). Almost the entire population of the Commonwealth lives on the southern three islands: Saipan, Tinian, and Rota, except for a few families who choose to inhabit the northernmost and still active volcanic islands. Table 1 provides a numerical background of CNMI, its waters, and its population.

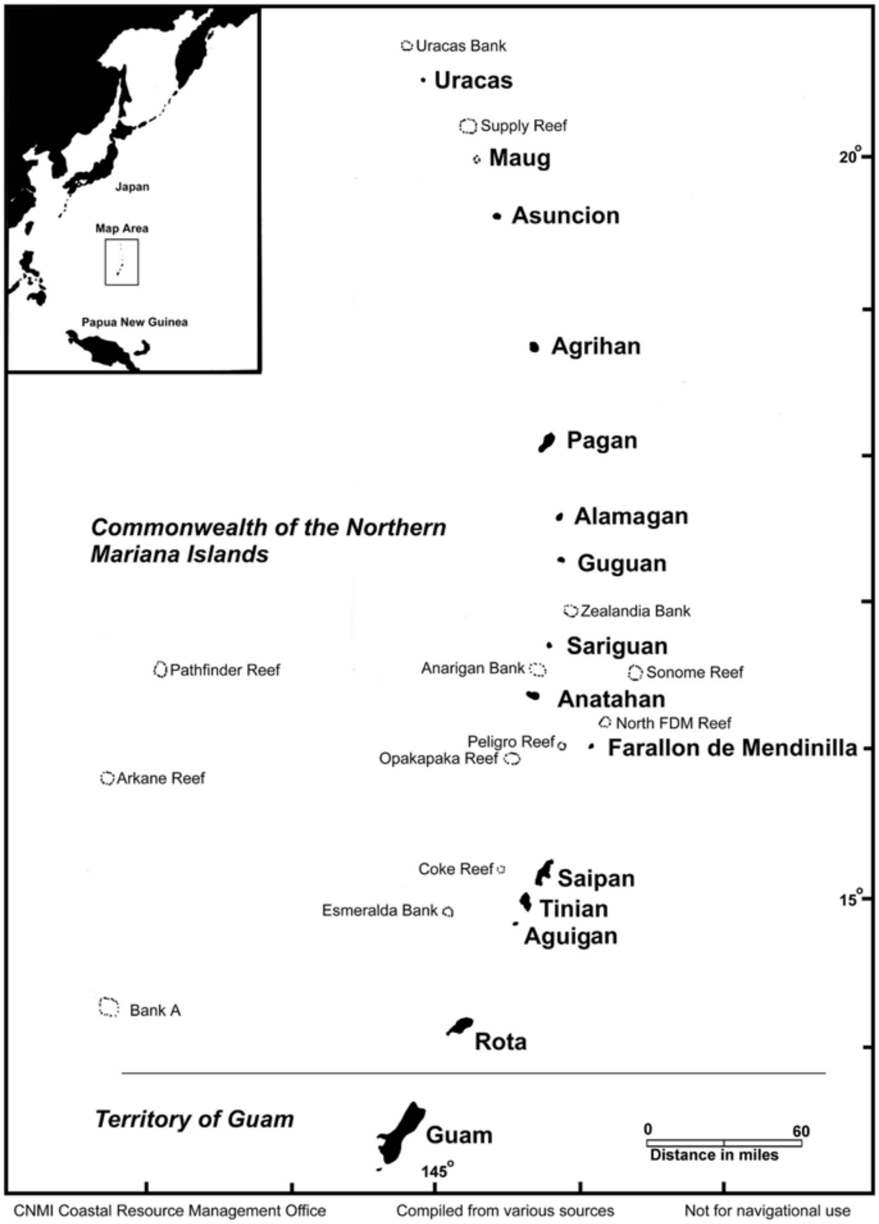
The three southern most islands are primarily limestone (uplifted coral reefs) with minor deposits of exposed volcanic rock. The remaining islands are primarily volcanic in nature with very little, if any, exposed limestone. Saipan is the largest and by far the most inhabited of the islands. The focus of this report is on Saipan, with less discussion and data provided for the other islands. Future monitoring and reporting efforts will work to include the other islands, however currently there are not enough resources within the CNMI to make more thorough assessments regarding other islands.

Resource	Value
Surface area of CNMI[1]	457.1 sq km
Surface area of Saipan[1]	120.4 sq km
Surface area of Tinian[1]	101.5 sq km
Surface area of Rota[1]	85.0 sq km
Population[1] (total)	71,912 (year 2000)
CNMI Residents	21,306 (in 1995)
Alien workers	37,540 (in 1995)
Tourists	497,601 (in 2001)
Length of perennial and intermittent streams on Saipan[2]	95.5 km
Area of freshwater and tidal wetlands on Saipan[2]	2,808 sq km
Area of Saipan lagoon[2]	30,750 sq km
Length of Saipan coastline[2]	83.81 km
Area of bays (Lau Lau Bay, Saipan) [2]	10,662 sq km
Area of Saipan marina (Smiling Cove) [2]	0.1 sq km
Area of CNMI EEZ[3]	414,398 sq km (approximate)

Table 1. Atlas of Commonwealth Resources.

[1] from the CNMI Department of Commerce Statistical Yearbook 1996 (based on 1995 census)
[2] from the CNMI Geographic Information System
[3] from the CNMI Department of Commerce

Figure 1. The Mariana Islands.



C. Surface Water Quality Background

The health and economic wellbeing of the people of the CNMI depend upon good water quality. Next to federal grants, tourism is the driving force behind the CNMI economy. In the case of the CNMI, as with all island nations, discussions about water quality must include information regarding the various marine habitats that are present. Marine habitats are resultant from the waters which make them. These habitats can shift due to changes in temperature, nutrients, salinity, pH, Dissolve Oxygen, and other water quality criteria. Water quality measurements alone are affected by rainfall or storm events, tidal fluctuations, and other atmospheric and oceanographic conditions. This dynamic nature makes all water quality data very difficult to properly assess a region, project, or pollutant source. It is much more efficient for island nations to use marine habitat data coupled with water quality measurements to help assess the quality of the water.

Tourists come to see beautiful sandy beaches, clear blue water, and outstanding coral reefs and other marine environments. The CNMI has over 250 species of coral (Randall, 1995) over 850 species of fish (Myers, 2000), and many other marine invertebrates that make our corals reefs a highly sought after tourist destination. Healthy marine environments require clean water that remains within a narrow range of various water quality parameters. Local residents rely on good water quality to support fish stocks and provide recreation. Under the current development and fishing pressure, we are challenged to maintain and improve the quality of our water resources. The CNMI will need to increase monitoring and management activities to include all aquatic ecosystems in order assess regions and make recommendations for our decision makers to follow.

The CNMI has two classes (AA and A) for marine water use and two classes (1 and 2) for fresh surface water use. All fresh surface water bodies in the CNMI (wetlands, intermittent streams, and perennial streams) are Class 1 (Figure 2 and 3), meaning that these waters should remain in their natural state with an absolute minimum of pollution from any human-caused source. On Saipan Island there are approximately three perennial streams, one lake, and several isolated wetland regions. On Rota there are several streams, no lakes, and no wetlands. On Tinian there are several wetlands, no lakes, and no streams. Some of these resources are used for drinking water and recreation. The majority of these water bodies are not tested by the DEQ Lab on a regular basis.

The majority of the coastal marine waters are Class AA (Figure 4), meaning that these waters should remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-related source or actions. The uses protected in these waters are the support and propagation of marine life, conservation of coral reefs and wilderness areas, oceanographic research, and aesthetic enjoyment and compatible recreation inclusive of whole body contact (e.g. swimming and snorkeling) and related activities. Table 2 lists Class A waters in the CNMI and Figure 4 shows the sizes and locations of Saipan Class waters. Class A waters are protected for their recreational use and aesthetic enjoyment; other uses are allowed as long as they are compatible with the protection and propagation of fish, shellfish, and wildlife, and recreation in and on these waters of a limited body contact nature.

Both point and non-point source pollution are responsible for lowering the quality of the CNMI's surface waters. Sewage out-falls, sewer collection overflows, sedimentation from unpaved roads and development, urban runoff, reverse osmosis discharges, and nutrients from golf courses and agriculture are the most significant stressors on the CNMI's surface and marine water quality. Decreased water quality threatens all marine environments as well, as coral reefs and other marine systems rely on good water quality for life.

Water Body	Reason for Class A designation
Puerto Rico Industrial, Saipan	Commercial port and municipal waste outfall
Agingan Point, Saipan	Municipal waste outfall
East Harbor, Rota	Commercial port
West Harbor, Rota	Commercial port
San Jose Harbor, Tinian	Commercial port

Table2. Class A Waters, CNMI.

Figure 2. Class 1 Waters
Saipan, CNMI

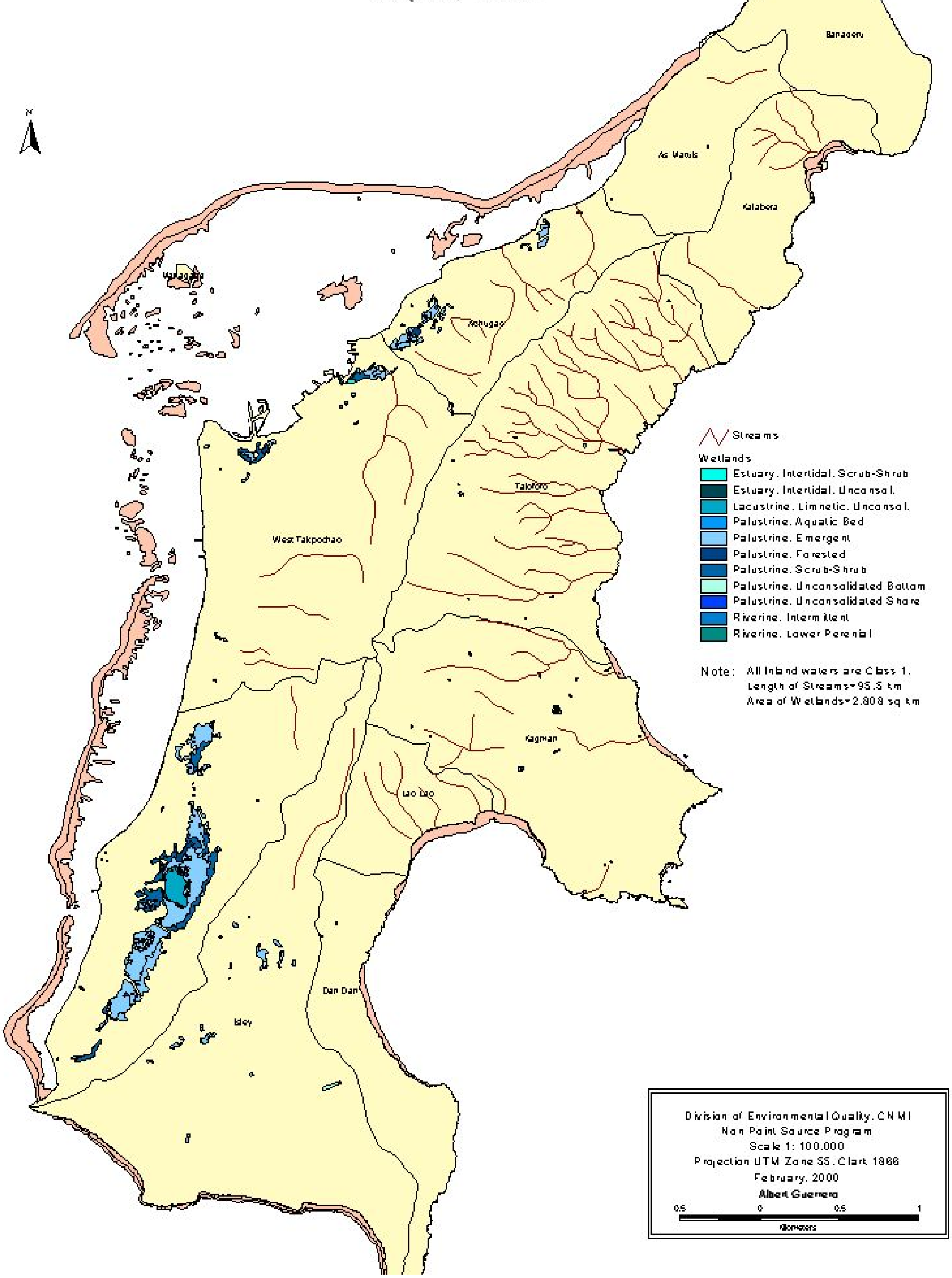


Figure 3. Class 1 Waters of Rota, CNMI

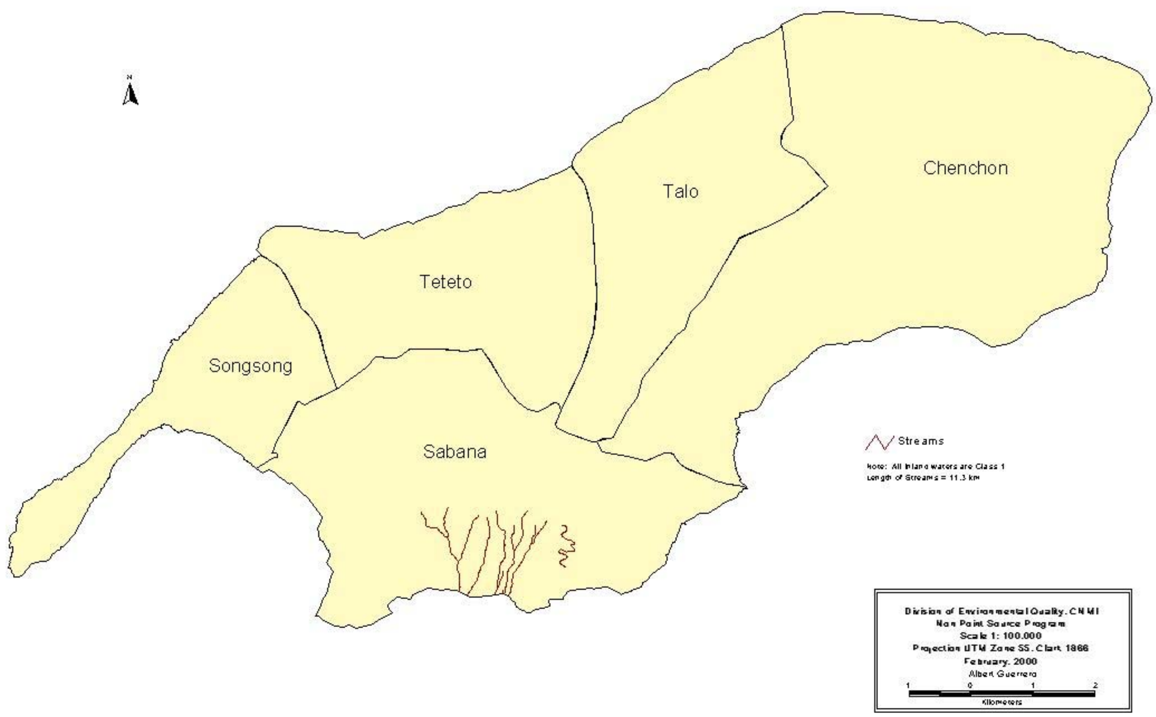
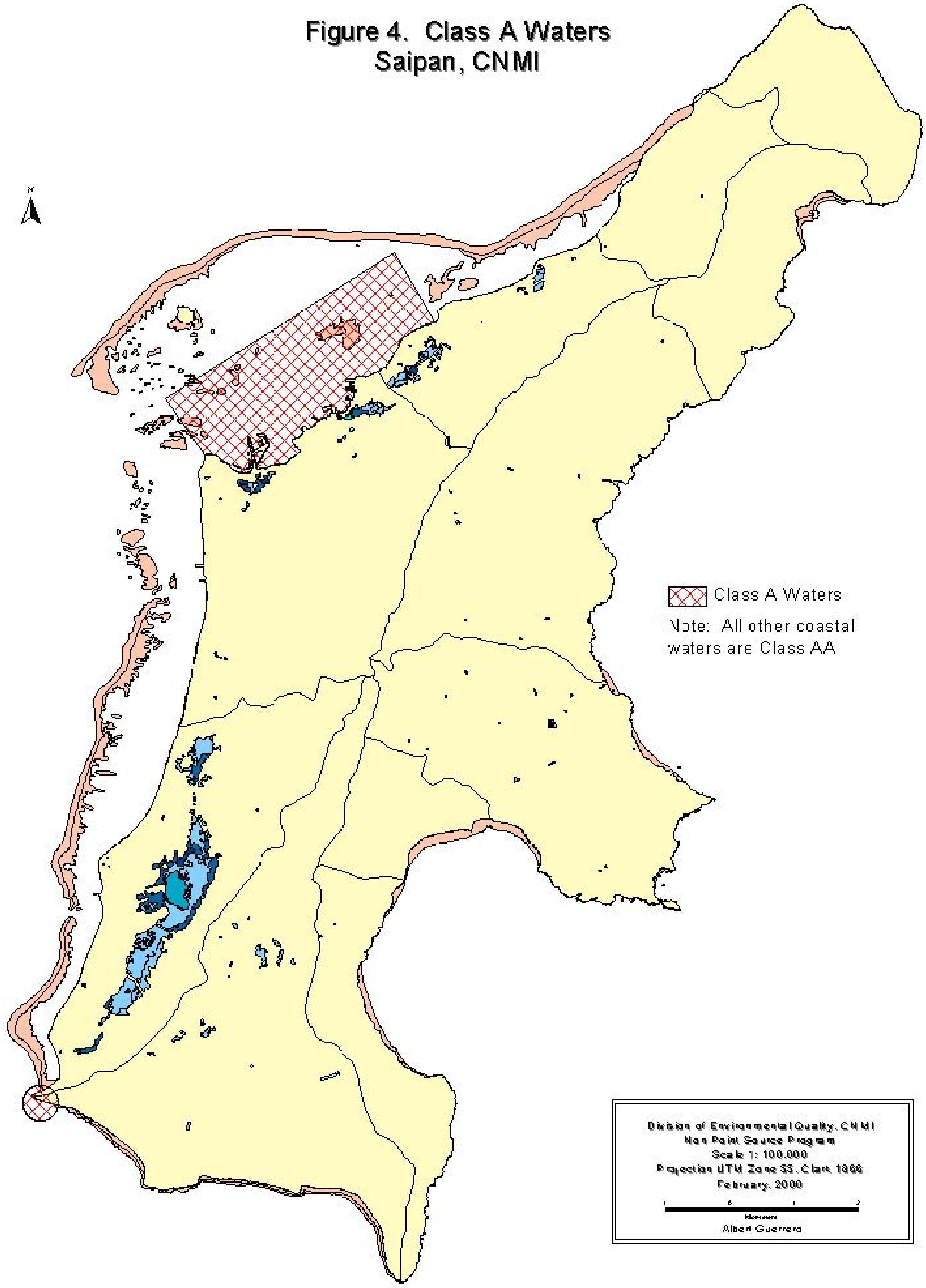


Figure 4. Class A Waters
Saipan, CNMI



D. Groundwater Background

The islands of the Northern Marianas formed as the result of arc volcanism west of the Pacific and Philippine plate junction. The geology of the southern islands suggests they were once submerged below sea-level, allowing a layer of coral reef to form over the volcanic rock. As a result of the most recent ice age when sea levels dropped (Neogene until present (Randall, 1995)) the exposed surfaces of the southern islands of Saipan, Tinian, Rota, Aguijan, and Farallon de Medinella are predominantly limestone (Randall, 1995). In contrast, the northern most islands of Anatahan, Sarigan, Guguan, Alamagan, Pagan, Agrihan, Asuncion, Maug, and Farallon de Pajaros are much younger and still have mainly or completely volcanic emergent surfaces. The geological nature of the southern islands influences the groundwater characteristics, where two types of aquifers are dominant. In isolated areas, the geology has created a situation where high-level limestone fresh water aquifers overlie an impermeable volcanic layer, which creates a good and relatively protected supply of drinking water. However, the majority of the fresh water is found in the basal aquifer with a fresh water lens sitting on top of sea water, separated as a result of differences in density of the fluids.

The location and distribution of the fresh water aquifers are of extreme importance in the CNMI because the vast majority of drinking water comes from aquifers. The largest ground water problem in the CNMI is high chlorides resulting from over-pumping of this basal aquifer in an effort to keep up with the increasing population demand. Over-pumping of groundwater can result in saltwater intrusion of the basal aquifer. The thickness of the freshwater lens on top of the saltwater is related to several factors, including extent of recharge areas, geology, and proximity to the coastline. Saltwater intrusion is reversible and does not cause permanent damage to the surrounding aquifer. The CNMI needs to focus on alternative sources of drinking water to relieve these issues. The chloride problem only exists on the island of Saipan, due to the large population, but new development initiated on Tinian and Rota may affect the basal aquifers there if future well drilling is not monitored or managed properly.

To protect the basal aquifer from saltwater intrusion, this would require limiting the drilling of new water wells, particularly in areas of thin water lenses. Therefore, new well explorations should be considered in areas where the thickness of the freshwater lens is identifiable and adequate. Other means of protecting the basal aquifer from saltwater intrusion are to control and limit the pumping rate of existing wells, and closely monitor the sample results of existing well for chlorides, conductivity and total dissolved solids.

On Saipan, there are several users of ground water. The CNMI is heavily dependent on tourism and garment factories for the local economy. Due to the high level of chlorides in the public water system, major hotels and factories along the coast drill seawater wells and use reverse osmosis treatment for their private water supply. It has been proposed that large-scale desalination of seawater should be explored, and the government is exploring the costs associated with this.

The problem of saltwater intrusion of aquifers is limited to the island of Saipan.

Saipan with a population of 71,912 (2000) has had a tremendous stress on the aquifers and ground water supply. The majority of the population resides on the western side of the island. The villages of Garapan, Chalan Laulao, Susupe, Chalan Kanoa, and San Antonio are estimated to have concentrated sixty percent of the total island's population within twenty percent of the available landmass on Saipan. The majority of the municipal water supply wells are located in the southern part of the island. These municipal wells operated by the Commonwealth Utilities Corporation (CUC) are pumping from the basal aquifer.

There is a smaller concentration of municipal wells located at higher elevations in the central part of the island, and a few springs, that serve the other forty percent of the population of Saipan.

At the present time the island of Rota, with a population of about 3,000, receives its municipal water from two springs (Water Cave and Onan Cave) and three newly drilled wells. Due to slightly different geologic formation the Rota municipal water is more palatable than that of Saipan's. These wells are drawing water from the high level aquifers and are not susceptible to salt water intrusion. However, the springs on Rota are suspected to be ground water under direct influence of surface water (GUDI). Presently, DEQ is initiating monitoring of turbidity changes in accordance with the seasonal changes in order to determine if further filtration should be required.

Tinian on the other hand, with a population of about 3,200, gets its municipal water from two Maui type wells also suspected of GUDI and three deep wells. Both Tinian and Rota have not had water demands that lead to over-pumping of the aquifers.

E. Wetland Background

Wetlands can be found on the islands of Saipan, Tinian, Rota, and Pagan, however they cover less than 2% of the CNMI at the present time (based on current CNMI GIS layers) (Figure 2). The wetlands provide habitat for unique and endangered plants and animals present in CNMI. Wetlands also serve other functional purposes such as storm runoff water storage and pollutant uptake. For a more detailed look at CNMI's wetlands and their functional roles one can refer to CNMI's "National Wetland Inventory" document (Prepared by US Fish and Wildlife, 1989, CRM Office). This document states there are approximately 600 acres of wetlands in CNMI. The "Commonwealth of the Northern Mariana Islands Wetlands Conservation Plan" states that only 36% of the original wetland acreage still exists (CRM Office). Further, this document states that losses are as follows; Garapan - 200 acres, San Roque - 50 acres, Flores Pond - 130 acres, Lake Susupe area - 200 acres, and Kagman and Lower Base - 600 acres. Saipan was heavily farmed during Japanese times (pre-World War II), which resulted in filling of wetland areas to make them suitable for farming. Increasing development continues to threaten wetlands on all of the islands.

F. Background on DEQ Programs to Correct Impairments

The CNMI Division of Environmental Quality has implemented several programs that address and regulate development and associated pollutants. All programs are mentioned below. Further information regarding present status and findings for each program are located in sections III and IV of this report.

There are two programs that **collect data** regarding CNMI's water quality status. The DEQ Lab has monitoring programs for Class 1, 2, A, AA waters. The DEQ Marine Biologist in cooperation with the CNMI Marine Monitoring Team (MMT) carries out two monitoring programs; The Saipan Lagoon Monitoring Program and the Nearshore Coral Reef Monitoring Program.

There are several other DEQ programs which deal with water quality and permitting issues. The DEQ Wastewater and Erosion Control Branch administers permitting programs for earthmoving and erosion control, wastewater treatment, land disposal of other wastewater, and Clean Water Act Section 401 Water Quality Certifications. The DEQ Non-Point Source Pollution Branch deals with stormwater runoff concerns at the watershed level. The NPS Branch also administers EPA 319 grants to help teach the community about NPS pollution and all available best management practices. The Safe Drinking Water Branch regulates public drinking water systems, well drilling, and underground injection wells. The DEQ Air and Toxic Management Branch deals with hazardous sources of pollution which may affect CNMI's waters. Finally, the DEQ Above and Underground Fuel Storage and Pesticide Branch also deals with hazardous sources of pollution which may affect CNMI's waters.

III. Surface Water Assessment

A. Water Quality and Other Data Collection Programs

1. Laboratory Program

a. QA/QC Description

The Division of Environmental Quality Surveillance Laboratory was established by the Commonwealth of the Northern Mariana Islands to provide monitoring data required under the Safe Drinking Water Act (P.L. 93-523) and other environmental programs. The data generated by the laboratory are used to evaluate the quality of drinking water and recreational waters in the Commonwealth. Therefore, a quality assurance plan is essential in the generation of these data and is an important part of the day-to-day activities of the laboratory. The DEQ Environmental Surveillance Laboratory Quality Assurance Manual includes Standard Operating Procedures (SOPs) for sampling, testing, reporting, and providing quality assurance for traditional water quality parameters.

The laboratory quality assurance plan has two primary functions: 1) It assures that proper quality control practices are implemented in day-to-day laboratory task, and 2) It assures that the reported data are valid, and are of a known precision and accuracy.

The elements of a basic quality control program are well defined by federal statute. Although the success of the program depends upon the training, professional pride and awareness of each individual technician, final responsibility for the reliability of reported analytical results rest with the Environmental Surveillance Laboratory Supervisor.

b. Data Management and Accuracy

The Environmental Surveillance Laboratory is responsible for measuring the quality of water that is used by the public for drinking, recreational and/or other purposes. It is the objective of DEQ's Environmental Surveillance Laboratory to assure that the data reported are valid, and of known precision and accuracy.

Staff in the Laboratory section are trained to input marine water quality data into an Excel-based spreadsheet. The section head or another peer technician then reviews the entries for any mistakes and corrects it before the laboratory supervisor reports it out. The database is updated monthly and verified before creating back-up copies of the data.

c. Sample Locations

On a weekly basis, DEQ monitors 39 fixed stations along Saipan's most used West coast beaches for microbiological and chemical parameters (Table 3 and Figure 5). Six beaches on the Northeast coast and six beaches on the Southeast coast are monitored only on a quarterly basis because the quality of the water is consistently good and a smaller population uses these less developed areas. Eleven sites around Managaha Island are also monitored on a monthly basis. Though the population recreating on this island is increasing, water quality is consistently good.

Each month, Tinian and Rota monitor eleven and twelve beach areas respectively (Table 4). These sites are frequently used by the community so they are now being monitored for microbiological and chemical parameters on a monthly basis.

Table 3. Saipan microbiological and chemical monitoring sites (n = 59).

Name	**Site ID#**	**Test Freq.**
Wing Beach	01	W
PauPau Beach	02	W
Nikko Hotel	03	W
San Roque School	04	W
Plumeria Hotel	05	W
Aqua Resort Hotel	06	W
Tanapag Meeting Hall	07	W
Central Repair Shop	08	W
Sea Plane Ramp	09	W
DPW Channel Bridge	10	W
N.Puerto Rico Dump	11.1	W
S. Puerto Rico Dump	11.2	W
Smiling Cove Marina	12	W
American Memorial Park Drainage	12.1	W
Outer Cove Marina	13	W
Micro Beach	14	W
Hyatt Hotel	15	W
Dai-Ichi Hotel	16	W
Garapan Drainage #1	17	W
Samoan Housing	18	W
Hafa-Adai Hotel	19	W
Garapan Drainage #2	20	W
Garapan Fishing Dock	21	W
Garapan Beach	22	W
Garapan Drainage #3	23	W
Chalan LauLau Beach	24	W
San Jose Beach	25	W
Civic Center Beach	26	W
Diamond Hotel	27	W
Grand Hotel	28	W
Community School	29	W
Sugar Dock	30	W
CK Dist #2 Drainage	31	W
CK Dist #4 Lally Beach	32	W
Chalan Piao Beach	33	W
Hopwood School	34	W
San Antonio Beach	35	W
PIC Beach	36	W
San Antonio Lift Station	37	W
Grotto Cave	01	Q
Bird Island Beach	02	Q
Jeffrey's Beach	03	Q
Old Man By the Sea	04	Q
Marine Beach	05	Q
Tank Beach	06	Q
Forbidden Island	09	Q
North Laulau Beach	10	Q
South Laulau Beach	11	Q
Obyan Beach	12	Q
Ladder Beach	13	Q
Unai Dangkulo Beach	14	Q
Managaha Beaches	01-11	M

Figure 5. Monitoring Locations
Saipan, CNMI

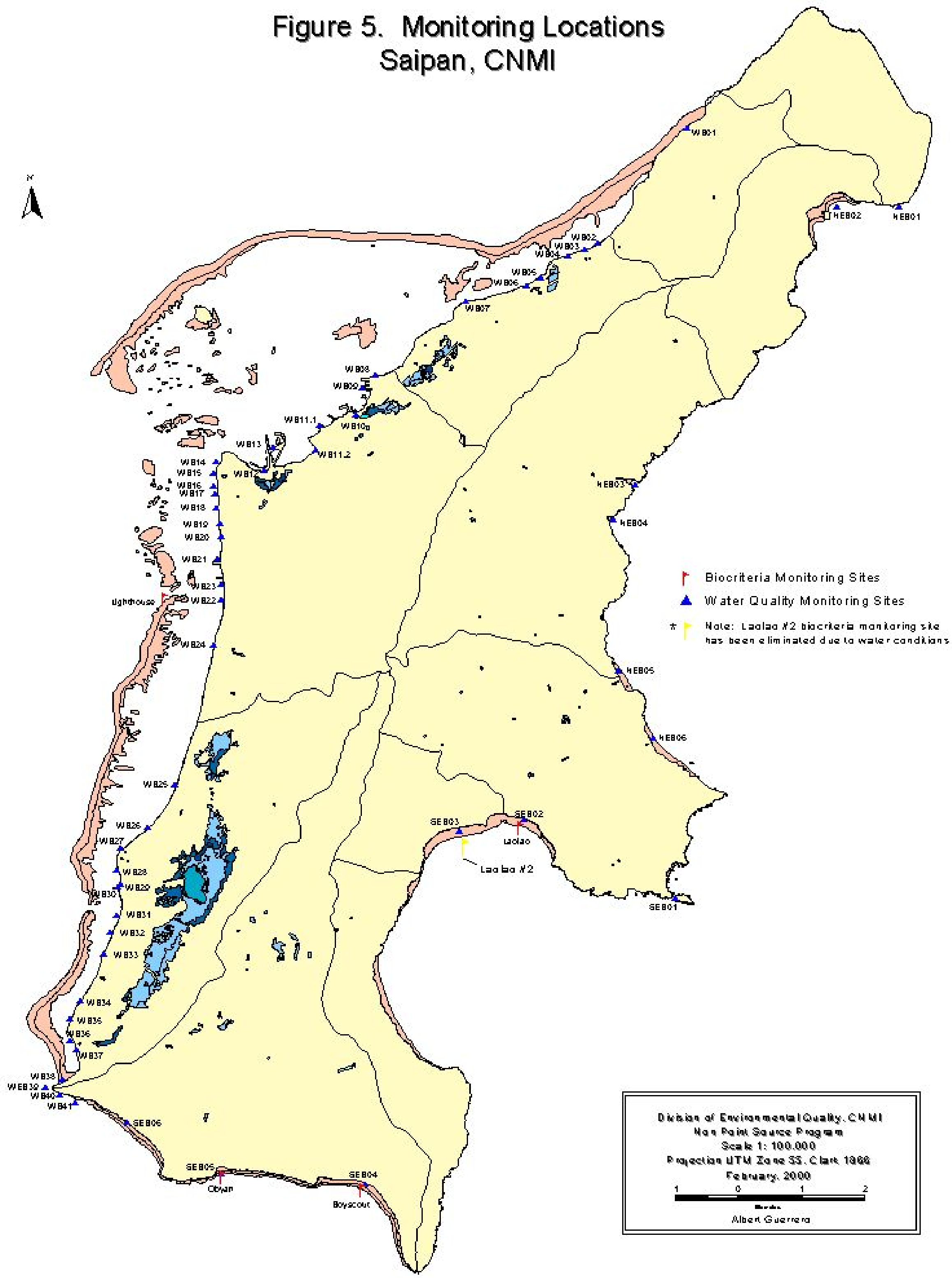


Table 4. Tinian and Rota microbiological and chemical monitoring sites.

Name	Site ID#	Test Freq.
Tinian		
Unai Masalok Beach	01	M
Unai Dangkolo Beach	02	M
Unai Babui	03	M
Unai Chulu	04	M
Leprosarium Beach I	05	M
Leprosarium Beach II	06	M
Tachogna Beach	07	M
Taga Beach	08	M
Harbor	09	M
Kammer Beach	10	M
Rota		
Coral Garden Beach	01	M
Kokomo Beach Club	02	M
Mobile Station Storm Drainage	03	M
East Harbor Dock	04	M
Tweksberry Beach	05	M
West Harbor Marina	06	M
District #2 Storm Drainage	07	M
District #1 Strom Drainage	08	M
Veterans Memorial Beach	09	M
Teteto Beach	10	M
Guata Beach	11	M
Swimming Hole	12	M

d. Parameters and Frequency of Sampling

The microbiological and chemical parameters that the Division of Environmental Surveillance Laboratory currently monitors includes: Salinity (‰), Dissolved Oxygen (% D.O.), Temperature (°C), pH, Turbidity (NTU), and Enterococci bacteria (cfu/100ml). These parameters are monitored on a weekly basis for Saipan West Beaches, bi-weekly for Susupe Lake, monthly for Tinian, Rota and Managaha Beaches. Saipan East Beaches are monitored on a quarterly basis.

e. Results and Water Quality Standards

As required under the Clean Water Act, the CNMI Water Quality Standards were last revised in 1997, and are due to be updated again.

The development of the CNMI Water Quality Standards were largely based upon the review of existing water quality standards for other Tropical islands (Table 5). Due to the potential impact and delicate aspects of the coral reef ecosystems and the lack of existing data, stringent nutrient standards were adopted for the CNMI. DEQ recently initiated the collection of nutrient level data as the environmental laboratory has just developed the ability to monitor nutrient levels. There is a concern whether or not the current readings of nutrients are reflective of natural or anthropogenic sources. To make such a determination might require monitoring nutrient levels in marine waters surrounding uninhabited islands of the CNMI over a sufficient period of time to establish natural ambient conditions in this area.

<u>Class A Waters, Puerto Rico Industrial Area</u>:

The Puerto Rico Industrial area waters are designated Class A because they surround the commercial port and the Sadog Tasi sewage treatment plant outfall. These Class A waters encompass 7.5 square kilometers of coastal waters from Puntan Muchot to Saddok As Agatan except for waters up to 2,000 feet in all directions from the mean high water mark on the shore of Managaha Island. The commercial port harbors container vessels, tankers, occasional cruise vessels, and the larger local tourist vessels. The sewage receives secondary treatment and is then discharged into the lagoon where the currents take it offshore to deeper waters. Other nearshore and in-water uses and activities include: the Puerto Rico dump, Smiling Cove marina, the CNMI’s only National Park, a popular swimming beach, and the only two mangrove stands remaining in the CNMI. Although this is primarily an industrial area, recreational boats and ships constantly ply these waters and certain beach areas are still popular for fishing and swimming. The Division of Environmental Surveillance laboratory tests the water quality of eight shoreline areas within the Class A-Puerto Rico Industrial area on a weekly basis. DPW Channel Bridge did not meet the microbiological Enterococci criteria of less than 125 CFU/100ml, as set forth in the CNMI Water Quality Standards, more than 19 times for the year 2000 and 17 times for the year 2001 (Table 6).

Table 5. CNMI Water quality standards.

PARAMETER	CLASS AA	CLASS A	CLASS 1	CLASS 2
Fecal Coliform (CFU/100 ml)	GM[1]< 200 < 400	GM[1]< 200 Never > 400	GM[1]< 200 Never > 400	GM[1]< 200 Never > 400
Enterococci (CFU/ 100 ml)	GM < 35	GM <125	GM < 33	GM < 90
PH	8.05 - 8.15	8.05-8.15	6.50-8.50	6.50 - 8.50
NO_3 - N (mg/L)	< 0.20	< 0.50		
Total Nitrogen (mg/L)	< 0.4	< 0.75	< 0.75	< 1.50
Orthophosphate PO_4 (mg/L)	< 0.025	< 0.05	< 0.10	< 0.10
Total Phos PO_4 (mg/L)	< 0.025	< 0.05	< 0.10	< 0.10
Ammonia (mg/L) (un-iodized)	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved O_2 (%)	> 75	> 75	> 75	> 75
Total Filterable Suspended Solids (mg/L)[2]	5	40	5	40
Salinity (‰)[2]	10	20‰ or above 250 mg/L	10	20‰ or above 250 mg/L
Total Dissolved Solids (mg/L)		500 mg/L		500 mg/L
Temperature (°C)[2]	1.0	1.0	1.0	1.0
Turbidity (NTU)[2]	0.5	1.0	0.5	1.0
Radioactive Materials	Discharge prohibited	Discharge prohibited	Discharge prohibited	Discharge prohibited
Oil & Petroleum	ND[3]	ND[3]	ND[3]	ND[3]

[1] GM - Geometric mean in not less than five samples over a 30 day period.
[2] Shall not exceed ambient by more than the stated value.
[3] ND - Non-detectable.

Table 6. Class A-Puerto Rico Industrial Microbiological Violations 2000-2001.

Lab I.D.	Site	# Violations by Quarter FY 2000 1Q	2Q	3Q	4Q	Total Violations
8	Central Repair Shop	0	0	0	0	0
9	Sea Plane Ramp	0	0	0	0	0
10	DPW Channel Bridge	0	9	7	3	**19
11.1	North Puerto Rico Dump	0	0	0	0	0
11.2	South Puerto Rico Dump	0	1	3	1	*5
12	Smiling Cove Marina	0	0	0	0	0
12.1	American Memorial Park Drainage	*	*	*	*	*
13	Outer Cove Marina	0	0	0	0	0

- 5 or more violations/year, **10 or more violations/year, ^Sewage treatment plant lift station to outfall

Lab I.D.	Site	# Violations by Quarter FY 2001 1Q	2Q	3Q	4Q	Total Violations
8	Central Repair Shop	3	1	1	2	*7
9	Sea Plane Ramp	1	0	2	0	3
10	DPW Channel Bridge	4	6	3	4	**17
11.1	North Puerto Rico Dump	0	0	1	0	1
11.2	South Puerto Rico Dump	4	0	1	0	*5
12	Smiling Cove Marina	1	0	2	1	4
12.1	American Memorial Park Drainage	0	0	0	2	2
13	Outer Cove Marina	1	0	1	0	2

- 5 or more violations/year, **10 or more violations/year, ^Sewage treatment plant lift station to outfall

Class AA Waters:

Thirty-nine sites are monitored weekly for traditional water quality parameters. Unsurprisingly, in 2000 and 2001, most microbiological violations occurred in areas with heavy stormwater run-off. Many of these sites are within the highly developed Garapan district (West Takpochau watershed), which encompasses sites 14 through 23 (Table 7). Other frequent violations occur within Saipan's marinas or in waters surrounding docks. These include; Tanapag Meeting Hall, Seaplane ramp; DPW channel Bridge, Smiling Cove Marina, Garapan Fishing Dock, and Sugar Dock (Table 7). Almost all of the sites have violated the water quality standard of more than 5 times for the year 2000 and 2001.

Rainy season, which runs from July through November, may also be associated with increased fecal coliform violations. This may be due to increased run-off from land, and overflowing sewers as a result of the current sewage infrastructure being unable to handle the increased water volume during storm events. Discussion regarding present data can be found in the Discussion Section (III, f).

Each of the following sites: San Roque School Beach, Tanapag Meeting Hall Beach, Dai-Ichi Hotel Beach, Garapan Drainage #1, Hafa-Adai Hotel Beach, Garapan Drainage #2, Garapan Fishing Dock, Garapan Beach, Sugar Dock, CK District #2 Drainage, and San Antonio Lift Station, did not meet the microbiological Enterococci criteria for Class AA waters (geometric mean of 35 CFU/100 mL within 5 consecutive samples) more than five times per year during 2000-2001.

Class 1 Waters:

Although no method has been developed to assess Class 1 waters, the Division of Environmental Quality Surveillance Laboratory on a bi-weekly basis collects samples for Enterococci, Turbidity, Salinity, Dissolved Oxygen, temperature, conductivity, chloride, hardness and nutrients. Nutrients were not measured in 2000 – 2001 due to a lack of laboratory supplies, but testing for Nitrate and Orthophosphate will resume next year.

Susupe Lake did not meet the microbiological fecal coliform criteria for Class 1 waters of less than 33 CFU/100 ml, as set forth in the CNMI Water Quality Standards of more than 5 times from June to December of 2001. Microbiological violations could have resulted from a nearby house close to our sampling site.

Table 7. ***Class AA-Saipan Lagoon Microbiological Violations FY 2000-2001.***

Site ID	Region	Site	Total E. coli Violation	
			2000	2001
1	1	Wing Beach	0	1
2	1	PauPau Beach	0	2
3	1	Nikko Hotel	0	2
4	1	San Roque School	2	10
5	1	Plumeria Hotel	0	3
6	1	Aqua Resort Hotel	0	3
7	1	Tanapag Meeting Hall	6	9
8	1	Central Repair Shop	0	7
9	1	Sea Plane Ramp	0	3
10	1	DPW Channel Bridge	19	17
11.1	1	N. Puerto Rico Dump	0	1
11.2	1	S. Puerto Rico Dump	5	5
12	1	Smiling Cove Marina	0	4
12.1	1	American Memorial Park Drainage	*	2
13	1	Outer Cove Marina	0	2
14	1	Micro Beach	0	2
15	1	Hyatt Hotel	0	2
16	1	Dai-Ichi Hotel	0	8
17	1	Drainage #1	10	17
18	1	Samoan Housing area	0	4
19	1	Hafa-Adai Hotel	0	7
20	1	Drainage #2	11	6
21	1	Garapan Fishing Dock	15	14
22	1	Garapan Beach	0	5
23	1	Drainage #3	1	4
24	1	Chalan Laulau Beach	2	3
25	1	San Jose Beach	1	2
26	1	Civic Center Beach	0	2
27	1	Diamond Hotel	0	1
28	1	Grand Hotel	0	0
29	1	Community School Beach	0	1
30	1	Sugar Dock	12	14
31	1	CK District #2 Drainage	0	5
32	1	CK District #4 Lally Beach	0	4
33	1	Chalan Piao Beach	0	2
34	1	Hopwood School Beach	1	2
35	1	San Antonio Beach	0	4
36	1	Pacific Islands Club (PIC)	0	3
37	1	San Antonio Lift Station	1	6
1	2	Grotto Cave	0	0
2	2	Bird Island Beach	0	1
3	2	Jeffrey's Beach	2	0
4	2	Old Man by the Sea	*	0
5	2	Marine Beach	0	1
6	2	Tank Beach	0	1
1	6	Forbidden Island	1	0
2	6	North Laulau Beach	1	0
3	6	South laulau Beach	0	0
4	6	Obyan	0	0
5	6	Ladder Beach	0	0
6	6	Unai Dangkulo Beach	0	2
		Total Violations =	**90**	**194**
		(% Violations from Total) =	**7%**	**12%**
		Total samples =	**1227**	**1609**

f. Discussion of Water Quality Monitoring Results

The goal of the DEQ Lab Surface Water Quality Monitoring Program is to assess various point and non-point sources of pollution. During the past two years (2000 – 2001) the monitoring program has expanded and now has capabilities for testing of bacterial contamination as well as nutrients levels. One major set-back to all water quality monitoring programs is the dynamic nature and rapid dilution of bacteria and nutrients. Currently, the DEQ Lab samples sites once weekly and all results are influenced by meteorological, oceanographic, and tidal conditions. Without having continuous data collection it is very difficult to assess watersheds for non-point source pollutants. It would take a large increase in resources to monitoring surface waters more than once weekly. Thus, water quality data must be accompanied with other information. Currently, collaborative efforts are being carried out between the DEQ Lab Water Quality Monitoring Program and the Marine Monitoring Program. For further discussion on this topic see "Marine Monitoring Section" of this report.

Non-point source pollution is a major concern for CNMI's surface and marine waters. In order for CNMI to plan infrastructure development projects, data are necessary for watershed assessments on a regional basis. Presented below are discussions regarding the relationship between bacteria levels and rainfall events. Nutrient data from this time period were not continuous and not able to be analyzed or discussed.

Discussion will be limited to nine (9) sites which results have shown five (5) or more violations for high bacteria counts (and beach closures). The goal of the present analysis was to understand what may be causing the various violations and beach closures. Specifically, there are two types of pollution that we are concerned with 1) point source and 2) non-point source pollution. Violations may be occurring as a result of sewer overflows, faulty septic systems, or other point sources. Violations may also be occurring as a result of runoff and non-point source pollution. (For further discussion regarding this see "Non-Point Source Pollution" section in this report.) The questions, or hypotheses, that are tested here are weather or not various regions show relationships between bacteria levels and rainfall. This will help to depict the source and nature of pollutants affecting CNMI's surface waters.

Rainfall data was supplied by USGS and was entered into the DEQ lab water quality results spreadsheet. Weekly rainfall levels were used to test for relationships with weekly bacteria count data. As stated above, nine (9) sample locations were tested based upon five (5) or more bacteria violations and beach closures. Regressions between rainfall and bacteria levels for all nine locations showed only two statistically significant relationships, Dai-Ichi Drainage and Hafa Adai Drainage (Table 8, Red Colors). Other locations showed relationships that were close to, but not significant (Table 8, Yellow Colors). The remaining sample locations showed no relationship between bacteria levels and rainfall events (Table 8, Green Colors). Further analysis of the Dai-Ichi Drainage results depicts how large storm events and associated bacteria violations may be resultant from non-point source pollution in the watershed (Figure 6). Further analysis of the San Roque drainage samples depicts how rainfall events are not associated with bacteria violations (Figure 7). In this case, there may be a periodic release of a pollutant source that is responsible for the bacteria violations noted.

Results from ongoing DEQ Lab Water Quality Monitoring Program are used to assess the health of each watershed. These data tell us what type of pollution, if any, may be present within each watershed. The follow up task is now to intensively survey all watersheds associated with bacteria violations and rainfall for point and non-point source pollution sources. Further details regarding this are presented under the "Non-Point Source Pollution" section of this report.

Site Name	Significant Relationship Between Bacteria Counts and Rainfall	P Value (Level of Significance)	
San Roque School Beach	No	0.55704	
Tanapag Meeting Hall Beach	No	0.57369	
DPW Channel Bridge Beach	No	0.12773	
Smiling Cove Marina	No	0.87737	
Outer Cove Marina	No	0.41227	
Dai-Ichi Drainage Beach	Yes	0.00003	***
Hafa-Adai Drainage Beach	Yes	0.00487	**
Garapan Fishing Dock Marina	No	0.97486	
Sugar Dock Marina	No	0.45614	

Table 8. Results from statistical regression analysis for nine (9) sample locations. Red colors indicate a strong relationship between bacteria violations and rainfall events, Yellow colors indicate small relationship between bacteria violations and rainfall events, Green colors indicate no relationship between bacteria violations and rainfall events.

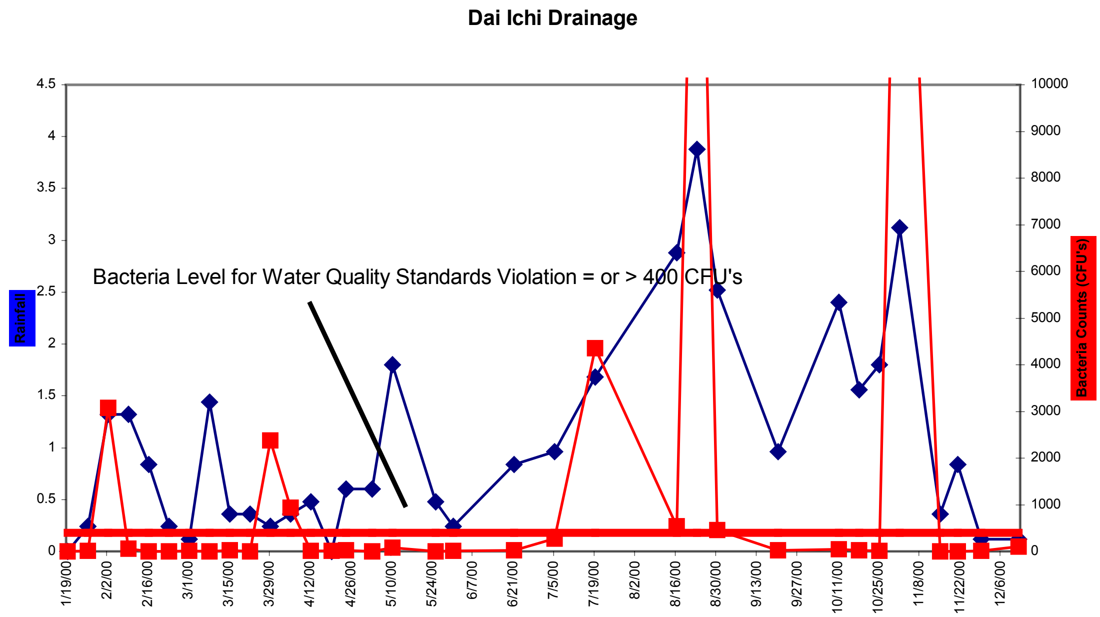


*Figure 6. Graphical representation of the association between rainfall and bacteria levels for Dai Ichi drainage sample location. In this case rainfall and bacteria levels **were** strongly related.*

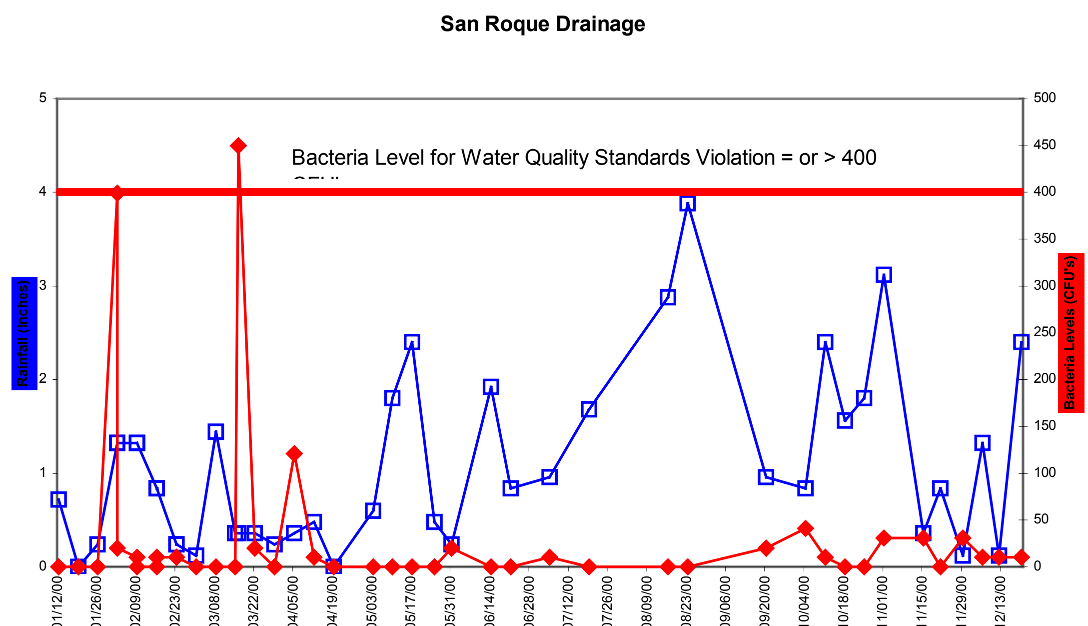


*Figure 7. Graphical representation of the association between rainfall and bacteria levels for San Roque drainage sample location. In this case rainfall and bacteria levels were **not** strongly related.*

2. Marine Monitoring Team Data Collection Programs

a. Introduction

The CNMI Marine Monitoring Team (MMT) consists of members from the Division of Environmental Quality (DEQ), Coastal Resources Management Office (CRMO), and the Division of Fish and Wildlife (DFW). The CNMI Inter-Agency Marine Monitoring Team (MMT) was initially established in 1997 to help CNMI understand the current conditions of their coral reefs and coral reef resources. Last year DEQ prepared the first State of the Reef Report for Saipan and Rota Island (Houk, 1999 and 2000, respectively). These reports documented baseline conditions in most cases and will be used for future assessments and regional management recommendations. It is the goal of the CNMI Marine Monitoring Team to carry out this long term monitoring program to continually assess our reefs as CNMI grows.

DEQ plays a major role in the MMT through its Marine Monitoring Program, Non-Point Source Pollution Program, and Laboratory Program. Since the previous 305b report DEQ and the MMT have initiated two large-scale bio-criteria monitoring programs. Both of these are very different from EPA funded bio-criteria monitoring programs in the U.S. mainland. Tropical marine systems are much more dynamic and harbor very different organisms. Bio-criteria programs set forth in the U.S. mainland fail to provide useful techniques for the CNMI. One monitoring effort is the Saipan Lagoon Monitoring Program (DEQ and CRM only), and the other is the CNMI Near shore Reef Monitoring Program (DEQ, CRM, and DFW). The goal of these programs is to gather continuous data from marine systems that are affected by water quality concerns (e.g. watershed drainages, sewage pump failures and outfalls, and other sources of point and non-point source pollution).

Many monitoring programs that deal with water quality data collection only are not sufficient to detect changes over time. The only way for water quality data alone to provide useful statistically significant data would be through the use of continuous recording instruments or for samples to be collected on a daily basis from all locations (very expensive and difficult). A much more efficient method is to gather data on the distribution and abundances of organisms that live within the waters. For all island nations with tropical marine waters these marine communities will shift in response to nutrient loads, sediment loads, temperature, turbidity, and other water quality parameters (Rogers, 1990, Telesnicki and Goldberg, 1995). CNMI can then use the available water quality data (discussed in Laboratory Program), collected once per week, and combine this with other benthic community data to get statistically valid results for understanding the extent of upland pollution. Once we have a set of baseline data from which we can make assessments, recommendations can be made for various regions regarding management and mitigation projects. Continuous monitoring will then be used to assess any mitigation measures, best management practices, etc., and ensure their effectiveness.

b. Methodology

Saipan Lagoon Monitoring Program:

Our goal is to document the present status of the Saipan Lagoon by quantitative and qualitative measures. All habitats found within the lagoon will be delineated and surveyed. Aerial photographs will also be used to produce a boundary map and quantify areas of each habitat.

Ground surveys will first identify each habitat that exists within the Saipan Lagoon. This will be completed by drawing a series of transect lines perpendicular to shore extending outwards to the barrier reef, passing through several different Saipan Lagoon Habitats. The exact number of these transect lines required to survey the Saipan Lagoon has not yet been identified. Each habitat transition along the transect lines will be marked with a hand held GPS (Global Positioning System) for creation of a GIS (Geographic Information System) habitat map. Within each visually identified habitat, qualitative and quantitative data are gathered. Numerical data regarding percentage of benthic coverage, numbers of invertebrates, and numbers of seagrass roots (where applicable) are collected. Qualitatively, checklists of all marine organisms found in each habitat are being created. Benthic coverage data is being analyzed using Cluster Analysis Similarity Testing to statistically test the habitat delineations. Aerial imagery will then be incorporated into our final habitat map to provide a much clearer picture of all marine systems encountered, and calculate habitat areas and boundaries. An interactive Arc View or Arc Explorer GIS database will be created once data collection is completed, and become available as a final CD-ROM in FY 03. Our information will also be available through our DEQ web site in FY 03. This will then serve as our baseline data for future comparison purposes, and to assess future management practices and projects put in place.

Near Shore Coral Reef Monitoring Program Methodology:

Site Selection and Set-up:

The goal of this data collection program is to monitor regions that are associated with potential water quality disturbances (runoff, sewage outfalls, urban development, etc.). Sites are selected based upon these criteria, and not randomly selected. If our Marine Monitoring Team (MMT) was large enough we would prefer to monitor one site from each coral reef habitat that exists in CNMI, however not enough resources are available. For each site three to five 50 m transect lines are laid parallel to the shoreline in an end-to-end manner. The beginning and end of all transect lines are permanently marked with a re-bar driven into the reef substrate. Once finished setting up each site, a GPS reading was collected from the beginning of the first transect and stored.

Benthic Cover:

Benthic cover was evaluated using the photo point quadrat method and video belt transect method (Randall and Birkeland, 1978, and Aronson et al., 1994). For each site video or photographs were collected for each of three to five 50-m transects. An underwater camera was used to take still photographs of .5-m quadrats placed at all even numbers along the transect line. An underwater digital video camera was used to record a .5m by 50m belt. All images were analyzed at the DEQ office by noting the life form under each of the random dots projected onto the image. Means, standard deviations, and standard errors were calculated based on the three to five 50-m replicates, with approximately n=300 individual points per 50-m replicate (n = 270 for photographs and n=320 for videos). The benthic categories chosen for analysis were corals (to generic level), turf algae (less than 2cm), macro-algae (greater than 2 cm, genus level if abundant), coralline algae, branching coralline algae, all other inverts (grouped together due to lack of abundances), and sand/bare substrate. In order to obtain useful statistically sound data no organisms are identified to the species level for benthic analysis due to the high diversity found within the CNMI.

Coral Communities:

Coral communities were further examined using the point-quarter method (Randall and Birkeland, 1978). A dive knife was haphazardly tossed 16 times along the three transects. For each toss the distance to the nearest living coral colony was noted for each of four quadrants, as well as the diameter and taxonomic name. This yielded data regarding population densities, species coverage, relative abundances, size distributions, and total coral coverage for any given site.

Fish Abundances:

Fish surveys were completed along each of the three to five 50-m transect lines. In each case, transect lines were set and all divers waited on the boat while a single observer swam along the transect lines recording data. Counts of all fishes were made within 5 meters of each side of the transect line. Fishes were identified to the family level and analyzed as such. In order to obtain useful statistically sound data no fish are identified to the genus or species level for abundance analysis due to the high diversity found within the CNMI.

Macro invertebrate Abundances:

Belt counts were made for all macro-invertebrates along three to five 50m transect lines for each site. All macro-invertebrates were counted within 2 meters of each side of the transect line. In each case the observer swam along the transect line and carefully observed all living macro-invertebrates present. The macro-invertebrates were identified to the generic level, which proved useful for statistical analysis.

Biodiversity Data:

At each site a list of all fishes and scleractinian corals observed was created. Coral nomenclature is based upon Randall (1995), and fish nomenclature is based upon Myers (1999).

c. Results

Near Shore Coral Reef Monitoring Program Results:

Results are presented below for FY 2001 monitoring efforts. Our goal is to present data here in a understandable format for environmental managers, teachers, governmental leaders, and other interested member of the public. A scientific report has already been created that documents the quality of all surveyed reefs in greater detail (Houk 1999 and Houk 2000), and this will be updated in FY 2003. Keeping this in mind, the results below are presented in a summary format. Only three islands in the CNMI have been surveyed thus far by the Near shore Coral Reef Monitoring Program, Saipan, Tinian, and Rota. For each island a coral reef summary map was created (Figures 8, 15, and 22) to give the reader an overall understanding of all observed reefs. Additionally, there are site location maps for each island which are color coded to coordinate with the data presentation (Figure 9, 16, and 23). All data that has been collected has been graphically presented below the site location maps (Figures 10 – 14, 17 – 21, and 24 - 27).

Our results show that CNMI's coral reefs range from very healthy to disturbed (Figures 8, 15, and 22). Data is available for many of the sites regarding "reef health" (Figures 10 – 14, 17 – 21, and 24 - 27). Reef health has been defined for the purpose of this report as 1) percentage of live coral living on the reef substrate, 2) percentage of turf and coralline algae living on the reef substrate, 3) abundance of grazing herbivorous fish, 4) abundance of grazing sea urchins, and 5) the number of coral and fish species living at any particular site (diversity). Water quality measurements would be very useful for understanding reef health, however due to the large amount of labor and cost involved only few sets of data are available for each site. It is important to understand all of the reef health characteristics when assessing a particular site.

Example 1:

Storm water runoff associated with non-point source pollution draining into the ocean will provide excess nutrients to the coral reef system. As a result, the organism that can use this available energy the fastest will dominate. In marine systems turf and macro-algae can uptake nutrients quicker than corals or coralline algae. The result of continuous polluted storm water runoff will be an increase in turf or filamentous algae cover. This in turn effects juvenile coral larvae that want to settle and grow on our reefs, but do not like to grow on turf or filamentous algae. Corals, in turn, provide habitat and refuge for many species of fish and invertebrates that we like to consume. Fewer corals settling on our reefs mean that there will be less available habitat for marine life to exist. This example shows that all components of the reef system rely on each other, and when one component changes (+ or -) the entire reef system may respond. The reefs surrounding Lau Lau Bay, Tank, and Marine Beach are good examples of these issues.

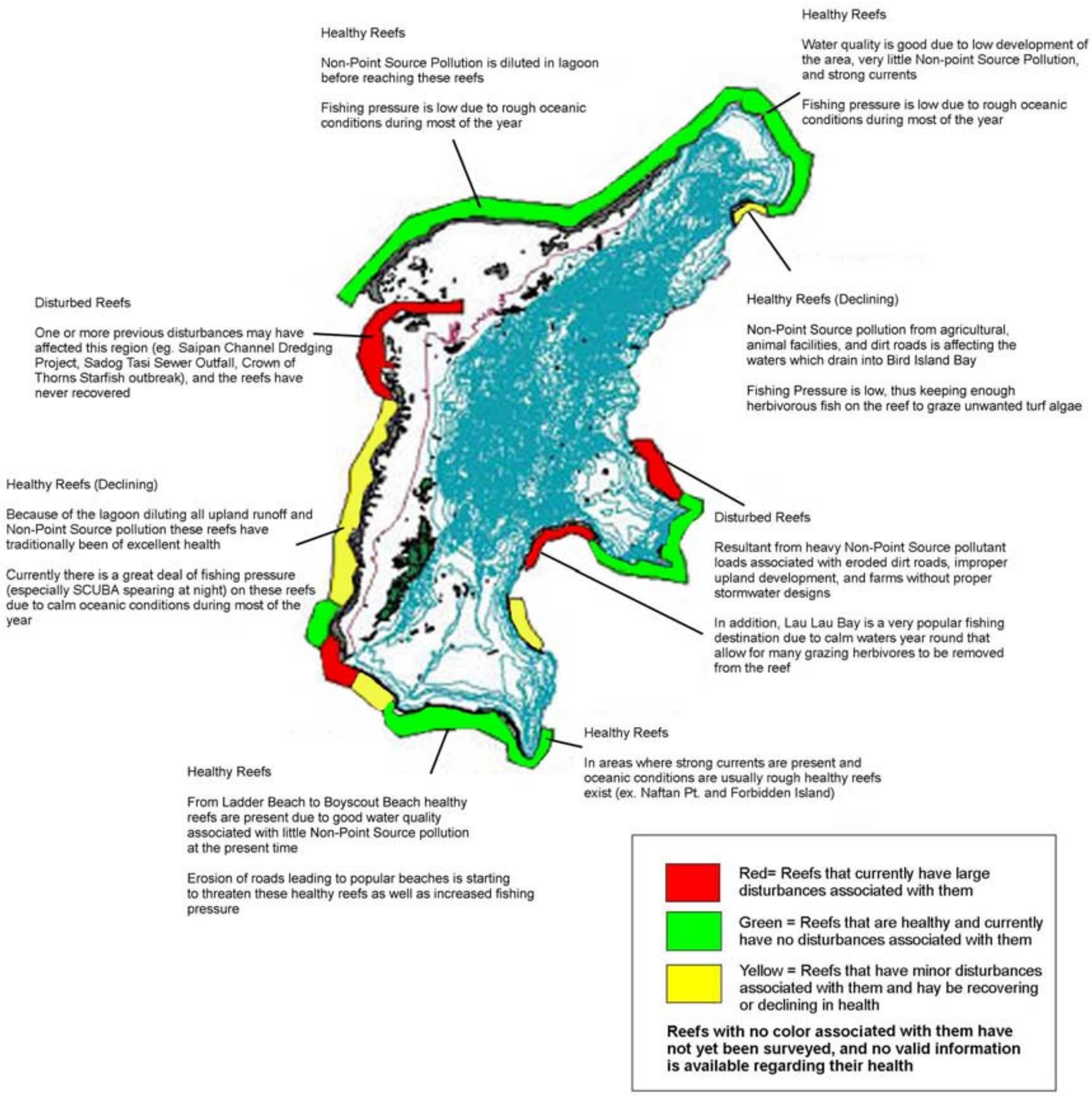


Figure 8. A coral reef health summary map for Saipan Island. See legend for definitions of colors.

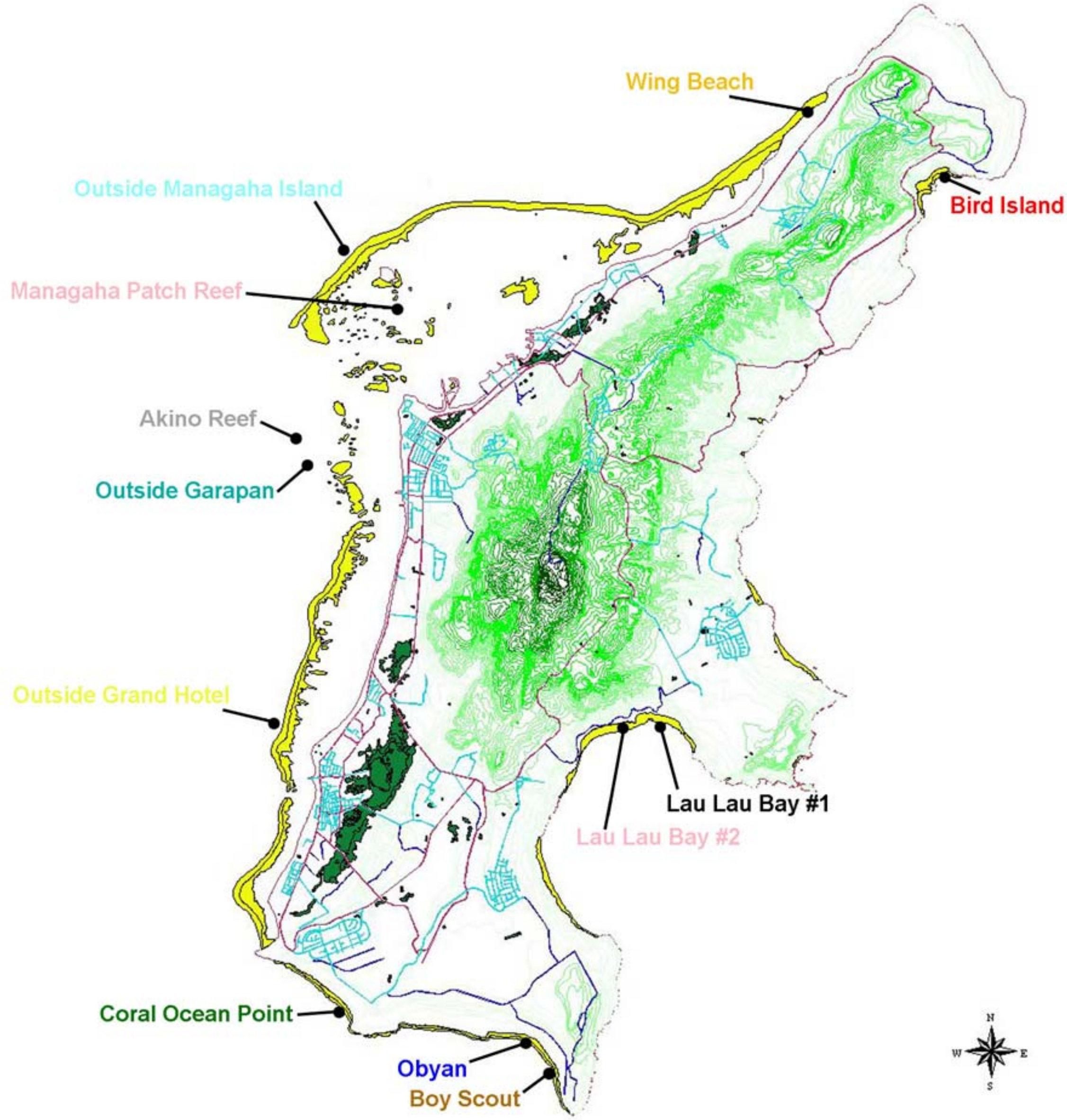


Figure 9. A map showing the surveyed reefs of Saipan Island. Site names are color coded with graphically presented data in Figures 10 - 14.

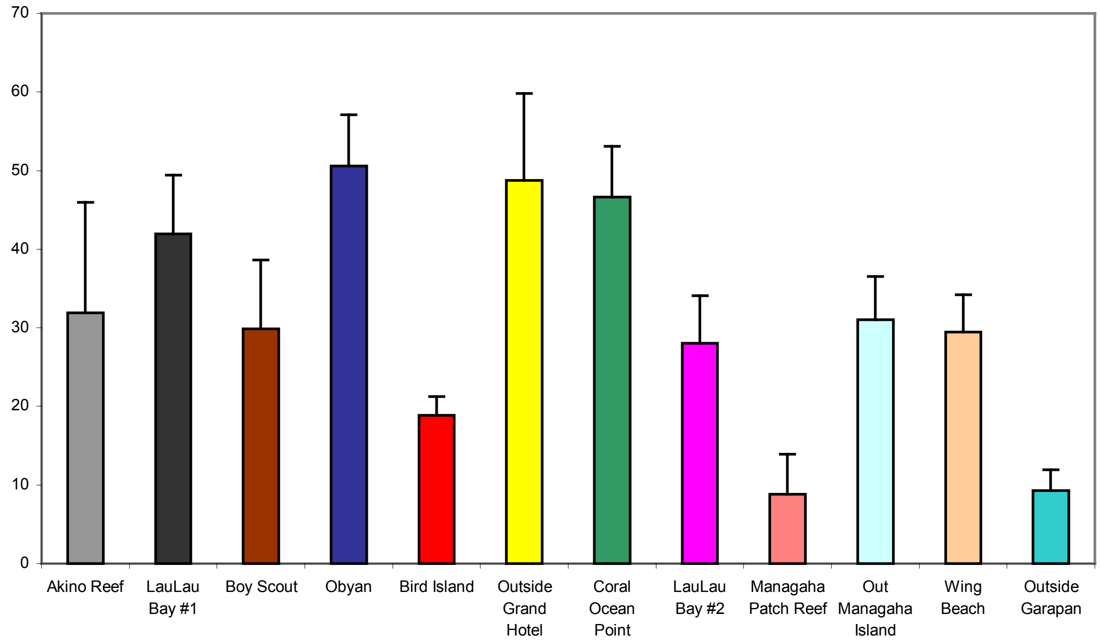


Figure 10. Coral cover among Saipan Island Sites. Highest coral cover is usually found among sites protected from rough oceanic conditions that are in good health. Bar graph colors are coded with site map (Figure 9) for reference.

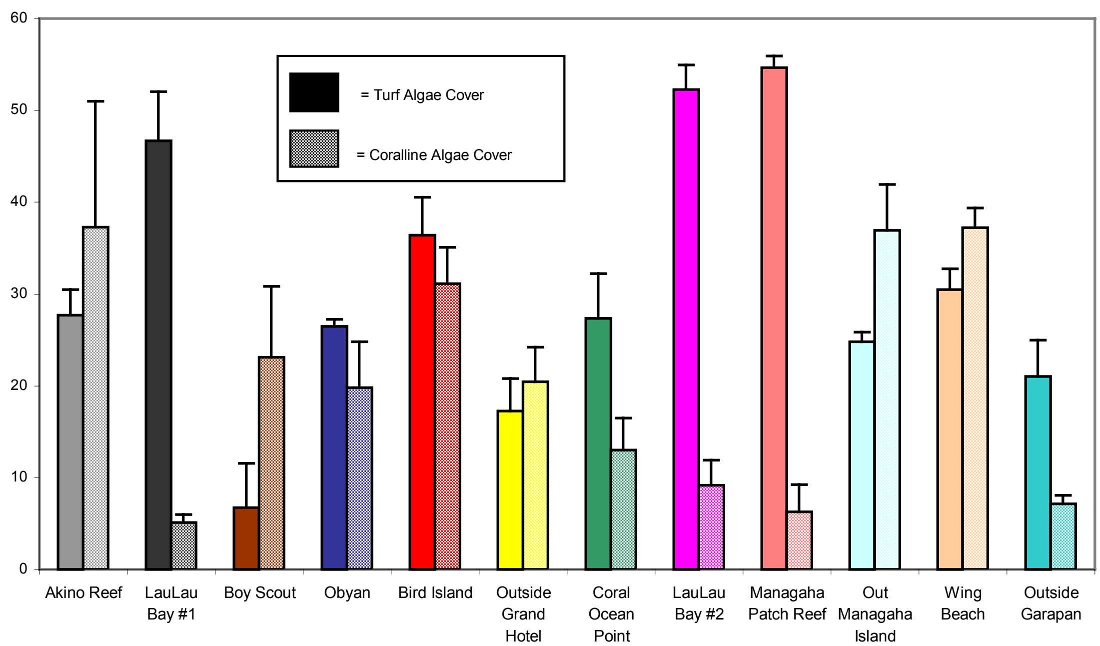


Figure 11. Turf and coralline algae cover among Saipan Island Sites. Coralline algae abundance is expected to be similar to, or greater than turf algae abundance for healthy reefs. Bar graph colors are coded with site map (Figure 9) for reference.

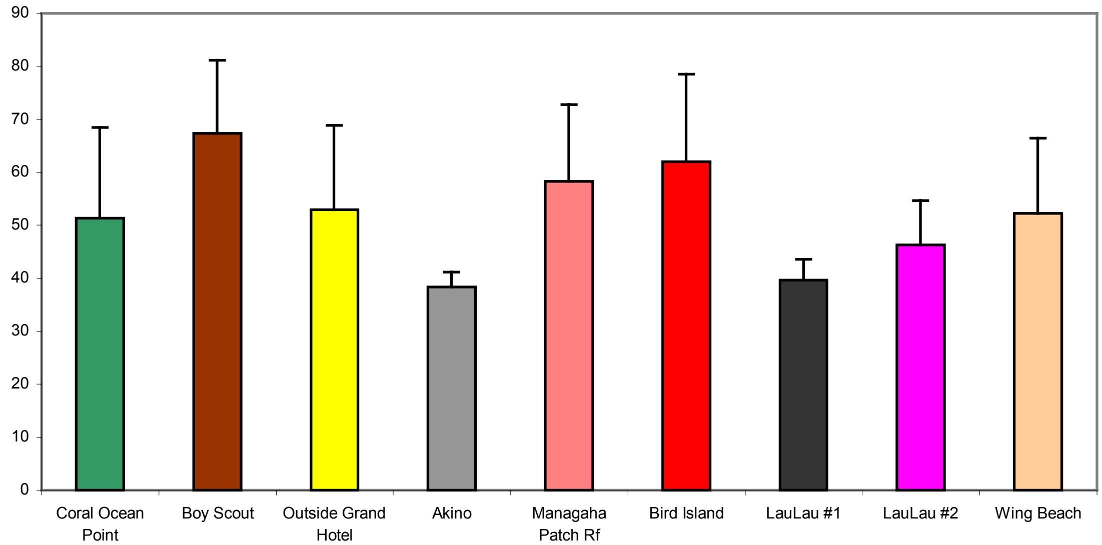


Figure 12. Average number of herbivorous fish among Saipan sites per 500 m^2. Smaller abundances of fish are seen at heavily fished sites like Lau Lau Bay and larger abundances are noted at more remote reefs like Bird Island and Boy Scout. Bar graph colors are coded with site map (Figure 9) for reference.

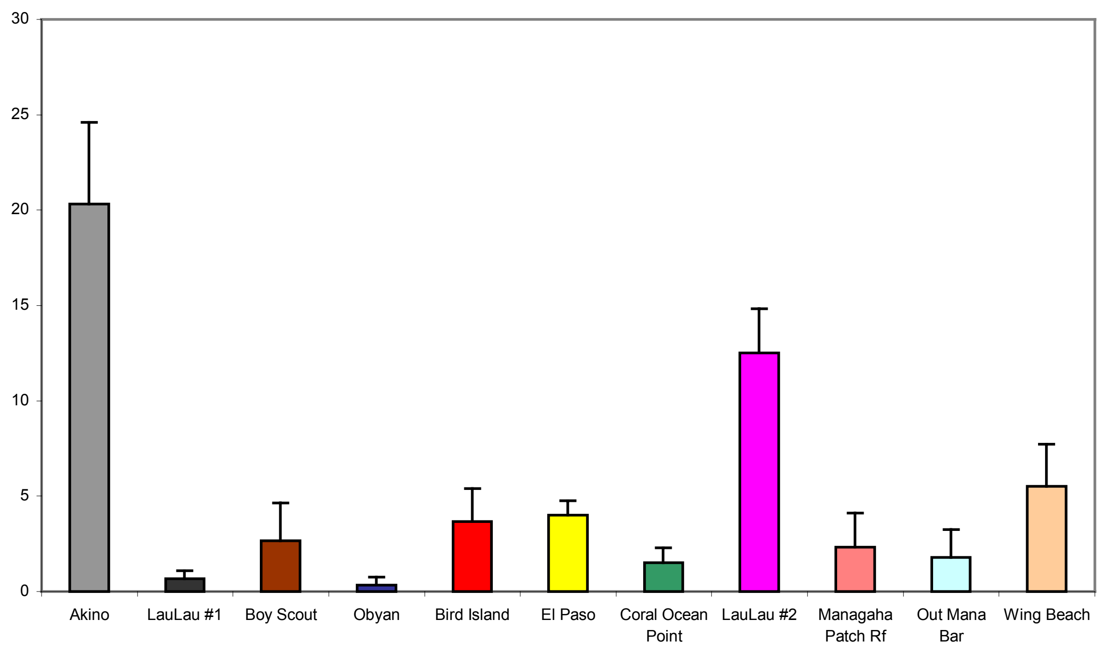


Figure 13. Average number of grazing urchins among Saipan sites per 100 m^2. Grazing urchins are most dominant at remote sites where harvesting pressure is low, and where healthy reefs provide necessary refuge from predators. Bar graph colors are coded with site map (Figure 9) for reference.

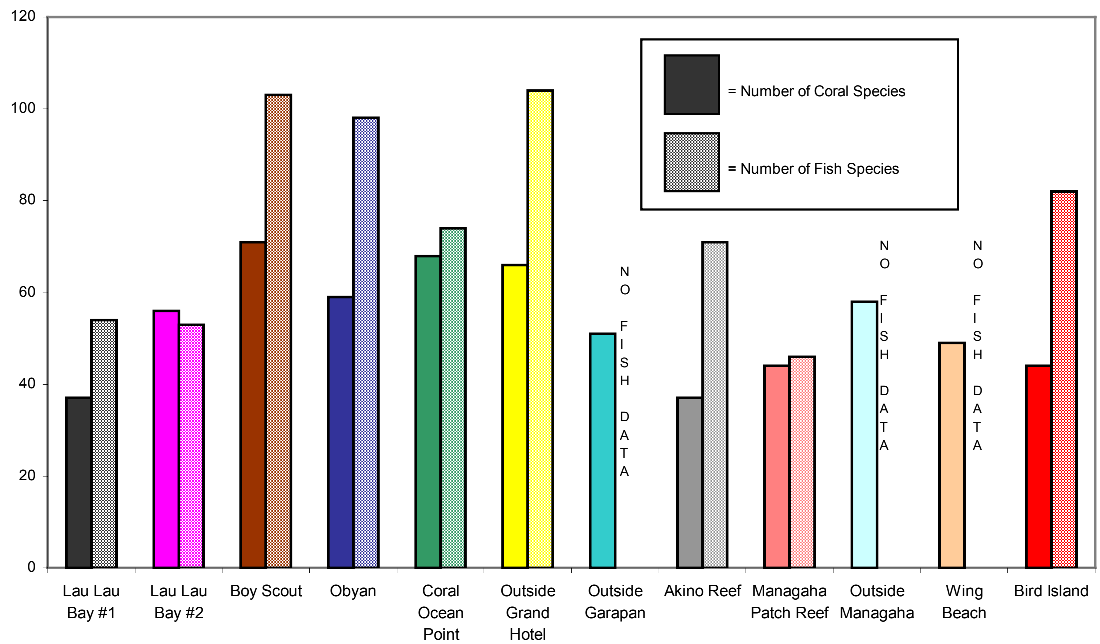


Figure 14. Total number of fish and coral species observed among Saipan sites. The diversity of each site was measured by total numbers of species observed, and is directly related to the health of the reef. Bar graph colors are coded with site map (Figure 9) for reference.

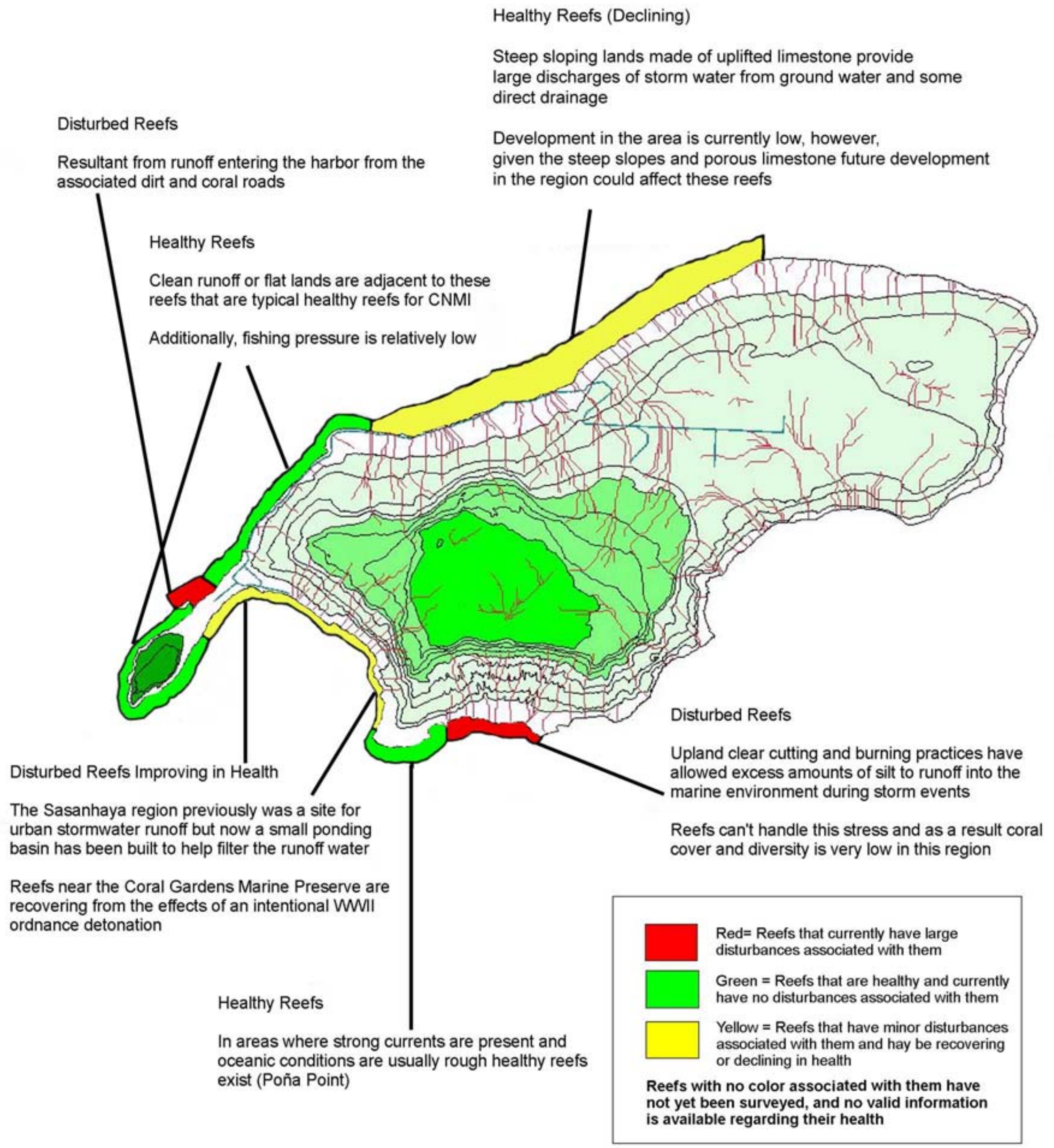


Figure 15. A coral reef health summary map for Rota Island. See legend for definitions of colors.

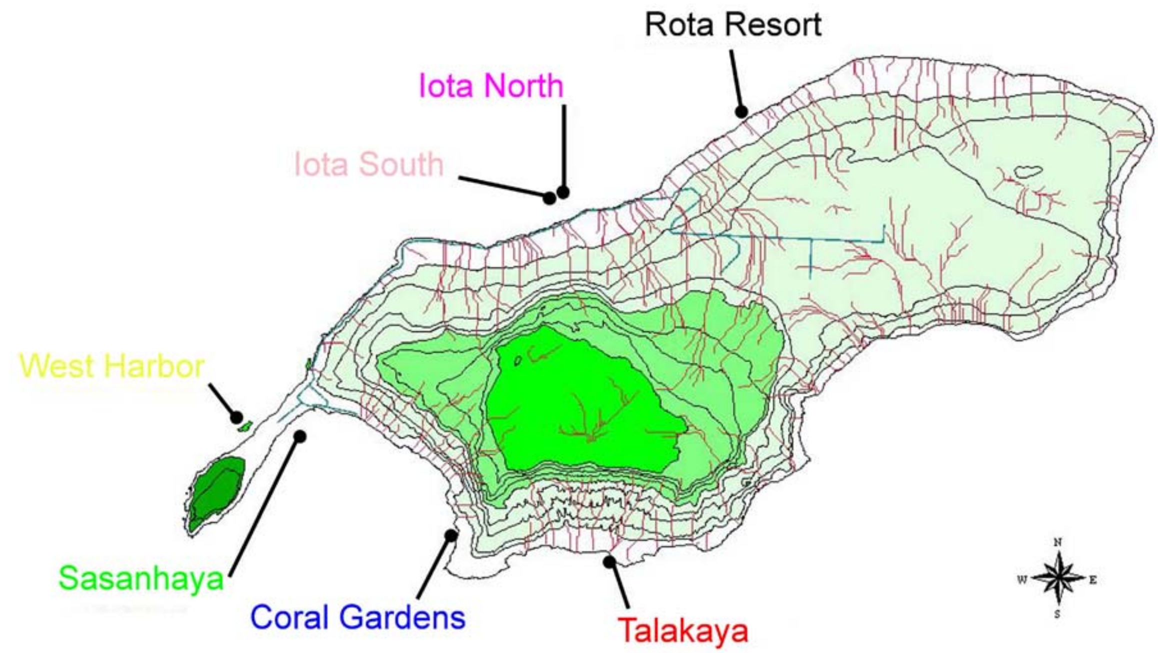


Figure 16. A map showing the surveyed reefs of Rota Island. Site names are color coded with graphically presented data in Figures 17 - 21.

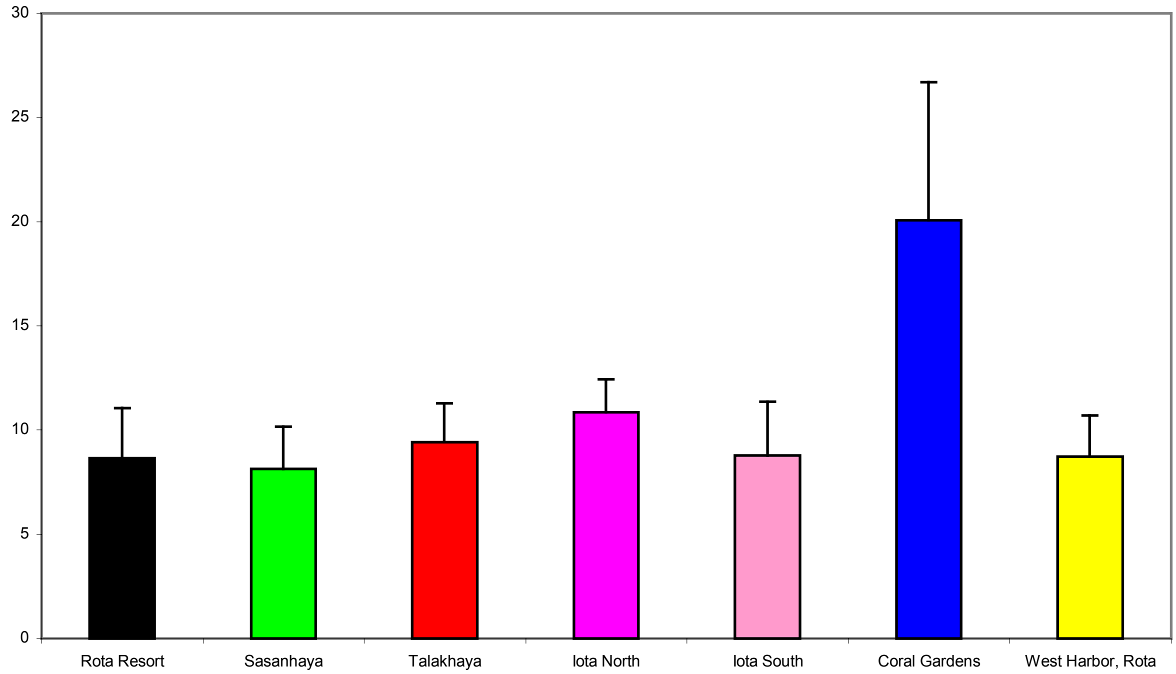


Figure 17. Coral cover among Rota Island Sites. Highest coral cover is usually found among sites protected from rough oceanic conditions that are in good health. Bar graph colors are coded with site map (Figure 16) for reference.

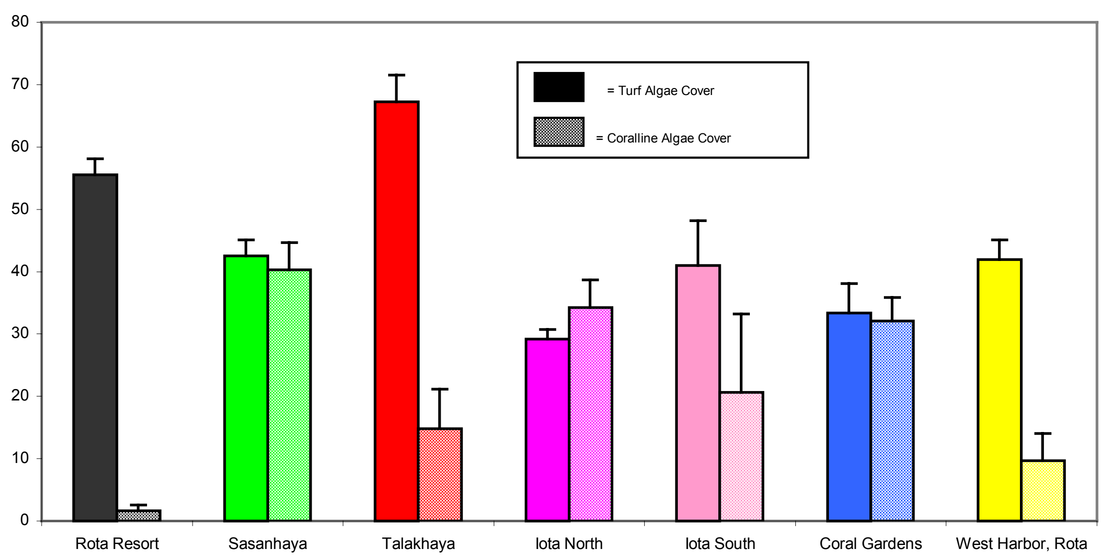


Figure 18. Turf and coralline algae cover among Rota Island Sites. Coralline algae abundance is expected to be similar to, or greater than turf algae abundance for healthy reefs. Bar graph colors are coded with site map (Figure 16) for reference.

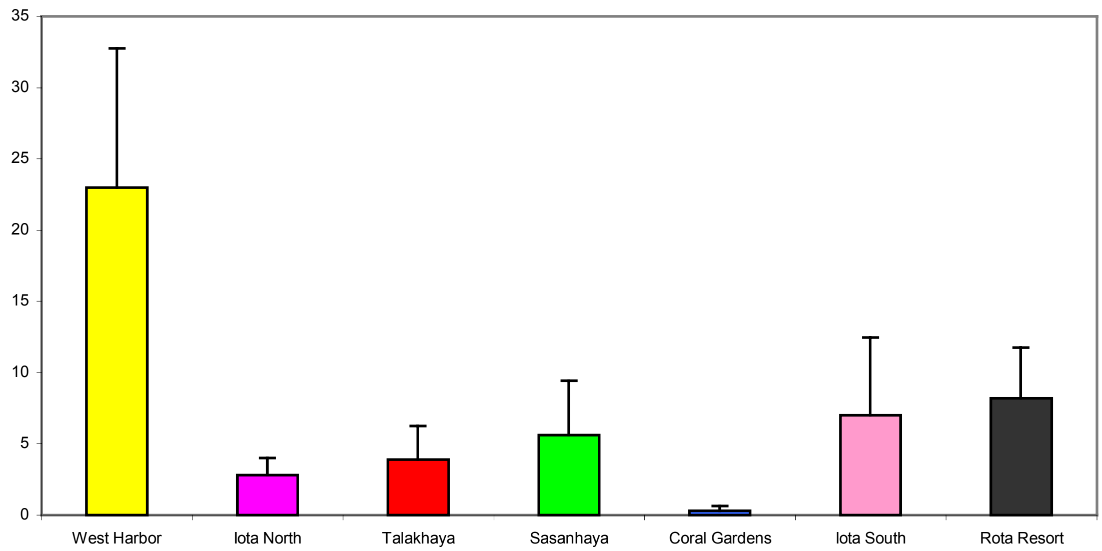


Figure 19. Average number of grazing urchins among Rota sites per 100 m^2. Grazing urchins are most dominant at remote sites where harvesting pressure is low, and where healthy reefs provide necessary refuge from predators. Bar graph colors are coded with site map (Figure 16) for reference.

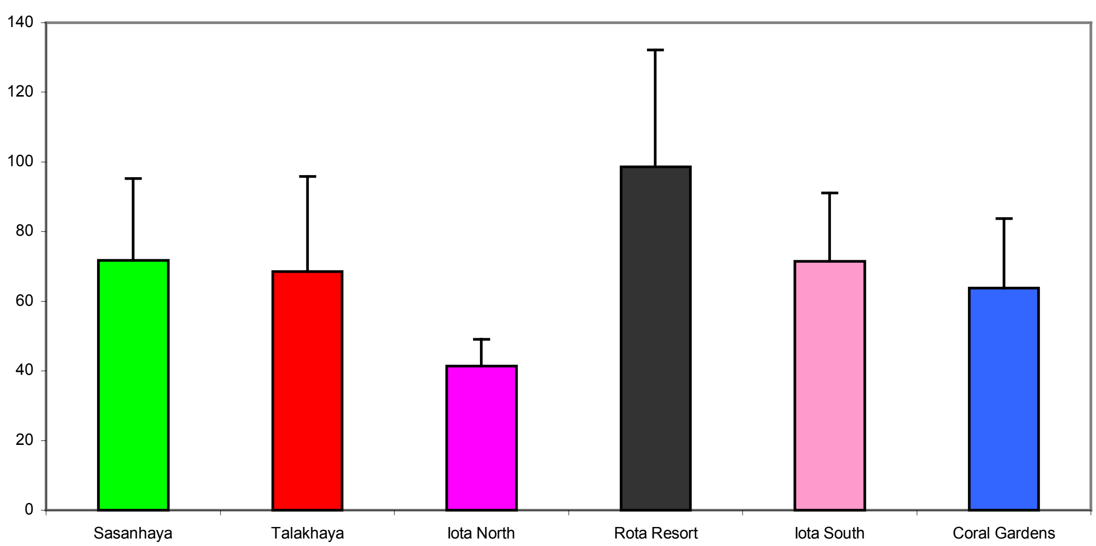


Figure 20. Average number of herbivorous fish among Rota sites per 500 m^2. Bar graph colors are coded with site map (Figure 16) for reference.

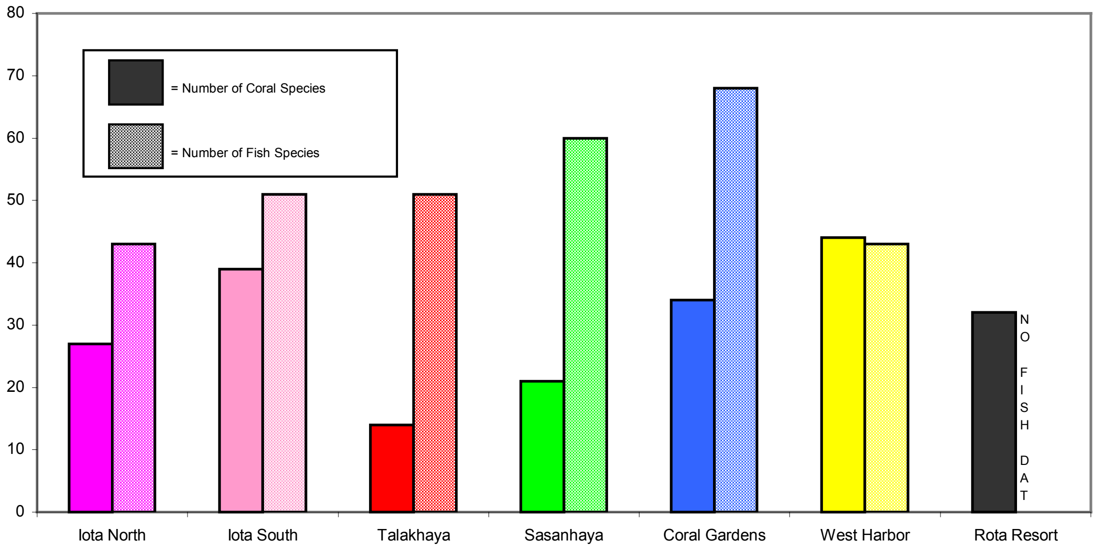


Figure 21. Total number of fish and coral species observed among Rota sites. The diversity of each site was measured by total numbers of species observed, and is directly related to the health of the reef. Bar graph colors are coded with site map (Figure 16) for reference.

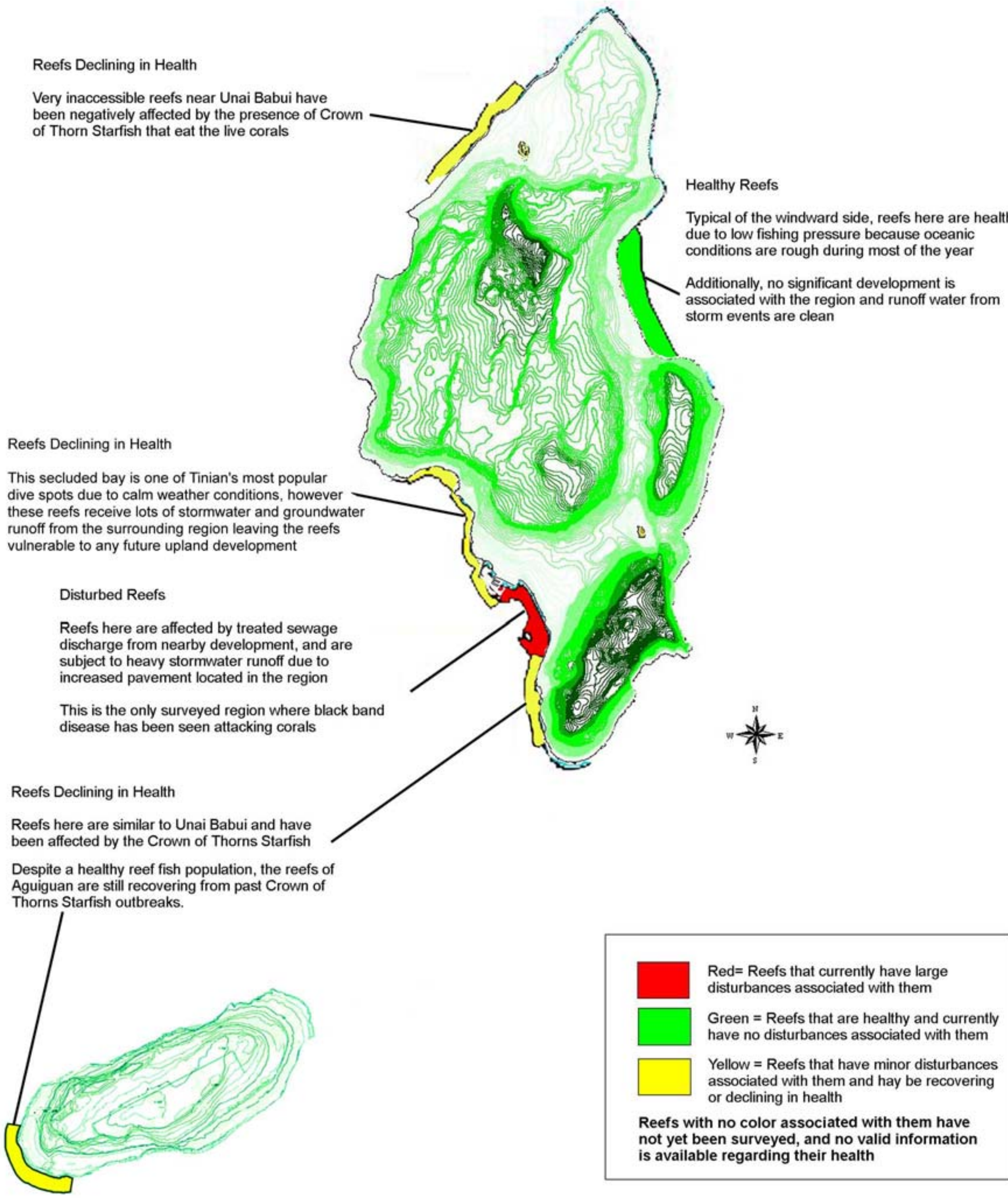


Figure 22. A coral reef health summary map for Tinian and Goat Island. See legend for definitions of colors.

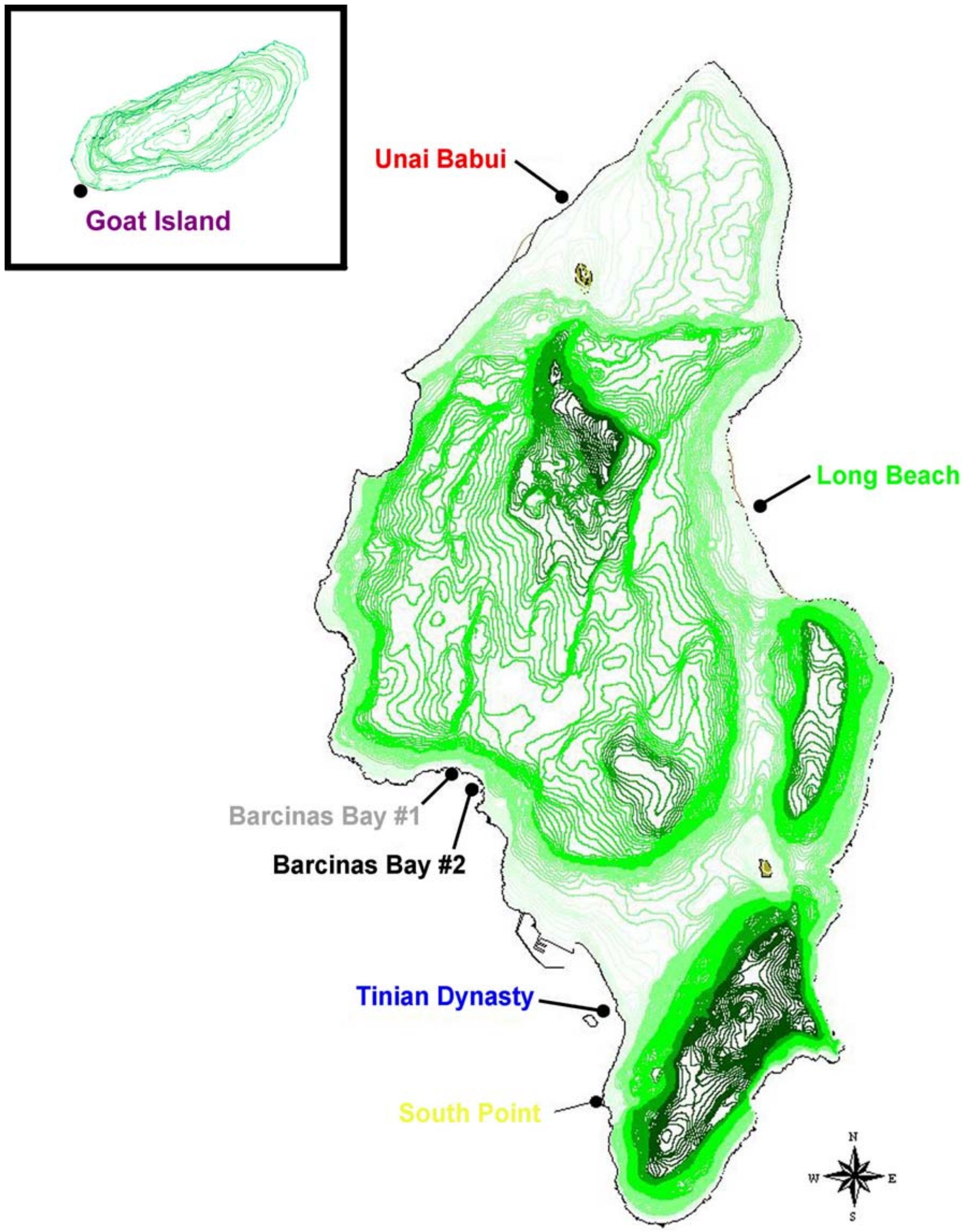


Figure 23. A map showing the surveyed reefs of Tinian and Goat Island. Site names are color coded with graphically presented data in Figures 24 - 27.

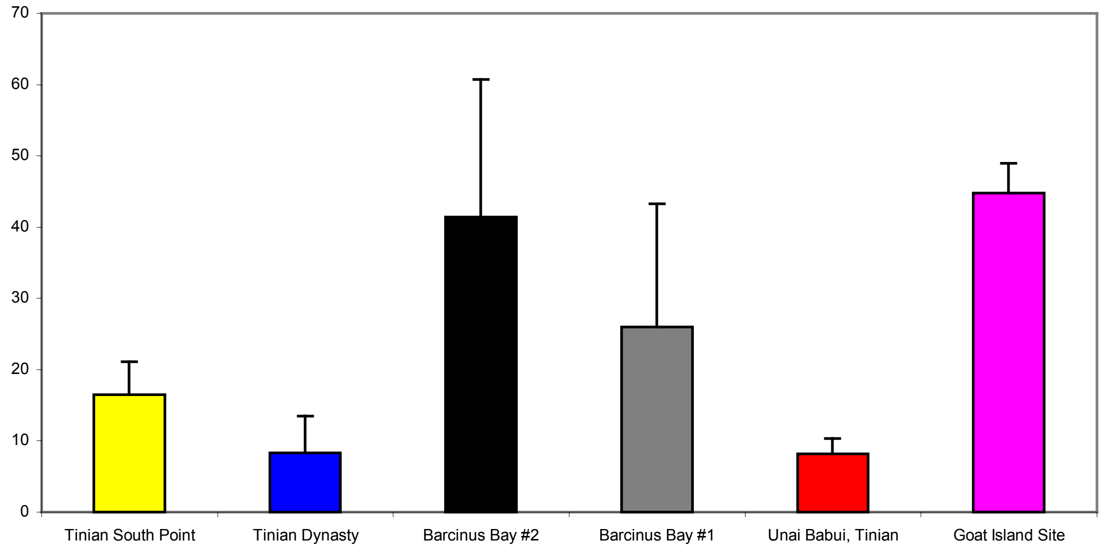


Figure 24. Coral cover among Tinian and Goat Island Sites. Highest coral cover is usually found among sites protected from rough oceanic conditions that are in good health. Bar graph colors are coded with site map (Figure 23) for reference.

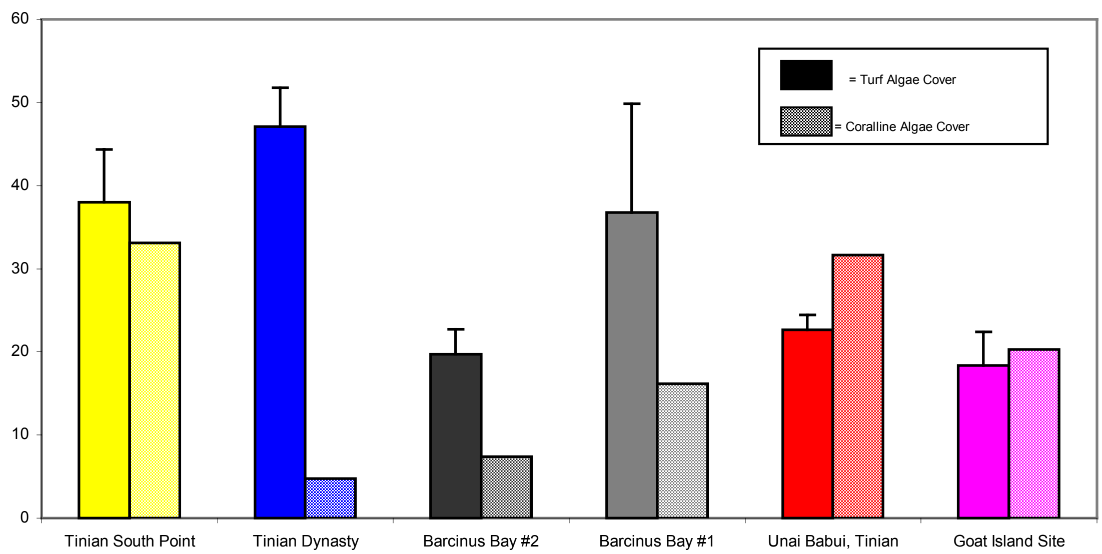


Figure 25. Turf and coralline algae cover among Tinian and Goat Island Sites. Coralline algae abundance is expected to be similar to, or greater than turf algae abundance for healthy reefs. Bar graph colors are coded with site map (Figure 23) for reference.

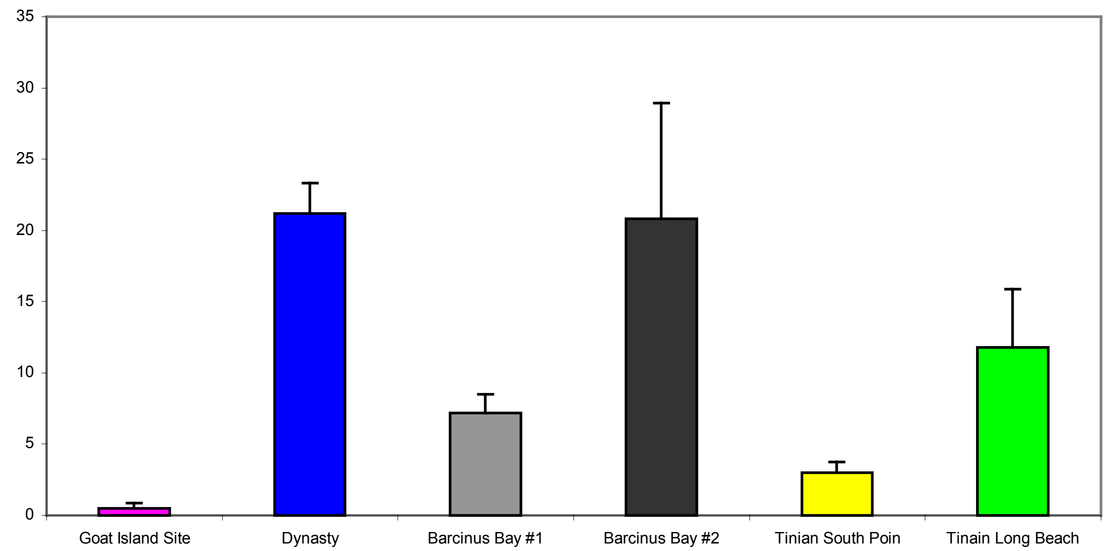


Figure 26. Average number of grazing urchins among Tinian and Goat Island sites per 100 m^2. Grazing urchins are most dominant at remote sites where harvesting pressure is low, and where healthy reefs provide necessary refuge from predators. Bar graph colors are coded with site map (Figure 23) for reference.

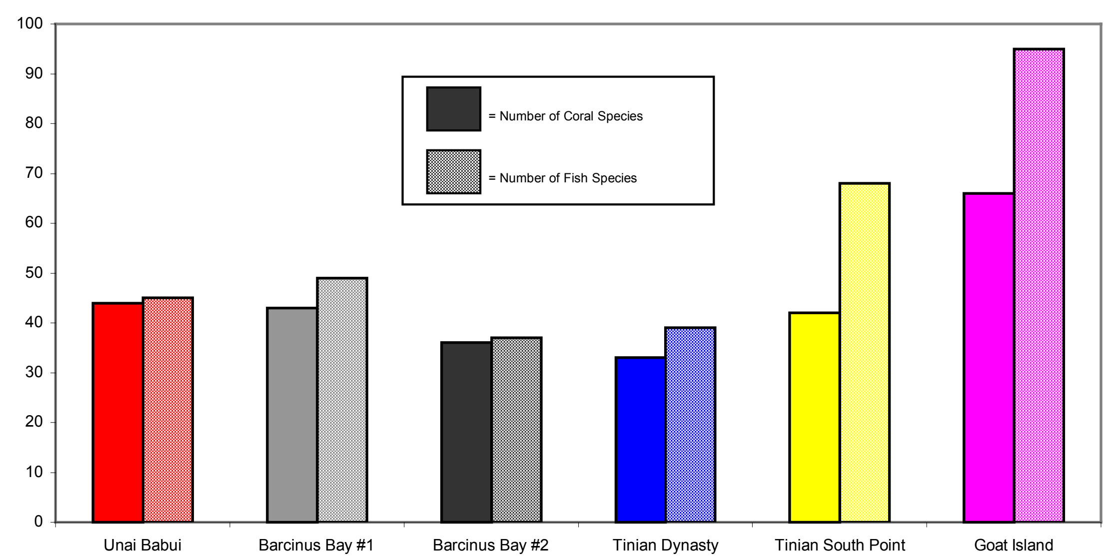


Figure 27. Total number of fish and coral species observed among Tinian and Goat Island sites. The diversity of each site was measured by total numbers of species observed, and is directly related to the health of the reef. Bar graph colors are coded with site map (Figure 23) for reference.

Saipan Lagoon Monitoring Project Results:

Currently, our monitoring efforts have covered approximately 4 square kilometers of the Saipan Lagoon (Figure 28). This represents the region extending from Quartermaster road (south) to Garapan Fishing Base (north). The state of all habitats found are described below. A scientific review of all collected data in a technical report format will be created in FY 03. This will include results for all data that has been collected. Our goal is to present the basic data here in an understandable format for environmental managers, teachers, governmental leaders, and other interested member of the public.

Figures (29 - 32) represent benthic coverage data that was collected from each habitat. These results should describe to the reader what is living in each section of the Saipan Lagoon, and the general health. A healthy lagoon environment should have low abundances of seasonal macro-algae, and large abundances of sand, coral, or seagrass. Inner lagoon habitats have the largest amount of seasonal macro-algae due to their proximity to land and associated nutrient rich runoff. Outer lagoon and back reef habitats have the highest water quality, and are the most diverse regions as a result. Monitoring of the lagoon is important to discover which regions are currently "disturbed", and what is the extent of disturbance.

The Inner Lagoon of the Study Region:

Habitat 1: Consists of a barren sand zone adjacent to shore. The common black sea cucumber *Holothuria atra* is abundant, and seasonal macro-algae without roots can be present dependant on local weather and oceanographic conditions. The average depth of this habitat is 1 – 2 feet. Abundances estimates for macro-invertebrates and the total number of marine organisms present (diversity) are the data that is being collected from this habitat.

Habitat 2: Consists of the large seagrass *Enhalus acoroides*. Root counts of seagrass are being completed in this habitat to understand how abundances may change over time. The average depth of this habitat is 2 – 4 feet. Currently, there are 81.8 (+- 17.1) roots per .25 m^2 in this habitat. Additionally, total number of marine organisms present (diversity) data is also being collected.

Habitat 3: Consists of a sandy bottom with the large seagrass *Enhalus acoroides* intermixed with the smaller seagrass *Halodule uninervis*. There is also a large abundance of seasonal macro-algae in this habitat. The average depth is 3 – 5 feet. Benthic coverage estimates, sea cucumber abundances, and total number of marine organisms present (diversity) are the data that is being collected from this habitat.

Habitat 4: Consists of the small seagrass *Halodule uninervis*, the common macro-algae *Halimeda opuntia*, and other seasonal macro-algae. The average depth of this habitat is 3

Lagoon Habitat Monitoring Project

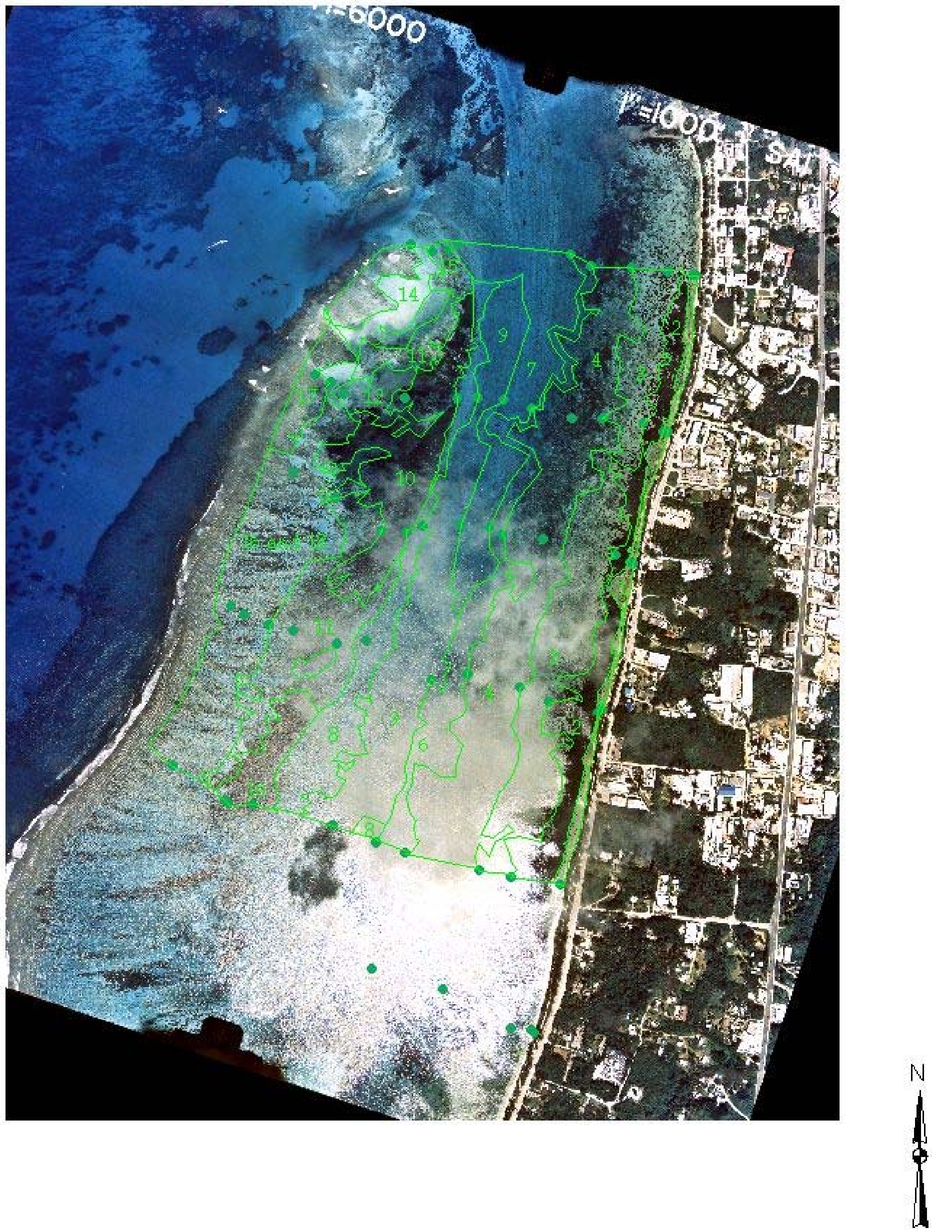


Figure 28. Aerial image of current Saipan Lagoon Project area. Habitats are outlined in green and numbers correspond to the habitat numbers.

– 5 feet. Benthic coverage estimates, sea cucumber abundances, and total number of marine organisms present (diversity) are the data that is being collected from this habitat.

Habitat 6: Consists of a sandy bottom with a dominance of seasonal macro-algae. This habitat is associated with a bathymetric (bottom depth) depth change from approximately 5 feet to over 10 feet. Benthic coverage estimates, sea cucumber abundances, and total number of marine organisms present (diversity) are the data that is being collected from this habitat.

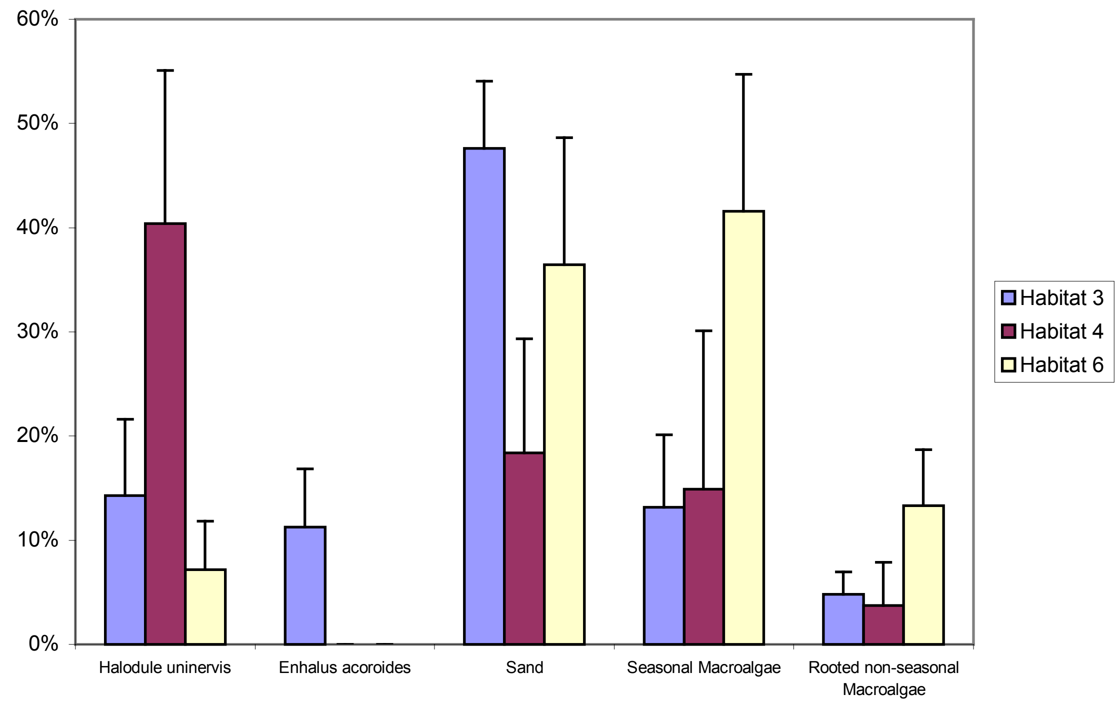


Figure 29. Benthic coverage estimates (and standard deviations) for inner-lagoon habitats. The seagrass Enhalus acoroides only exists in the inner lagoon. Seasonal macro-algae are most abundant in the inner lagoon habitats.

The Mid-Lagoon of the Study Region:

Habitat 7: Consists of a sandy bottom with a sparse abundance of living and dead corals. This habitat is in the deeper lagoon waters 10 – 12 feet. Dead corals have either turf algae or coralline algae growing on their surface and benthic coverage estimates record dead corals as turf or coralline algae. Benthic coverage estimates, sea cucumber abundances, and total number of marine organisms present (diversity) are the data that is being collected from this habitat.

Habitat 8: Consists of a sandy bottom with the small seagrass *Halodule uninervis* and the very tiny seagrass *Halophila minor*. This habitat is in the deeper lagoon waters, 10 – 12 feet. Abundances of the common black sea cucumber *Holothuria atra* are highest in this habitat due to the dominant sandy bottom. Benthic coverage estimates, sea cucumber abundances, and total number of marine organisms present (diversity) are the data that is being collected from this habitat.

Habitat 9: Consists of a sandy bottom with the small seagrass *Halodule uninervis* abundant in patches. This habitat is also in deeper lagoon waters, 10 – 12 feet. Benthic coverage estimates, sea cucumber abundances, and total number of marine organisms present (diversity) are the data that is being collected from this habitat.

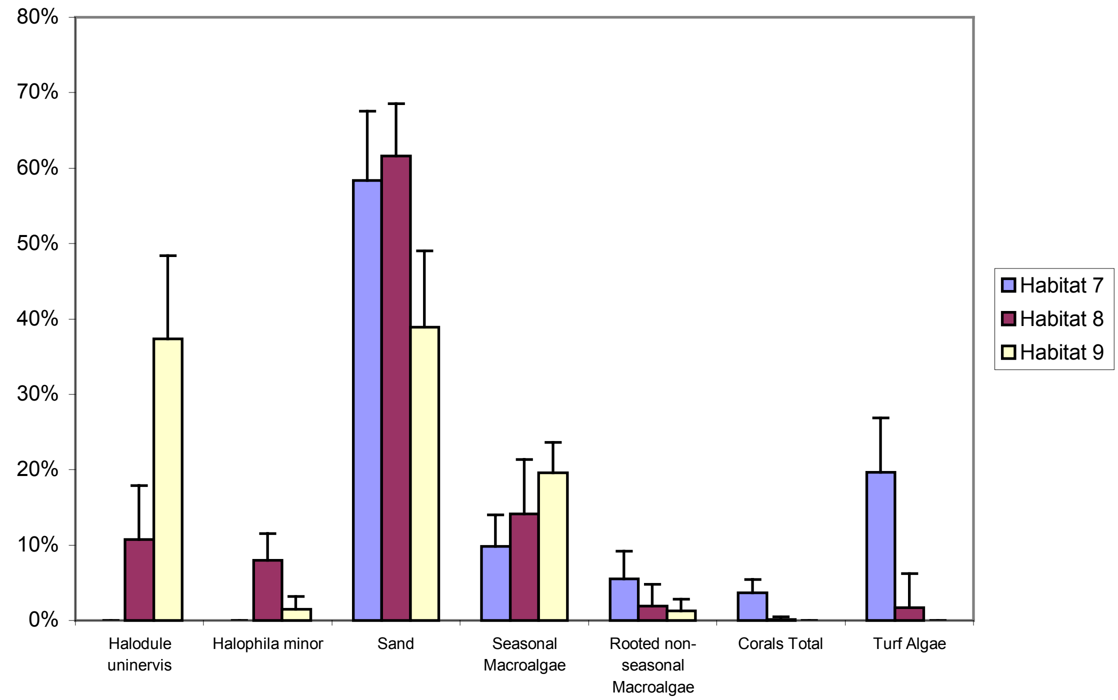


Figure 30. Benthic coverage estimates (and standard deviations) for mid-lagoon habitats. Mid lagoon habitats are all located in the deepest lagoon waters, approximately 8 – 12 feet.

The Outer Lagoon of the Study Region:

Habitat 10: Consists of a large abundance of the small seagrass *Halodule uninervis* with sand below. The average depth of this habitat is 3 – 5 feet. This is a healthy lagoon environment with very little seasonal macro-algae growing. Benthic coverage estimates, sea cucumber abundances, and total number of marine organisms present (diversity) are the data that is being collected from this habitat. Approximate benthic coverage estimates are; 60% for the small seagrass *Halodule uninervis*, and 40% for sand.

Habitat 11: Consists of a sandy bottom with the small seagrass *Halodule uninervis* abundant. The average depth of this habitat is 3 – 5 feet. Live and dead coral rocks are randomly located throughout this habitat, with less than 2% benthic coverage. This habitat is located adjacent to one or more barrier reef habitats.

Habitat 12: Consists of a sandy bottom with the tiny, leaf-like seagrass, *Halophila minor*, very abundant. *Halophila minor* is the only benthic plant that is abundant here. The average depth of this habitat is 3 – 5 feet.

Habitat 14: Consists of a completely sandy bottom with no benthic organisms being abundant. The average depth of this habitat is 2 – 4 feet.

Habitat 15: This habitat is only located adjacent to the lighthouse channel and has not been found in any other Saipan Lagoon location. This habitat consists of a sandy bottom with a large abundance of seasonal macro-algae. The average depth of this habitat is 2 – 4 feet.

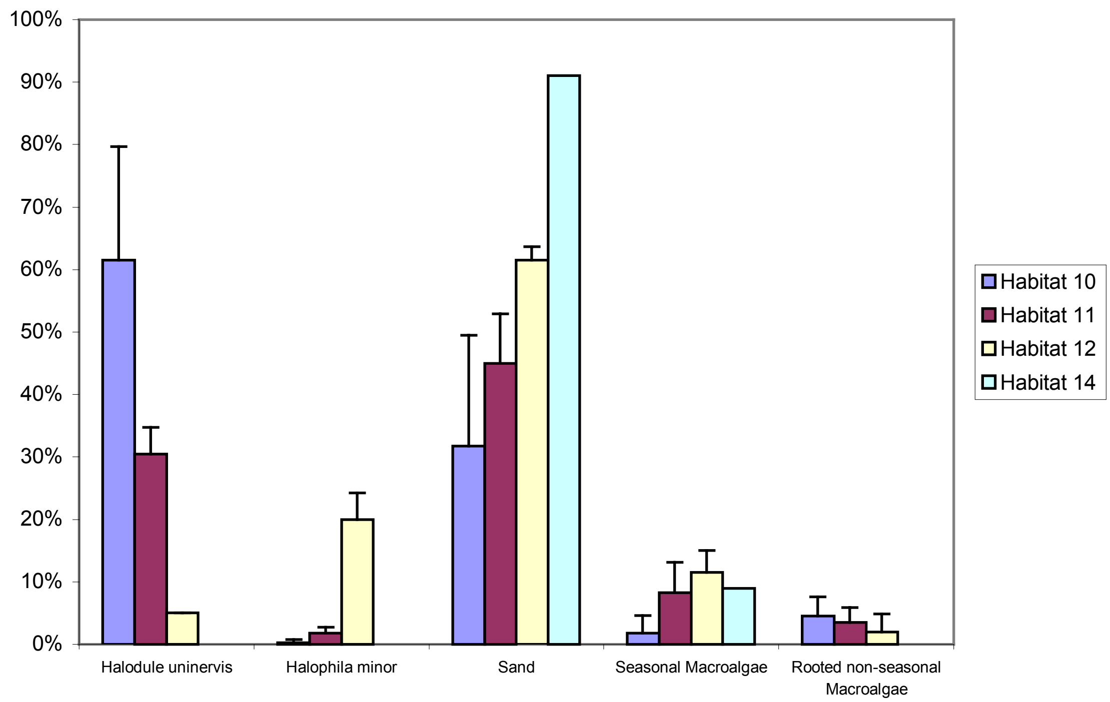


Figure 31. Benthic coverage estimates (and standard deviations) for outer-lagoon habitats. Outer lagoon habitats show much lower abundances of seasonal macro-algae than inner lagoon habitats.

The Back-Reef Habitats of the Study Region:

NOTE : *The summer of 2000 brought the CNMI elevated surface temperatures (up to 31-32 degrees Celsius) to the Southern Japan and the Mariana Island Chain. Lagoon back-reef coral communities could not handle this thermal stress and became bleached (white) and died. Turf algae now live on top of pre-existing coral skeletons. As a result our surveys show large abundances of turf algae for all back-reef habitats. These habitats are currently recovering from thermal induced stress.*

Habitat 16: Consists of a sandy bottom with live corals scattered in abundance. The most abundant living benthic organism here is turf algae. The depth of this habitat is very shallow, 1 – 3 feet. See discussion under "The Back-Reef Habitats" above for explanation of the high turf algae abundances.

Habitat 17: Consists of a sandy bottom with two dominant benthic organisms. The average depth of this habitat is 2 – 4 feet. The rooted macro-algae *Gelidiella acerosa* is abundant here as well as turf algae. See discussion under "The Back-Reef Habitats" above for explanation of high turf algae coverage.

Habitat 18: Consists of a sandy bottom with the staghorn corals, *Acropora spp.* in high abundances. Turf algae are also abundant. The average depth of this habitat is 5 – 7 feet. See discussion under "The Back-Reef Habitats" above for explanation of high turf algae coverage. The framework resultant from the branching staghorn corals provides refuge for fish and other invertebrates. As a result, many fisherman can be found within this habitat on a daily basis.

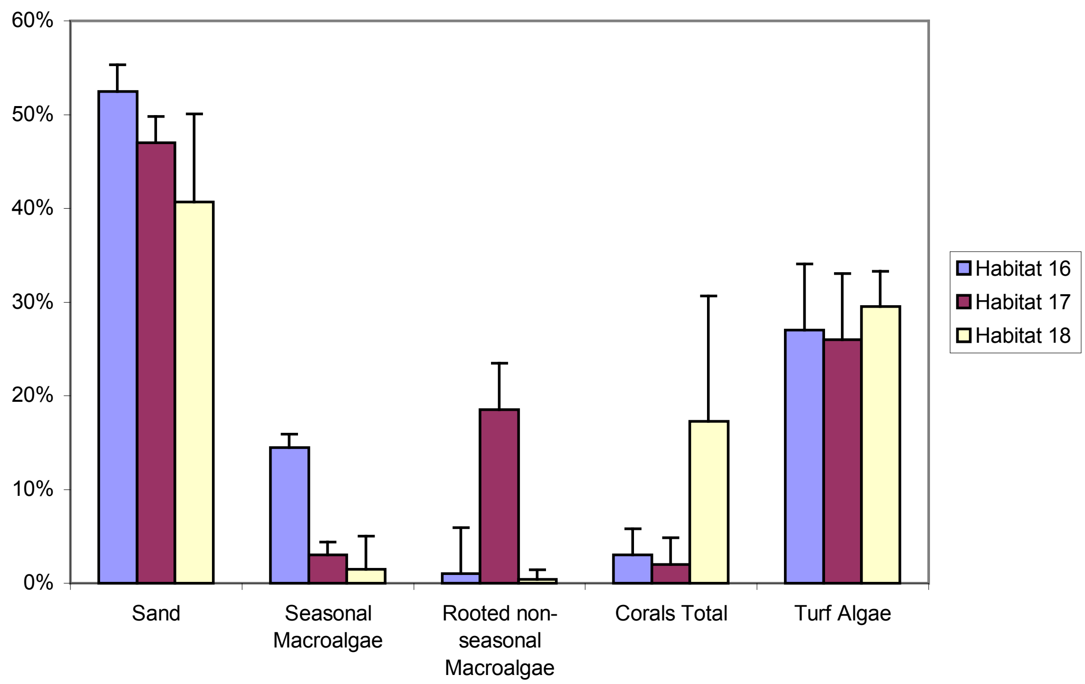


Figure 32. Benthic coverage estimates (and standard deviations) for back reef habitats. Back reef habitats are the most diverse and dynamic in the entire lagoon due to their location.

d. Discussion

Saipan Lagoon Monitoring Program:

At the present time the Saipan Lagoon Monitoring effort has completed one region of the lagoon. This represents the area extending from Quartermaster road to Garapan Fishing Base. Results show that the inner lagoon habitats (habitats 1 – 6) are affected by increased nutrients associated with all stormwater reaching the drainages and shores in this region. As a result these habitats have high abundances of seasonal macro-algae growth when compared to outer lagoon habitats. This region of the lagoon receives drainage from the West Takpochau watershed. It is speculated that the majority of pollutants carried to this region of the lagoon are from middle road, extending to beach road. This is the area where development is currently heavy and much of the existing land is now covered with impervious material (concrete roads, etc..). It is very important for government infrastructure development projects to address stormwater and associated non-point source pollution in this region. Marine monitoring efforts can and will only identify where problem(s) may exist and evaluate management measures used.

There are other sources of concern regarding all habitats in this region of the lagoon. One naturally occurring concern is related to Global Warming and associated ocean temperature increases. The summer of 2000 brought the CNMI increased surface temperatures (up to 31-32 degrees Celsius) to the Saipan Lagoon. Live coral animals can only exist in a narrow range of temperatures, and these increased temperatures caused a high mortality. While there is nothing that CNMI can do to prevent similar events from occurring, clean waters will allow a quicker and stronger recovery.

The last major concern facing all habitats in this region of the lagoon is related to fishing and fishing pressure. Fish are very important for all marine systems because they help to recycle nutrients and clean reefs of turf algae (similar to us brushing our teeth). In the past 50 years technological advances in fishing methods and storage have hurt the traditional, sustainable methods that foster a good fishery. These days, fishermen are catching and selling even the small herbivorous fish that entire marine systems rely upon. This has the potential to hurt CNMI's tourism industry and future subsistence fishermen alike. Coupled with lowered water quality, a decrease in fish stocks will result in an increase of nuisance macro-algae (un-eaten herbivorous fish food) washing upon our beautiful beaches. Our leaders must work with our managers to create more enforceable fishing regulations.

Near Shore Coral Reef Monitoring Project:

Discussion of individual sites regarding reef health and current status have already been made in previous State of the Reef Reports (Houk 1999 and Houk 2000, copies available through DEQ office). A general discussion regarding overall reef health and recommendations for improving conditions follows.

Only a small portion of CNMI's reefs have been accurately surveyed, with previous baseline data existing. It is the goal the nearshore monitoring program to select sites based upon known disturbances (e.g. Lau Lau Bay and the issue of sediment runoff). We now have a good set of baseline data from which management measures, improved roads, drainages, etc., can be judged for effectiveness.

Two of the major concerns with CNMI's near shore coral reef systems are the same that are affecting the Saipan Lagoon; non-point source water pollution and inadequate fisheries regulations and enforcement. Both have been described above under the Saipan Lagoon Monitoring Program "Discussion" section.

Additionally, there are natural disturbances that affect our reefs. Of greatest concern are Crown of Thorn Starfish Outbreaks. There have been at least three Crown of Thorn Starfish outbreak events since the late 1960's. These starfish prey on live corals and during an outbreak their high abundances have affected entire CNMI reef systems (Cheney, 1973). The marine monitoring program is currently testing a method to kill the starfish and pose no threat to the marine environment. Work is being done in conjunction with the Northern Marianas Dive Operators Association (NMDOA). The exact cause of outbreaks is still unknown by scientists around the world, and the best protection CNMI can have against these starfish is a control program.

B. Water Quality Permitting and Other Pollution Prevention Programs

The Division of Environmental Quality (DEQ) and other CNMI government agencies implement several environmental programs to control point and non-point sources of pollution. Some of the programs are related to federal standards, whereas others are locally developed. Many of DEQ's programs focus primarily on permitting, therefore serving as a pollution prevention mechanism for new development, and as an enforcement mechanism for previously permitted development and discharges.

DEQ also implements other, non-permitting programs that focus more on public education and demonstrations, such as the Non-Point Source (NPS) Pollution Control Program, which focuses primarily on public education and the administration of Section 319 demonstration project grants. DEQ's NPS program also coordinates with EPA, NOAA, and the CNMI Coastal Resources Management Office to implement the requirements of the Section 6217 Coastal Non-Point Source Pollution Program into all applicable CNMI regulations and environmental programs.

1. *Non-Point Source Pollution Control Program*

a. Overview

The CNMI Division of Environmental Quality's (DEQ) Non-point Source Pollution (NPS) Program is an interactive program in its fifth year of existence. The program relies and gives support and assistance to other programs within DEQ, other CNMI and federal agencies, and the general public. The CNMI implements its NPS program to understand its water quality problems and make management decisions and recommendations. The NPS program responsibilities include:

- ensuring all public and private activities comply with Section 319 of the Clean Water Act;
- administering the 319 grant program for best management demonstration - projects;
- participating on the CNMI's Marine Monitoring Team that implements the Long-Term Marine Monitoring Plan for bio-criteria assessment of water quality;
- participating on the Interagency Watershed, Coral Reef, and GIS groups ;
- developing a Geographic Information System to analyze and spatially display environmental data and to integrate GIS and GPS;
- reviewing CRM permit applications;
- reviewing DEQ Section 401 Water Quality Certification applications;
- coordinating with DEQ's Earthmoving and Erosion Control program;
- developing Total Maximum Daily Load (TMDL) plans for impaired waterbodies;
- preparing water quality assessment reports; and
- implementing the Clean Water Action Plan by developing a Unified Watershed Assessment and Action Strategies for prioritized watersheds.

In the CNMI, the main sources of non-point source pollution are land runoff from urbanization, land clearing, solid and human waste disposal, and agricultural practices. Sediments, nutrients, and toxic chemicals are the three greatest threats to clean nearshore waters and healthy marine ecosystems. The resource agencies of the CNMI have built up their efforts to prevent, control, and reduce the amount of non-point source pollution entering the ground and surface waters.

The CNMI uses a watershed management approach to protect and restore water quality impaired by non-point source pollution. Each year, the Interagency Watershed Working Group identifies watersheds of concern, and members focus their efforts on solving problems in those watersheds. This process has been formalized through the completion of the Unified Watershed Assessment, which categorizes and prioritizes watersheds for restoration. The development of the Watershed Restoration Action Strategies (WRAS) will also provide additional useful information to better address non-point source pollution. Any 319 funds that become available as a result of the Clean Water Action Plan will be targeted for the highest priority watersheds in Category I as listed in the Unified Watershed Assessment, and projects will be prioritized in accordance with the WRAS. The CNMI's Non-point Source Pollution program is well integrated with other natural resource programs. This is done primarily through the participation of appropriate agencies in the Interagency Watershed Working Group, Local Coral Reef Advisory Group and the Geographic Information System (GIS) group whom are combining efforts to share, record and analyze various types of data on a watershed scale. The designation of the watersheds of concern, as described above, are based primarily on an examination the quality of water and natural resources surrounding the watershed. DEQ is responsible for collecting and analyzing marine water quality data, groundwater quality data, and has initiated a unique marine monitoring program to examine the health of the coral reef. The Non-point Source Pollution program analyzes these data on a watershed basis and focuses its programs in watersheds with known water quality problems. The marine monitoring program uses various marine monitoring methods to detect problems. The NPS program acts upon information gathered from the marine monitoring program.

b. 6217 Coastal Non-Point Program

In 1994, the CNMI Coastal Resources Management Office (CRM) and the Division of Environmental Quality (DEQ) created the Section 6217 Coastal Non-point Source Pollution Prevention and Control Plan (e.g. 6217 plan), which has guided the agencies efforts to implement NPS related projects. The plan also serves as a program upgrade for the CNMI's existing non-point source program's coastal waters element, administered by DEQ, under Section 319 of the Water Quality Act of 1987. To date, CRM and DEQ continue to work on getting the program fully approved by June, 2002.

The CNMI's 6217 program identifies best management practices (BMPs) that will be used to control non-point sources of pollution. These BMPs are implemented through the following programs: Coastal Resources Management permitting program, coral reef monitoring, surface and ground water quality monitoring, the Section 401 Water Quality Certification program, the Earthmoving and Erosion Control program, other DEQ programs, the 319 grant program.

The yearly program plan for the Non-point Source Pollution section includes a schedule with goals, objectives, and milestones for implementation of projects. DEQ uses funding through 319 grants, base grant from EPA, and local funds to implement the program. CRM uses federal 6217 funds, Coral Reef Initiative and monitoring grants, and local funds to address Non-point Source Pollution problems.

c. Present 319 Projects

Know Your Watershed –

This project's goals are to minimize and/or control the environmental impact caused by stormwater runoff and individual contribution. The first goal of the project is to educate and bring public awareness within the community about the impacted watershed. The second goal aims at creating an alliance with members of the affected community. The main focus of creating this partnership is for the Garapan community to take part in protecting and maintaining the health of their watershed. With this project people are being made aware of the degrading water quality in their watershed as well as their environment. They are also given the opportunity to get involved in clean-ups of the drainage in their area, and are taught how to reduce, reuse and recycle. The project is still ongoing with a wide variety of awareness campaigns and public education materials still being distributed to the Garapan community.

Rota Ponding Basin –

The basin is constructed in Sasanhaya Bay, Rota to gauge the degree of success of its ability to minimize sedimentation discharge. Construction was completed in July, 2001 and it has been online for the past six (6) months. Water samples were collected and analyzed for basic parameters prior to and after installation, all results were non-detect. Marine monitoring surveys in the Sasanhaya Bay will further serve to understand the success of the BMP project.

Pesticide Mixing Station –

The mixing facility is designed to allow for safe storage, mixing and clean-up of agrichemicals used on farms. It is also to demonstrate the efficiency and safety benefits of providing such a facility for use by Saipan Farmers. Proper handling and use of pesticides in a centralize location will minimize any threat of contamination to the water supply within the Kagman Watershed.

Stormwater BMP Manual –

The CNMI Division of Environmental Quality has identified a need for new guidance manuals to assist the local engineering and development community in the development of stormwater and erosion control plans that conform with current engineering practice. The development of two manuals are for Stormwater Best Management Practices Design Manual, and an Erosion Control Best Management Practices Design Manual which will include training for engineers, contractors, and developers focusing on the content of the manuals.

Beach Road Area Management Project –

This is one of the newest projects for fiscal year 2002. The goal of the project is to determine, design and install best management practices that will visibly demonstrate various measures to manage NPS that can be readily adapted for widespread use. Proposed demonstration projects include such measures as vegetative filter strips, grassed/ rock-lined waterways, new landscaping (grasses, shrubs, trees and vines to minimize erosion and increase sediment filtration), diversions (of upland runoff from reaching the lagoon), sediment basins and velocity controls (in and adjacent to drainageways), delineated parking sites (to let grass grow and reduce compaction), porous surfacing for individual parking spots, drainage cleanouts (from Middle Road to lagoon outlet), bank stabilization (along drainageways), road shoulder planting (to reduce dust and mud), street sweeping, road grading (e.g. crowns & waterbars on the road from Beach Road to Gualo Rai), agriculture/animal waste management, and others to be determined and refined through the planning process.

Tinian Animal Wastes Project –

This project is designed to demonstrate to swine producers how to protect the island's water supply. The aquifer located in the Marpo watershed is Tinian's sole source for drinking water. The use of local materials are being used for composting chipped wood with animal wastes to minimize nutrient loadings through absorption of the wastes. The compost is distributed to all swine producers within the Marpo watershed, and has been recognized to minimize animal wastes runoff into the Marpo wetland.

d. Watershed Inspections

The Non-point Source Branch has recently begun watershed inspections in Priority 1 – Category I watersheds, (i.e., West Takpochau, Kagman, Laulau, Achugao). The goal of the watershed inspections is to gather data during storm events regarding non-point source pollutant loads based on water quality criteria. This is done by marking GPS points at the bottom of a major drainage region, and working upward. All GPS points will be integrated onto a GIS map to be created for long-term storage. Water sampling along all GPS points for dissolved oxygen, temperature, pH, conductivity, turbidity, nitrates and phosphates will occur during storm events for a given drainage. This will identify where the major sources of non-point source pollution are coming from and allow for proper best management practices (BMP) placement.

2. *Earthmoving and Erosion Control Permitting Program*

a. Overview

The Division of Environmental Quality (DEQ) administers a permitting program under the authority of the CNMI Earthmoving and Erosion Control Regulations. The regulations require all earthmoving activities above a certain size to obtain an Earthmoving and Erosion Control Permit. The definition of what constitutes an earthmoving activity is very broad and encompasses almost all construction, agriculture, and underwater construction activities. The earthmoving permit program also serves as the primary permitting mechanism for other environmental and regulatory programs, with each permit application requiring the review and approval of the CNMI Coastal Resources Management Office (CRMO), CNMI Division of Fish and Wildlife (DFW), and the CNMI Historic Preservation Office (HPO). The earthmoving permit then serves as the primary enforcement mechanism for both DFW and HPO, through site-specific conditions included in each permit. CRMO uses the earthmoving permit application as their primary screening mechanism for determining whether a project requires a Coastal Resources Management Permit.

To obtain a permit, an applicant must provide both temporary and a permanent erosion control plans. In practice, DEQ requires that the permanent erosion control plan also address post-development stormwater runoff from the entire developed site or activity. The plans must meet the requirements of the regulations, which specify that erosion control measures be designed for the 25 year, 24 hour storm, and be based on either 75% sediment removal rate, or 24-hour detention of runoff. DEQ considers the appropriate use of stormwater and erosion control Best Management Practices (BMPs) to be consistent with these requirements, and routinely provides technical guidance to the public on BMP selection and design. Through a Clean Water Act Section 319 grant, DEQ will be developing a stormwater and erosion control BMP design manual over the next year, which will be applicable to the CNMI, Guam, and other Pacific islands that wish to use the manual.

Issuance of all commercial and non-residential, non-commercial earthmoving projects is contingent upon the review and approval of DEQ's technical staff, and pre-construction site inspection by DEQ environmental specialists. Certain residential projects with erosion or stormwater concerns also receive this level of review, on a case-by-case basis depending on need. Once construction commences, DEQ inspects all permitted projects to ensure the approved erosion control measures have been implemented, with the exception of residences in areas served by subdivision stormwater systems and other minor projects not requiring the installation of BMPs. DEQ also requires inspection prior to concealment of all post-construction (permanent) stormwater and sediment control structures, such as catch basins and underground infiltration fields.

b. Program Status/Major Projects

During Fiscal Year 2001, DEQ received 102 commercial and 257 non-commercial earthmoving and erosion control permit applications. Non-commercial permits are defined to include all government, agricultural, and residential earthmoving activities.

Due to the decline in economic activity associated with the Asian financial crisis, generally acknowledged as having begun in 1997, there has been little commercial development during the past year. All commercial earthmoving projects during FY 2001 and early FY 2002 were of a relatively small nature. Many of the large resort projects previously permitted by DEQ have yet to begin construction, such as the Bird Island and Obyan Beach Golf Courses and Resorts. These large projects had been permitted in the mid-1990's, but were put on hold pending the resolution of endangered species concerns, and the economic down-turn in the late 1990's may have further delayed these projects.

The only earthmoving projects with a significant potential impact to water quality during FY 2001 and early FY 2002 were large government projects. A brief summary of these projects is included below:

<u>West Tinian Airport Airside Improvements</u> -

The Commonwealth Ports Authority (CPA) is currently constructing a new runway at the Tinian Airport. The project involved over 350 acres of land clearing, and was permitted in December, 2000. Erosion and sediment control structures were installed in accordance with the DEQ-approved erosion control plan. The project is situated on mostly flat ground, with very permeable soils, and a relatively low hazard of erosion. Construction is expected to continue until late 2002.

<u>Kagman Juvenile Detention Facility</u> -

This project involves the construction of a relatively small detention facility (about 5 acres), located on severely erodible soils in a sloped area above Lau Lau Bay. DEQ issued a Notice of Violation and Cease and Desist Order against this project in June, 2001, after repeated warnings to the contractor to install the approved erosion control measures. The start of heavy rains in June caused severe erosion from the site, including from a very large soil stockpile (more than 30,000 cubic yards), which carried the fine red sediment into Lau Lau Bay at the site of a popular recreational beach and dive site. As a result of DEQ's enforcement action, by August, 2001, the approved erosion control measures were in place and the stockpiled soil was removed to a location that did not present a hazard to surface waters.

<u>Tanapag Heights Subdivision</u> -

The CNMI Office of Public Lands (now the Marianas Public Lands Authority) applied in 2001 for the construction of subdivision roads and infrastructure for 273 homestead lots on a steeply sloped and severely erodible area above Tanapag Village. This project is discussed below under the section on Water Quality Certifications. DEQ, EPA, and other CNMI and federal agencies weighed in with serious concerns regarding the potential impact of this project on streams, wetlands, and the Tanapag Lagoon. This project is presently under review, but the EPA has twice recommended that the Army Corps of Engineers deny the Section 404 Permit.

Saipan Integrated Solid Waste Management System -

DEQ issued earthmoving permits for the construction of the new Marpi Solid Waste Landfill Facility and the Lower Base Transfer Station. Neither project poses a significant threat to surface waters, although severe groundwater degradation could occur if these facilities are not constructed or operated properly. The most important aspect with relation to water quality is that the completion of these two facilities will allow the final closure of Puerto Rico Dump, which has undeniably contributed to water quality degradation in Tanapag Harbor. Construction of the transfer station started in 2001, and construction of the landfill began in February, 2002, at about the time this report was written. Construction of the landfill is expected to be completed by December, 2002, and closure of the Puerto Rico Dump will begin shortly thereafter.

c. Program Goals

DEQ has a number of goals for the Earthmoving and Erosion Control Permitting Program:

Stormwater and Erosion Control BMP Manual -

DEQ is presently planning the development of a design manual for the CNMI and Guam that will provide everything necessary to develop site erosion and stormwater control plans, based on the use of Best Management Practices. DEQ received a combination of Section 319 grant funds and money that had bee set aside by EPA for educational programs in the Pacific Islands to pay for the development of the manual. DEQ is in the process of developing a scope of work acceptable to both EPA and Guam EPA, and expects to issue a Request for Proposals (RFP) by mid 2002 for the project. The project will also include workshops to introduce the new manual to the public in the CNMI and in Guam.

Revise Regulations -

The Earthmoving and Erosion Control Regulations need to be amended to focus more on the use of BMPs, and to implement certain requirements of the Section 6217 Coastal Non-Point Source Pollution Program. In addition, DEQ regularly receives pressure from the regulated community to streamline the permit application process. DEQ sees an opportunity to improve the regulations in conjunction with the development of the Stormwater and Erosion Control BMP Manual described above.

Increase Monitoring and Inspection -

DEQ plans to increase monitoring and inspection of on-going construction projects during 2002 utilizing existing program personnel.

Implement post-construction BMP inspection and evaluation program -

DEQ would like to implement an inspection program to evaluate the long-term effectiveness of stormwater BMPs implemented as part of earthmoving permit requirements. DEQ plans to develop a general inspection program strategy and identify resource and personnel needs before the end of 2002.

Secondary Road Maintenance -

Secondary (coral) roads in the CNMI are one of the biggest sources of eroding sediment in the CNMI. In 1997, DEQ hosted a workshop for government road maintenance personnel on proper road grading to minimize erosion. However, many of the operators present at this training have retired or no longer work for the government. DEQ would like to host another workshop in the near future, preferably with the assistance of an experienced consultant. DEQ will look into funding for such a workshop in FY 2003. Additionally, DEQ will look into the possibility of issuing island-wide general permits for road maintenance operations as a means of enforcement, as maintenance of existing roads is presently no permitted.

3. *Water Quality Standards & Certification Program*

a. Overview

The CNMI Water Quality Standards set criteria for all Commonwealth waters and ground water in order to protect their use and value for propagation of fish and wildlife, recreational purposes, public water supply use, and takes into consideration their use and value for commerce. DEQ frequently uses the numerical and narrative water quality standards as the basis for enforcement actions in cases where other CNMI regulations are not quite so clear, for instance, sewer overflows from privately owned sewers. In addition to providing numerical and narrative water quality standards, the Standards also contain the CNMI Anti-Degradation Policy, Mixing Zone requirements, Land Disposal of Wastewater permitting program, and the Section 401 Water Quality Certification program. DEQ also consults the Water Quality Standards when evaluating Coastal Resources Management (CRM) Major Siting Permits, and has cited the potential for violation of the Standards as justification for both special conditioning of CRM permits, and occasionally denial recommendations.

DEQ issues Section 401 Water Quality Certifications for any federally-permitted or licensed activity that may result in a discharge into waters of the United States. This includes all projects requiring an NPDES permit, an Army Corps of Engineers Section 404 permit, and certain projects permitted under Section 10 of the Rivers and Harbors Act that may involve discharges, such as commercial jet ski operations that involve the installation of fixed platforms and buoys. The CNMI Water Quality Standards form the basis of certification determinations.

b. Program Status/Major Projects

CNMI Section 401 Water Quality Certifications cover a wide variety of discharges, from sewage outfalls to minor activities occurring in wetlands under the authority of the Corps' Nation-Wide Permit program. In addition to individual Section 401 Water Quality Certifications, the program also provides for DEQ review and approval of Storm Water Pollution Prevention Plans (SWPPP) for projects and activities that require a NPDES Stormwater General Permit, such as the bulk fuel facilities at each island's seaports and airports.

The following is a brief list of major projects and on-going activities that either received Section 401 Water Quality Certification or were monitored for compliance with certifications issued in prior years:

Reverse Osmosis Discharges -

In 2000, EPA issued a General Permit for the discharge of reverse osmosis brine from commercial de-salinization plants. Typically, these plants are operated by hotels to provide potable water for their guests and operations, but there are also several garment manufacturing facilities and commercial bottled water suppliers that are covered by this permit. The facilities that are covered typically discharge directly to the shoreline through existing storm drainages. Most (if not all) of the storm drains where discharges occur suffer from serious water quality problems, including microbiological violations and algae blooms, the sources of which are not clear. Over the past two years, all but a few dischargers have obtained coverage under the NPDES Permit and individual Section 401 Water Quality Certifications. However, many permittees are not meeting the discharge monitoring requirements, and most that are have been found to be violating the discharge limits for nitrogen, phosphorous, sulfide, and ammonia. In December, 2001, EPA held a meeting with all permitted dischargers to discuss compliance. It was decided during the meeting that the dischargers, with assistance from DEQ, would jointly fund a study to determine the effects of their discharge on the nearshore marine environment, to either support a change in the discharge limitations, or to support alternate disposal requirements if adverse effects are discovered. As of the date of this report, no progress has been made toward commissioning this study.

Sadog Tasi Sewage Treatment Plant -

This treatment plant is operated by the Commonwealth Utilities Corporation (CUC) and is designed to provide secondary treatment for an average daily flow of 4.8 million gallons per day (MGD). The annual average flow was 3.0 MGD in 1998. The treated effluent is discharged through an ocean outfall at a depth of 49 feet, approximately 1,200 feet offshore into the Class A receiving waters of Tanapag Harbor. A new NPDES Permit was issued by EPA in April, 2001. As part of this permit, CUC was required to establish a mixing zone. The mixing zone analysis was performed by EPA, and resulted in the determination that the discharge is presently violating the CNMI Water Quality Standards for Enterococci, copper, silver, and zinc. In their April 9, 2001, cover letter for the NPDES Permit, EPA stated that issuance of an Administrative Order would follow within weeks, and would require that CUC come into compliance with the discharge requirements within a set time schedule. DEQ's Section 401 Water Quality Certification was issued with the condition that CUC strictly follow the requirements of EPA's proposed Administrative Order, which was said to be forthcoming at the time. As of the date of this writing (March, 2002), EPA has not issued an Administrative Order.

The NPDES Permit contained discharge monitoring and reporting requirements, including the requirement to monitor and report marine water quality at the site of the outfall. In 2001, DEQ collected split samples with CUC at the boundaries of the 49-ft. mixing zone. The samples indicated violations of the microbiological criteria, low dissolved oxygen (less than 10%), and elevated turbidity. CUC's reporting of their monitoring results had been inconsistent. DEQ is working with CUC to improve reporting.

Agingan Point Sewage Treatment Plant -

This plant is also operated by the Commonwealth Utilities Corporation, and was designed to provide secondary treatment for an average daily flow of 3.0 million gallons per day (MGD). The annual average flow was 2.04 MGD in 1998. The treated effluent is discharged at the surf line through an intertidal outfall into the Class A receiving waters of Tinian Channel. EPA issued an NPDES permit on September 20, 1999, and an Administrative Order on November 1, 1999, for violations of effluent limitations for indicator organisms, nutrients, metals, and turbidity. A compliance schedule was developed by CUC and EPA which calls for the construction of a new ocean outfall, and additional treatment to reduce concentrations. As of the date of this writing, the design of the new outfall is underway, and CUC anticipates construction to begin in spring 2003.

The NPDES Permit contained discharge monitoring and reporting requirements, including the requirement to monitor and report marine water quality along the surf zone near the outfall. To date, CUC has not complied with the requirement to report these marine water quality monitoring results. DEQ has not performed independent water quality monitoring at the site of the Agingan STP outfall.

Santa Margarita Salvage Operation -

This is an underwater salvage project that has been on-going since 1994. DEQ issued a revised Section 401 Water Quality Certification in early 1999, and work has proceeded under this authorization each dive season since then. The 2001 dive season passed with no trouble. Daily turbidity monitoring reports were submitted by the permittee (IOTA Partners) and no violations were noted.

Saipan Integrated Solid Waste Management System -

DEQ issued a Section 401 Water Quality Certification for this project in August, 2000, which includes the construction of a new solid waste transfer station and landfill. The reason for issuance of this certification was the filling of a small jurisdictional wetland at the Lower Base Transfer Station site. This wetland was replaced with an on-site mitigation wetland of larger size than was filled. The most important aspect of this project, however, is the construction of the new landfill in Marpi, which will allow the final closure of the Puerto Rico Dump. The continued operation of the Puerto Rico Dump is perhaps the most visible environmental problem in the CNMI, and has been the subject of an EPA Administrative Order based on violations of the Clean Water Act since 1994. Construction of the Lower Base Transfer Station began in 2001, and construction of the Marpi Solid Waste Landfill Facility began in February, 2002. Completion of construction is expected in December, 2002, which would allow final closure of the Puerto Rico Dump to begin by early 2003, depending on funding.

<u>Tanapag Heights Subdivision Project</u> -

The CNMI Office of Public Lands (now the Marianas Public Lands Authority, or MPLA) applied in 2001 for the construction of subdivision roads and infrastructure for 273 homestead lots on a steeply sloped and severely erodible area above Tanapag Village. The proposed construction involved several stream crossings and wetland fills. DEQ responded to the application with a number of serious concerns regarding the project's potential to adversely affect not only the site streams and wetlands, but also the Tanapag Lagoon below the site. DEQ's concerns were followed by similar letters from the CNMI Division of Fish and Wildlife, the U.S. Fish and Wildlife Service, and the EPA. The EPA's letter recommended that the Corps deny the permit. The applicant has recently revised their application to reduce the proposed number of homestead lots to 131 units, and eliminated lots in the most sensitive watershed. However, as of this writing, EPA's most recent response continues to recommend that the Corps deny the permit.

c. Program Goals

DEQ has a number of goals for the Water Quality Standards and Certification Program:

<u>Water Quality Standards Update</u> -

DEQ will soon update the Water Quality Standards, which is required every three years. The last update was in 1997. At this time, and in consideration of the workload on DEQ's limited technical staff, DEQ sees no need for this update to go beyond a simple update of numerical water quality criteria to reflect changes in the EPA's National Recommended Water Quality Criteria, and errors noted in DEQ's 1997 standards. DEQ intends to develop the draft update before the end of FY 2002.

<u>Education/Outreach</u> –

DEQ has observed a general lack of understanding regarding the actual function of the Water Quality Standards, which contain many different elements. DEQ would like to educate its own staff, the public and other elements of the CNMI government. In particular, and first priority, DEQ wants to host a workshop for the Coastal Resources Management Office (CRMO) permitting and enforcement staff, as well as for the members of the CRM Permitting Board Agencies. This workshop will also incorporate DEQ staff. DEQ tentatively plans to develop and host this workshop around the end of FY 2002.

Sanitary Sewer Overflows -

SSOs occur regularly from the Commonwealth Utilities Corporation sewer system. Many overflows discharge directly to marine waters, usually at beach areas. Overflows that no not discharge directly to the marine water indirectly eventually reach surface waters through transport by stormwater runoff. DEQ has identified SSOs as one of the more important causes of microbiological contamination at Saipan's Beaches. Many of the overflows are caused by sewer lift station failures, and are preventable. CUC recently hired a maintenance manager for their Wastewater Division, and began monthly wastewater meetings with DEQ to discuss overflows and progress made toward preventing them. CUC had several lift station upgrade projects underway at the time of this writing. DEQ's goal is to develop a strategy for actions the agency can take to improve the overflow problems.

4. Individual Wastewater Disposal System Permitting Program

a. Overview

The Division of Environmental Quality (DEQ) administers a permitting program under the authority of the Individual Wastewater Disposal Systems (IWDS) Rules and Regulations. The regulations establish minimum standards for on-site disposal systems, including septic systems and other wastewater treatment systems (OWTS), such as package treatment plants. All new development that is not connected to a sewer system must obtain a permit for the construction of an IWDS or OWTS. The OWTS regulations also require treatment of animal waste, but no specific treatment requirements are included in the regulations.

The program also covers the maintenance of new and existing IWDS, requirements when the systems fail, requirements for temporary toilets at construction sites and outdoor events, and a registration program for wastewater haulers.

The regulations set somewhat rigid design requirements for septic systems. Each application for a new or replacement septic system is thoroughly reviewed by DEQ program and technical staff for adherence to these requirements. Septic system designs are based on individual percolation tests for each site. DEQ assists applicants with septic system design, and has developed materials that graphically illustrate the requirements of the regulations, including detail drawings suitable for incorporation into residential design plans. DEQ held a design workshop in 1999 for local engineers and contractors, and intends to host another workshop this year. DEQ has found that the combination of the workshop and the printed materials has dramatically improved compliance and permit issuance time.

Once a permit is issued, DEQ staff perform a series of inspections for every system to ensure it is properly constructed. Inspections occur prior to permitting once system component locations are staked out, and at every step requiring concealment of work. When construction has been completed to DEQ's specifications, the owner is issued a certification of use, and the Department of Public Works building occupancy permit can be released. DEQ does not yet have a program in place to inspect septic systems for proper maintenance once in use.

Larger facilities that cannot connect to a sewer system must construct an Other Wastewater Treatment System (OWTS). The regulations reference design standards for the construction of sewage treatment plants. Over the past several years, DEQ has issued permits for several facilities employing OWTS for on-site sewage treatment, ranging from a small package treatment plant for a U.S. government communication facility on Tinian, to a large lagoon and wetland system for a resort in Rota. OWTS permits require discharge monitoring, and enforcement is entirely within the jurisdiction of DEQ.

Recently, several subsurface-flow constructed wetland systems have been built on Saipan, which fall somewhere between a traditional septic system and a more maintenance-intensive OWTS. Because DEQ's regulations do not cover these systems specifically, DEQ has permitted them as OWTS, but with far less monitoring and maintenance requirements. The regulations need to be revised to accommodate such facilities, which have been proven to provide very effective treatment with low maintenance requirements.

b. Program Status/Major Projects

DEQ received 107 IWDS Permit applications, 18 Wastewater Pumper Truck Registrations, and 3 OWTS applications in FY 2001. Most IWDS applications were for individual residences or small commercial buildings. The three OWTS applications were for subsurface flow constructed wetland systems at the Kagman High School, Kagman Junior High School, and Kagman Juvenile Detention Facility on Saipan. Of those three, only the Kagman High School OWTS had been constructed and permitted for use at the time of this writing.

The following is a summary of important OWTS that have been previously permitted by DEQ, and are presently being monitored:

<u>Stanford Hotel (San Vicente, Saipan)</u> –

The Stanford Hotel operates an OWTS consisting of an aerobic treatment unit and subsurface discharge. This system had been previously permitted by DEQ, but the Stanford Hotel has not renewed their permit and is not currently complying with OWTS operation and monitoring requirements. DEQ is in the process of developing an enforcement action.

Er Est Golf Course Resort (Rota) –

The Rota Resort operates an OWTS consisting of a lagoon system with a free water surface constructed wetland, ultraviolet disinfection, and re-use of treated effluent for golf course irrigation. The treatment system has been operating considerably below its design capacity since it was constructed, and is regularly augmented with well water to maintain flow. Aside from occasional late reporting of discharge monitoring results, the Rota Resort has generally maintained compliance with permit conditions.

McDonalds Restaurant (Chalan Lau Lau, Saipan) –

McDonalds operates a package treatment plant and discharges to a subsurface seepage pit. In January, 2001, McDonalds connected to a new sewer line in the area, and is in the process of decommissioning their treatment plant.

Seishin Farms (Kalabera, Saipan) –

DEQ issued an OWTS permit for this relatively large pig farm in 1996. At the time, the treatment system consisted of a mechanical solids removal system and an oxidation pond. Solids were to be removed and dried on a nearby, concrete drying bed. Treated effluent from the oxidation pond was to be disposed by spray irrigation onto a nearby vegetated area. In September 2001, DEQ inspected the site based on a complaint, and found that the treatment system had fallen into disrepair and was no longer in operation. Sludge had spread across a large portion of the property, and wastewater was routinely overflowing off the site onto neighboring properties, into a stream bed leading toward the ocean. A Notice of Violation was served to the owner, who secured an agreement for assistance from the USDA Natural Resources Conservation Service. To date, no further progress has been made by the owner. DEQ is continuing with monitoring and enforcement procedures.

Tinian Dynasty Hotel & Casino (San Jose, Tinian) –

The Tinian Dynasty operates a large package treatment plant that discharges to a series of subsurface leaching fields, approximately 1,000 feet from the shoreline at Tachogna Beach. While the Tinian Dynasty has been submitting monitoring reports, they have failed to monitor for nitrate and settleable solids for approximately the past year. Previous monitoring results had revealed the plant consistently violated the 1.0 mg/l Nitrate limit, which had been based on the DEQ Water Quality Standards, although the results were below the 10 mg/l drinking water limit. As part of the Tinian Dynasty's original CRM permit, marine monitoring at Tachogna Beach had been required to monitor for potential adverse effects related to the effluent discharge. The Tinian Dynasty has yet to implement the required monitoring program, despite repeated meetings and written notices.

LSG Flight Kitchen (Saipan Airport) –

This facility utilizes a combination of aerobic treatment and a subsurface flow constructed wetland prior to discharge to a subsurface leaching field. Though the facility has occasionally failed to submit monitoring reports, and suffered one overflow incident, recent monitoring reports have shown that the facility is performing satisfactorily. This facility will eventually be decommissioned when the Airport sewer system is completed, which could occur as early as late 2002.

Pena Plantation (Papago, Saipan) –

This is a relatively simple treatment system, designed to serve a small residential subdivision (less than 5,000 GPD) and was permitted in 1997. Treatment consists of a sedimentation/septic tank, followed by a subsurface-flow constructed wetland prior to subsurface discharge in a small leaching field. Although the system is small, DEQ's original permit included the same operation and reporting requirements required for large package treatment plants, including monthly discharge monitoring and supervision by a licensed wastewater treatment system operator. After a few years of operation below design capacity, and regular submission of monitoring reports showing satisfactory to excellent performance, DEQ suspended many of the operation and monitoring requirements indefinitely.

Kagman Sewage Treatment Plant (Kagman, Saipan) –

Although no application has been submitted, the Commonwealth Utilities Corporation (CUC) is in the process of designing a sewage collection and treatment system for the Kagman area of Saipan. Initial discussions indicate that this project will not involve an ocean outfall, and may instead limit disposal to effluent reuse by the Lau Lau Bay Golf Course and the nearby agricultural area, or by deep injection. As such, the project may not require an NPDES permit from EPA, and primary regulatory responsibility would fall to DEQ's OWTS permitting program. The proposed system would be the largest and most complex system permitted under the OWTS program. DEQ has made every effort to work with CUC and their designer to ensure all regulatory concerns are taken into consideration. DEQ has also made considerable effort to steer the design toward more simple and easily maintained treatment methods, such as lagoons and wetlands. However, the designer recommended a more complex tertiary treatment system based on an activated sludge process at the most recent meeting involving DEQ (summer, 2001). In the time that has elapsed since then, DEQ has not been included in any further meetings with the designer, however, CUC has reportedly continued to push for a simpler design. CUC personnel traveled to the U.S. with the designers to tour lagoon and constructed wetland systems in January, 2002.

c. Program Goals

DEQ has a number of long-term goals for the IWDS/OWTS permitting program:

Regulation Revision -

The recent permitting of several constructed wetland systems has illuminated the need for revisions to the regulations. In addition, the upcoming Kagman Sewage Collection and Treatment System may require revisions to the regulations in order to allow beneficial reuse of treated effluent. At present, DEQ's regulations are very inflexible regarding reuse of effluent, while other states have adopted reuse regulations that allow more beneficial uses. Depending on DEQ's workload, draft regulations may be developed toward the end of 2002. Potential areas requiring revision include:

- Constructed wetland design and permitting requirements
- Revised wastewater reuse regulations
- Performance and permitting requirements for alternative on-site treatment methods
- Performance and permitting requirements for Confined Animal Feeding Operations (CAFOs)

IWDS Inspection Program -

DEQ needs to implement an inspection program to ensure permitted septic systems are maintained in accordance with the provisions in the regulations. As part of this program, DEQ would also collect data on performance and failure of permitted systems. DEQ identified the need for an additional FTE to carry out this program, however, the position was re-allocated within DEQ and the program was not implemented. DEQ hopes to have this position filled by 2003, depending on budget.

Outdoor toilets -

Village inspections by the CNMI Bureau of Environmental Health in 2000 found that in some villages on Saipan, as many as 30% of the homes do not have septic systems, and instead rely on outdoor "pit" toilets and outdoor showers. DEQ would like to work with BEH and other CNMI government entities to assist these people with installing septic systems (or sewer connections) and more sanitary plumbing facilities. An inter-agency public health regulations task force had been formed to address this and other issues in 2000, but ceased to function in 2001 due to departure of key personnel. Progress on this issue ceased with the dissolution of the task force.

IWDS Design Workshop -

DEQ plans to host another septic system design workshop in 2002, similar to the workshop held in 1999, to train local engineers, architects, and contractors on the basic design requirements for septic systems.

5. *Other Programs and Issues Related to Water Quality*
    a. Puerto Rico Dump

As discussed in the sections above, the construction of a new Municipal Solid Waste Landfill in Marpi, Saipan, began in February, 2002. The opening of the new landfill will finally allow the cessation of dumping at the Puerto Rico Dump, however, no funds for the actual closure of PRD had been identified at the time of this writing. Governor Juan N. Babauta appointed a Solid Waste Task Force in February, 2002, with the express purpose of addressing the closure of the PRD, as well as all other solid waste issues. If all goes well, the CNMI government expects the new landfill to be opened by December, 2002, and final closure of the Puerto Rico Dump to begin shortly thereafter.

b. Rodent Control Task Force

In late 2000, two cases of the disease leptospirosis surfaced on Saipan, including one fatality. Both victims had visited an area of the island known as Talofofo; but only the victim who died had swam in the Talofofo falls. Although there was no conclusive evidence linking the Talofofo area to the disease, a multi-agency task force was formed to investigate. Although sampling results showed violations of the microbiological standards for E. coli and Enterococci, a watershed survey performed by DEQ revealed no obvious sources of the disease, which is commonly carried by livestock. Therefore, and under the direction of the CNMI Veterinarian, the task force shifted focus to the other most common carrier of the disease – rats. The name of the task force was changed to reflect its new mission. Since its inception, the task force has produced and distributed an informative brochure in English and Chinese about the disease, how to avoid contracting it, and how to keep rats away from one's home or business. At the time of this writing, the task force was in the process of developing a 60-second educational television spot for regular broadcast to the public with the assistance of and funding by DEQ. Other issues discussed by the task force included a potential rat baiting campaign, and efforts at improving general village sanitation.

IV. Ground Water Assessment

A. Numeric Ground Water Standards

At the present time, the CNMI does not have numerical classification standards for ground water. There is a requirement in the CNMI Groundwater Management and Protection Act for the designation of Class I, II, and III aquifers. U.S. EPA Region IX and DEQ are presently planning to use contracted resources to develop aquifer classification maps for Saipan based on existing geologic and groundwater data. This has been difficult to do without any significant data sources on quality of aquifers. However, as the GIS system develops, this will allow for a better opportunity to designate aquifers. Although not enforceable, Saipan is still a long way from meeting the EPA secondary drinking water standards. However, they are being proposed and monitored to be used in aquifer classification. Marine water quality standards will be used to protect ground water in the near-shore environment.

B. Summary Results of Ground Water Monitoring

The CNMI Groundwater Protection and Management Act was enacted into law in 1988. The first set of Well Drilling regulations were adopted in 1992 and later amended in 1994. The well drilling regulations set standard requirements and criteria for licensed well drillers, well construction, setback distances, and requirements for operating of new and renewed wells. As part of operations, annual monitoring of chlorides, conductivity, total dissolve solids, pH, total coliform and monthly withdrawal rate of water are required for all wells.

With the new GIS program and hand held GPS units, DEQ will continue to develop a database of all private wells with information on operation date, location, and monitoring data. The database is its early infantile stages with much need for improvement on quality control of missing or inaccurate data. It is envisioned that the data will be integrated into the CNMI GIS system. DEQ will be able to use the fully developed GIS system to identify existing sources of contamination and potential problems for proposed new and existing wells.

A general review of the sample data for the private wells shows that chlorides and conductivity gradually increase over time in many of the wells. In some wells, a reduction in the operating pressure has resulted in a decrease in conductivity and chlorides. (Note: Conductivity was believed to be a better indicator of increasing saltwater intrusion due to potential laboratory error associated with testing equipment for chlorides). It is the current unofficial policy to limit all new wells to under a pumping rate of 20 gallons per minute unless there are unusual circumstances with high quality aquifer and special needs.

As DEQ laboratory capabilities increase, DEQ will continue requiring the testing of nitrates in private and municipal water wells used for drinking and other human consumptions. To be assured that the quality of ground water being used by the local community is not contaminated from old military or current activities, testing for metals, volatile organic compounds, and synthetic organic compounds, pesticide and herbicide, radionuclides and other inorganic compounds were required as part of a source water assessment. In May 2000, DEQ and EPA region IX conducted an island wide sampling of all private wells for VOC's, metals, pesticides and herbicides on several wells. In 1999, DEQ started enforcing the Phase II/V chemical monitoring and is currently underway. Several private well were found to have exceeded the EPA Maximum Contaminant Level (MCL) for drinking water.

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