301(h) MODIFIED PERMIT APPLICATION

AGANA

SEWAGE TREATMENT PLANT

GUAM WATERWORKS AUTHORITY

Government of Guam
Post Office Box 3010, Agana, Guam 96932
Phone: (671)479-7813 Fax: (671)479-7879

MAR 27 1998

Lily Ning Lee
Guam Program Manager
U.S. Environmental Protection Agency
Pacific Insular Areas Program
75 Hawthorne Street (CMD-5)
San Francisco, Ca. 94105

Re: 301 (h) Modified Permit Application for Northern District STP

Dear Lily:

Enclosed is the Guam Waterworks Authority's 301(h) Modified Permit Application for the Agana Sewage Treatment Plant.

This package contains a certification of veracity, a signed, completed NPDES application and a completed application questionnaire.

Included in the revised application package are the A/E and construction schedules for the Agana STP outfall extension. The A/E work - inclusive of the baseline study - has begun and although, funding has not yet been secured to construct the Agana outfall extension, GWA intends to identify funding sources to keep with the attached construction schedule (Appendix G). GWA is committed to extending the outfall to a point sufficient to demonstrate that no decrease in receiving water quality will occur and that water currents will not carry material back into the inner reef areas or to shore.

Copies of the attached will be forwarded to the local EPA office, Bureau of Planning and Department of Agriculture. These particular agencies oversee programs which may be impacted by GWA's discharge at Tanguisson Point. As such, in sections of the Application Questionnaire where input regarding their programs are requested, reference will be made to these letters of determination and forthcoming comments from these respective agencies.

The results of the Priority Pollutant Scan and the Industrial User Survey will be forwarded to your office as soon as GWA receives them and has completed its review of the resulting data.

Please advise me if additional information is needed to complete the application process.

Sincerely,

Richard A. Quinanilla
General Manager

cc: Director, Bureau of Planning
Administrator, Guam EPA
Director, Department of Agriculture

TABLE OF CONTENTS

ITEM	APPENDICES	
O	Appendix A:	Outfall Repair Information
P	Appendix B:	Population Information
Q	Appendix C:	Discharge Monitoring Reports
R	Appendix D:	Daily and Monthly Flow Reports
S	Appendix E:	Revised Guam Water Quality Standards
T	Appendix F:	Water Pollution Control Act
U	Appendix G:	Outfall Extension - A/E and Construction Schedule
V	Appendix H:	Outfall Extension - Memo to DPW (WWTP refurbishment money)
W	Appendix I:	Outfall Extension - Baseline A/E Requirements
X	Appendix J:	Letter of Determination Requests
Y	Appendix K:	Industrial Users' Survey
Z	Appendix L:	As Built Record of System
A1	Appendix M:	Engineering Details: ASTP Outfall

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

GUAM WATERWORKS AUTHORITY

Government of Guam
Post Office Box 3010, Agana, Guam 96932
Phone: (671)479-7823 Fax: (671)479-7879

Statement of Veracity

I certify that under penalty of law that I have personally examined and am familiar with the information submitted in the attached document(s) and, based on my inquiry of those individuals immediately responsible for obtaining the information. I am convinced that the information is true, accurate and correct. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Richard A. Quintanilla
General Manager

A

NPDES APPLICATION

FORM APPROVED
OMB No. 158-R0100

FOR AGENCY USE

		Number of Discharge Points		Total Volume Discharged, Million Gallons Per Day
To: Surface Water	107a1	1	107a2	
Surface Impoundment with no Effluent	107b1	N/A	107b2	N/A
Underground Percolation	107c1	N/A	107c2	N/A
Well (injection)	107d1	N/A	107d2	N/A
Other	107e1	N/A	107e2	N/A
Total Item 7	107f1	1	107f2	
If 'other' is specified, describe	107g1			

If any of the discharges from this facility are intermittent, such as from overflow or bypass points, or are seasonal or periodic from lagoons, holding ponds, etc., complete Item 8.

8. Intermittent Discharges

a. Facility bypass points Indicate the number of bypass points for the facility that are discharge points. (see instructions) — 108a: 1

b. Facility Overflow Points Indicate the number of overflow points to a surface water for the facility (see instructions). — 108b: None

c. Seasonal or Periodic Discharge Points Indicate the number of points where seasonal discharges occur from holding ponds, lagoons, etc. — 108c: None

9. Collection System Type Indicate the type and length (in miles) of the collection system used by this facility. (see instructions) — 109a

- Separate Storm — ☐ SST
- Separate Sanitary — ☒ SAN
- Combined Sanitary and Storm — ☐ CSS
- Both Separate Sanitary and Combined Sewer Systems — ☐ BSC
- Both Separate Storm and Combined Sewer Systems — 109b: ☐ SSC
- Length — _____ miles

10. Municipalities or Areas Served (see instructions)

	Name		Actual Population Served
110a	Asan/Piti	110b	4,645
110a	Central Guam	110b	43,680
110a	Tamuning	110b	18,500
110a	Yona	110b	3,320
110a	Military	110b	12,700
	Total Population Served	110c	82,845

Form Approved.
OMB No. 2040-0086
Approval expires 7-31-88

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NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER

STANDARD FORM A – MUNICIPAL

SECTION I. APPLICANT AND FACILITY DESCRIPTION

Unless otherwise specified on this form all items are to be completed. If an item is not applicable indicate 'NA.'

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

Please Print or Type

1. Legal Name of Applicant (see instructions)	101	Public Utility Agency of Guam
2. Mailing Address of Applicant (see instructions) Number & Street	102a	P.O. Box 3010
City	102b	Agana
State	102c	Guam
Zip Code	102d	96910
3. Applicant's Authorized Agent (see instructions) Name and Title	103a	
Number & Street	103b	P.O. Box 3010
City	103c	Agana
State	103d	Guam
Zip Code	103e	96910
Telephone	103f	671 (Area Code) 646-8891-5 (Number)
4. Previous Application If a previous application for a permit under the National Pollutant Discharge Elimination System has been made, give the date of application.	104	___ ___ ___ YR MO DAY

I certify that I am familiar with the information contained in this application and that to the best of my knowledge and belief such information is true, complete, and accurate.

Joseph F. Mesa (Printed Name of Person Signing)	102e	Chief Officer, PUAG (Title)
Signature of Applicant or Authorized Agent	102f	28 DEC 1990 (YR MO DAY) Date Application Signed

18 U.S.C. Section 1001 provides that:

Whoever, in any matter within the jurisdiction of any department or agency of the United States knowingly and wilfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statement or representation, or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.

FOR AGENCY USE

Received ___ ___ ___ YR MO DAY

OFFICE: ___ EPA Region Number
___ State

FOR AGENCY U.

11. Average Daily Industrial Flow — Enter estimated average daily waste flow from all industrial sources. | 111 | _____ mgd

Note: All major industries (as defined in Section IV) discharging to the municipal system must be listed in Section IV.

12. Permits, Licenses and Applications
List all existing, pending or denied permits, licenses and applications related to discharges from this facility. (see instructions)

	Issuing Agency	For Agency Use	Type of Permit or License	ID Number	Date Filed YR/MO/DA	Date Issued YR/MO/DA	Date Denied YR/MO/DA	Expiration Date YR/MO/DA
112	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.								
2.								
3.								

13. Maps and Drawings
Attach all required maps and drawings to the back of this application. (see instructions)

14. Additional Information

114 Item Number	Information

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STANDARD FORM A—MUNICIPAL

FOR AGENCY USE

SECTION II. BASIC DISCHARGE DESCRIPTION

Complete this section for each present or proposed discharge indicated in Section I, Items 7 and 8, that is to surface waters. This includes discharges to other municipal sewerage systems in which the waste water does not go through a treatment works prior to being discharged to surface waters. Discharges to wells must be described where there are also discharges to surface waters from this facility. Separate descriptions of each discharge are required even if several discharges originate in the same facility. All values for an existing discharge should be representative of the twelve previous months of operation. If this is a proposed discharge, values should reflect best engineering estimates.

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

1. Discharge Serial No. and Name
   a. Discharge Serial No. (see instructions) — 201a: 001
   b. Discharge Name Give name of discharge, if any (see instructions) — 201b: Agana Sewage Outfall
   c. Previous Discharge Serial No If a previous NPDES permit application was made for this discharge (Item 4, Section I) provide previous discharge serial number. — 201c: Gu 0020087

2. Discharge Operating Dates
   a. Discharge to Begin Date If the discharge has never occurred but is planned for some future date, give the date the discharge will begin. — 202a: 90 (YR) R (MO)
   b. Discharge to End Date If the discharge is scheduled to be discontinued within the next 5 years, give the date (within best estimate) the discharge will end. Give reason for discontinuing this discharge in Item 17. — 202b: N/A (YR MO)

3. Discharge Location Name the political boundaries within which the point of discharge is located:

			Agency Use
State	203a	Guam	203d
County	203b	N/A	203e
(If applicable) City or Town	203c	Agana	203f

4. Discharge Point Description (see instructions)
   Discharge is into (check one)

Stream (includes ditches, arroyos, and other watercourses)	204a	☐ STR
Estuary		☐ EST
Lake		☐ LKE
Ocean		☒ OCE
Well (Injection)		☐ WEL
Other		☐ OTH
If 'other' is checked, specify type	204b	

5. Discharge Point — Lat/Long. State the precise location of the point of discharge to the nearest second. (see instructions)

Latitude	205a	13	DEG.	29	MIN.	3.3 SEC
Longitude	205b	144	DEG.	44	MIN.	37.1 SEC

AGA 1774

DISCHARGE SERIAL NUMBER

001

FOR AGENCY USE

6. Discharge Receiving Water Name
Name the waterway at the point of discharge.(see instructions)

206a Agana Bay (Philippine Sea)

If the discharge is through an outfall that extends beyond the shoreline or is below the mean low water line, complete item 7.

206b

For Agency Use		
Major	Minor	Sub

206c

For Agency Use 303e

7. Offshore Discharge

a. Discharge Distance from Shore 207a 2,875 feet

b. Discharge Depth Below Water Surface 207b 85 feet

If discharge is from a bypass or an overflow point or is a seasonal discharge from a lagoon, holding pond, etc., complete items 8, 9 or 10, as applicable, and continue with item 11.

8. Bypass Discharge (see instructions)

a. Bypass Occurrence
Check when bypass occurs

Wet weather 208a1 ☒ Yes ☐ No

Dry weather 208a2 ☐ Yes ☒ No

b. Bypass Frequency Give the actual or approximate number of bypass incidents per year.

Wet Weather 208b1 1 times per year

Dry weather 208b2 4 times per year

c. Bypass Duration Give the average bypass duration in hours.

Wet weather 208c1 1-3 hours

Dry weather 208c2 _____ hours

d. Bypass Volume Give the average volume per bypass incident, in thousand gallons.

Wet weather 208d1 _____ thousand gallons per incident

Dry weather 208d2 _____ thousand gallons per incident

e. Bypass Reasons Give reasons why bypass occurs. 208e Heavy Rain, pump repair at Agana Main P.S., renovation of flap valve at Agana T.P. and sometimes due to power outage

Proceed to item 11.

9. Overflow Discharge (see instructions)

a. Overflow Occurrence Check when overflow occurs.

Wet weather 209a1 ☐ Yes ☒ No

Dry weather 209a2 ☐ Yes ☒ No

b. Overflow Frequency Give the actual or approximate incidents per year.

Wet weather 209b1 N/A times per year

Dry weather 209b2 N/A times per year

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Approval expires 7-31-88

DISCHARGE SERIAL NUMBER

FOR AGENCY USE

c. **Overflow Duration** Give the average overflow duration in hours.

Wet weather	209a1	N/A hours
Dry weather	209a2	N/A Hours

d. **Overflow Volume** Give the average volume per overflow incident in thousand gallons.

Wet weather	209d1	N/A thousand gallons per incident
Dry weather	209d2	N/A thousand gallons per incident

Proceed to Item 11

10. **Seasonal/Periodic Discharges**

a. **Seasonal/Periodic Discharge Frequency** If discharge is intermittent from a holding pond, lagoon, etc., give the actual or approximate number of times this discharge occurs per year. — 210a: N/A times per year

b. **Seasonal/Periodic Discharge Volume** Give the average volume per discharge occurrence in thousand gallons. — 210b: N/A thousand gallons per discharge occurrence

c. **Seasonal/Periodic Discharge Duration** Give the average duration of each discharge occurrence in days. — 210c: _____ days

d. **Seasonal/Periodic Discharge Occurrence—Months** Check the months during the year when the discharge normally occurs. — 210d:

☐ JAN ☐ FEB ☐ MAR
☐ APR ☐ MAY ☐ JUN
☐ JUL ☐ AUG ☐ SEP
☐ OCT ☐ NOV ☐ DEC

11. **Discharge Treatment**

a. **Discharge Treatment Description** Describe waste abatement practices used on this discharge with a brief narrative. (See instructions) — 211a:

DISCHARGE SERIAL NUMBER

FOR AGENCY USE

b. Discharge Treatment Codes Using the codes listed in Table I of the Instruction Booklet, describe the waste abatement processes applied to this discharge in the order in which they occur, if possible. Separate all codes with commas except where slashes are used to designate parallel operations.	211b	SC, G, M, C, D, T, VC, X, N
If this discharge is from a municipal waste treatment plant (not an overflow or bypass), complete items 12 and 13		
12. Plant Design and Operation Manuals Check which of the following are currently available		
a. Engineering Design Report	212a	☐
b. Operation and Maintenance Manual	212b	☒
13. Plant Design Data (see instructions)		
a. Plant Design Flow (mgd)	213a	17.0 mgd
b. Plant Design BOD Removal (%)	213b	25.40 %
c. Plant Design N Removal (%)	213c	%
d. Plant Design P Removal (%)	213d	%
e. Plant Design SS Removal (%)	213e	40-60 %
f. Plant Began Operation (year)	213f	1979
g. Plant Last Major Revision (year)	213g	N/A

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14. Description of Influent and Effluent (see instructions)

Parameter and Code 214	Influent	Effluent					
	Annual Average Value (1)	Annual Average Value (2)	Lowest Monthly Average Value (3)	Highest Monthly Average Value (4)	Frequency of Analysis (5)	Number of Analyses (6)	Sample Type (7)
Flow Million gallons per day 50050	8.83	8.83	7.79	9.79	7 Day/Wk	365	Com-posite
pH Units 00400			7.00	7.30	253/365		Com-posite
Temperature (winter) ° F 74028	N/A	N/A					
Temperature (summer) ° F 74027	N/A	N/A					
Fecal Streptococci Bacteria Number/100 ml 74054 (Provide if available)				N/A			
Fecal Coliform Bacteria Number/100 ml 74055 (Provide if available)				N/A			
Total Coliform Bacteria Number/100 ml 74056 (Provide if available)				N/A			
BOD 5-day mg/l 00310	128	79.9	58.4	107	44/365		Com-posite
Chemical Oxygen Demand (COD) mg/l 00340 (Provide if available)	N/A	N/A					
OR							
Total Organic Carbon (TOC) mg/l 00680 (Provide if available) (Either analysis is acceptable)	N/A	N/A					
Chlorine–Total Residual mg/l 50060	N/A	N/A					

AGA 1778

DISCHARGE SERIAL NUMBER

FOR AGENCY USE

14. Description of Influent and Effluent (see instructions) (Continued)

Parameter and Code 214	Influent	Effluent					
	Annual Average Value (1)	Annual Average Value (2)	Lowest Monthly Average Value (3)	Highest Monthly Average Value (4)	Frequency of Analysis (5)	Number of Analyses (6)	Sample Type (7)
Total Solids mg/l 00500	N/A						
Total Dissolved Solids mg/l 70300	N/A						
Total Suspended Solids mg/l 00530	97.3	54.6	37.6	68.0	253/365		Composite
Settleable Matter (Residue) ml/l 00545		0.76	0.58	1.0	253/365		Grab
Ammonia (as N) mg/l 00610 (Provide if available)	N/A						
Kjeldahl Nitrogen mg/l 00625 (Provide if available)	N/A						
Nitrate (as N) mg/l 00620 (Provide if available)	N/A						
Nitrite (as N) mg/l 00615 (Provide if available)	N/A						
Phosphorus Total (as P) mg/l 00665 (Provide if available)		N/A					
Dissolved Oxygen (DO) mg/l 00300	X	N/A					

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DISCHARGE SERIAL NUMBER

FOR AGENCY USE

15. Additional Wastewater Characteristics

Check the box next to each parameter if it is present in the effluent. (see instructions)

Parameter (215)	Present	Parameter (215)	Present	Parameter (215)	Present
Bromide 71870		Cobalt 01037		Thallium 01059	
Chloride 00940		Chromium 01034		Titanium 01152	
Cyanide 00720		Copper 01042		Tin 01102	
Fluoride 00951		Iron 01045		Zinc 01092	
Sulfide 00745		Lead 01051		Algicides* 74051	
Aluminum 01105		Manganese 01055		Chlorinated organic compounds* 74052	
Antimony 01097		Mercury 71900		Oil and grease 00550	X
Arsenic 01002		Molybdenum 01062		Pesticides* 74053	
Beryllium 01012		Nickel 01067		Phenols 32730	
Barium 01007		Selenium 01147		Surfactants 38260	
Boron 01022		Silver 01077		Radioactivity* 74050	
Cadmium 01027					

*Provide specific compound and/or element in Item 17, if known.

Pesticides (Insecticides, fungicides, and rodenticides) must be reported in terms of the acceptable common names specified in *Acceptable Common Names and Chemical Names for the Ingredient Statement on Pesticide Labels*, 2nd Edition, Environmental Protection Agency, Washington, D.C. 20250, June 1972, as required by Subsection 162.7(b) of the Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act.

DISCHARGE SERIAL NUMBER

16. Plant Controls Check if the following plant controls are available for this discharge

Alternate power source for major pumping facility including those for collection system lift stations

Alarm for power or equipment failure

218

☒ APS Some pump stations are provided

☒ ALM

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17. Additional Information

217

Item Number	Information

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FOR AGENCY USE

STANDARD FORM A—MUNICIPAL

SECTION III. SCHEDULED IMPROVEMENTS AND SCHEDULES OF IMPLEMENTATION

This section requires information on any uncompleted implementation schedule which has been imposed for construction of waste treatment facilities. Requirement schedules may have been established by local, State, or Federal agencies or by court action. IF YOU ARE SUBJECT TO SEVERAL DIFFERENT IMPLEMENTATION SCHEDULES, EITHER BECAUSE OF DIFFERENT LEVELS OF AUTHORITY IMPOSING DIFFERENT SCHEDULES (ITEM 1b) AND/OR STAGED CONSTRUCTION OF SEPARATE OPERATIONAL UNITS (ITEM 1c), SUBMIT A SEPARATE SECTION III FOR EACH ONE.

FOR AGENCY USE
Sched. No. _____

1. Improvements Required

a. Discharge Serial Numbers Affected List the discharge serial numbers, assigned in Section II, that are covered by this implementation schedule — 300

b. Authority Imposing Requirement Check the appropriate item indicating the authority for the implementation schedule If the identical implementation schedule has been ordered by more than one authority, check the appropriate items. (see instructions) — 301a: GEPA ____ USEPA ____ ____

	301b
Locally developed plan	☐ LOC
Areawide Plan	☐ ARE
Basin Plan	☐ BAS
State approved implementation schedule	☐ SQS
Federal approved water quality standards implementation plan	☒ WQS
Federal enforcement procedure or action	☐ ENF
State court order	☐ CRT
Federal court order	☐ FED

c. Improvement Description Specify the 3-character code for the General Action Description in Table II that best describes the improvements required by the implementation schedule. If more than one schedule applies to the facility because of a staged construction schedule, state the stage of construction being described here with the appropriate general action code. submit a separate Section III for each stage of construction planned. Also, list all the 3-character (Specific Action) codes which describe in more detail the pollution abatement practices that the implementation schedule requires.

3-character general action description	301c	NEW
3-character specific action descriptions	301d	PRI / DIS / SLP / SLD / OUT

2. Implementation Schedule and 3. Actual Completion Dates

Provide dates imposed by schedule and any actual dates of completion for implementation steps listed below. Indicate dates as accurately as possible. (see instructions)

Implementation Steps		2. Schedule (Yr /Mo /Day)		3. Actual Completion (Yr /Mo /Day)	
a. Preliminary plan complete	302a	71 / 4 / ____	302a	71 / 4 / ____	
b. Final plan complete	302b	72 / 5 / 10	302b	22 / 5 / 10	
c. Financing complete & contract awarded	302c	____ / ____ / ____	302c	____ / ____ / ____	
d. Site acquired	302d	____ / ____ / ____	302d	____ / ____ / ____	
e. Begin construction	302e	25 / 10 / ____	302e	76 / 4 / 5	
f. End construction	302f	78 / 3 / 25	302f	78 / 10 / 31	
g. Begin Discharge	302g	79 / 8 / ____	302g	79 / 8 / ____	
h. Operational level attained	302h	____ / ____ / ____	302h	____ / ____ / ____	

AGA 1782

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FOR AGENCY USE

STANDARD FORM A–MUNICIPAL

SECTION IV. INDUSTRIAL WASTE CONTRIBUTION TO MUNICIPAL SYSTEM

Submit a description of each major industrial facility discharging to the municipal system, using a separate Section IV for each facility description. Indicate the 4 digit Standard Industrial Classification (SIC) Code for the industry, the major product or raw material, the flow (in thousand gallons per day), and the characteristics of the wastewater discharged from the industrial facility into the municipal system. Consult Table III for standard measures of products or raw materials. (see instructions)

1. **Major Contributing Facility** (see instructions)

Name	401a	
Number& Street	401b	
City	401c	
County	401d	
State	401e	
Zip Code	401f	

2. **Primary Standard Industrial Classification Code** (see instructions) — 402 ____

3. **Principal Product or Raw Material** (see instructions)

			Quantity		Units (See Table III)
Product	403a	403c		403e	
Raw Material	403b	403d		403f	

4. **Flow** Indicate the volume of water discharged into the municipal system in thousand gallons per day and whether this discharge is intermittent or continuous.
   - 404a ____ thousand gallons per day
   - 404b ☐ Intermittent (int) ☐ Continuous (con)

5. **Pretreatment Provided** Indicate if pretreatment is provided prior to entering the municipal system — 405 ☐ Yes ☐ No

6. **Characteristics of Wastewater** (see instructions)

406a	Parameter Name							
406a	Parameter Number							
406b	Value							

This secti

APPLICATION

QUESTIONNAIRE

GENERAL INFORMATION

AND

BASIC DATA REQUIREMENTS

B

Treatment System Description

A. Treatment System Description

1. Are you applying for a modification based on a current discharge, improved discharge, or altered discharge as defined in 40 CFR 125.58?

   Guam Waterworks Authority (GWA) is applying for a modification based on the current actual volume, composition, and location of 301(h) discharge for the Agana Sewage Treatment Plant. However, GWA is presently under contract with a local A/E firm to conduct the baseline survey and design a new ocean outfall. The new ocean outfall is schedule for completion by December 30, 2000.

2. Description of the Treatment/Outfall System

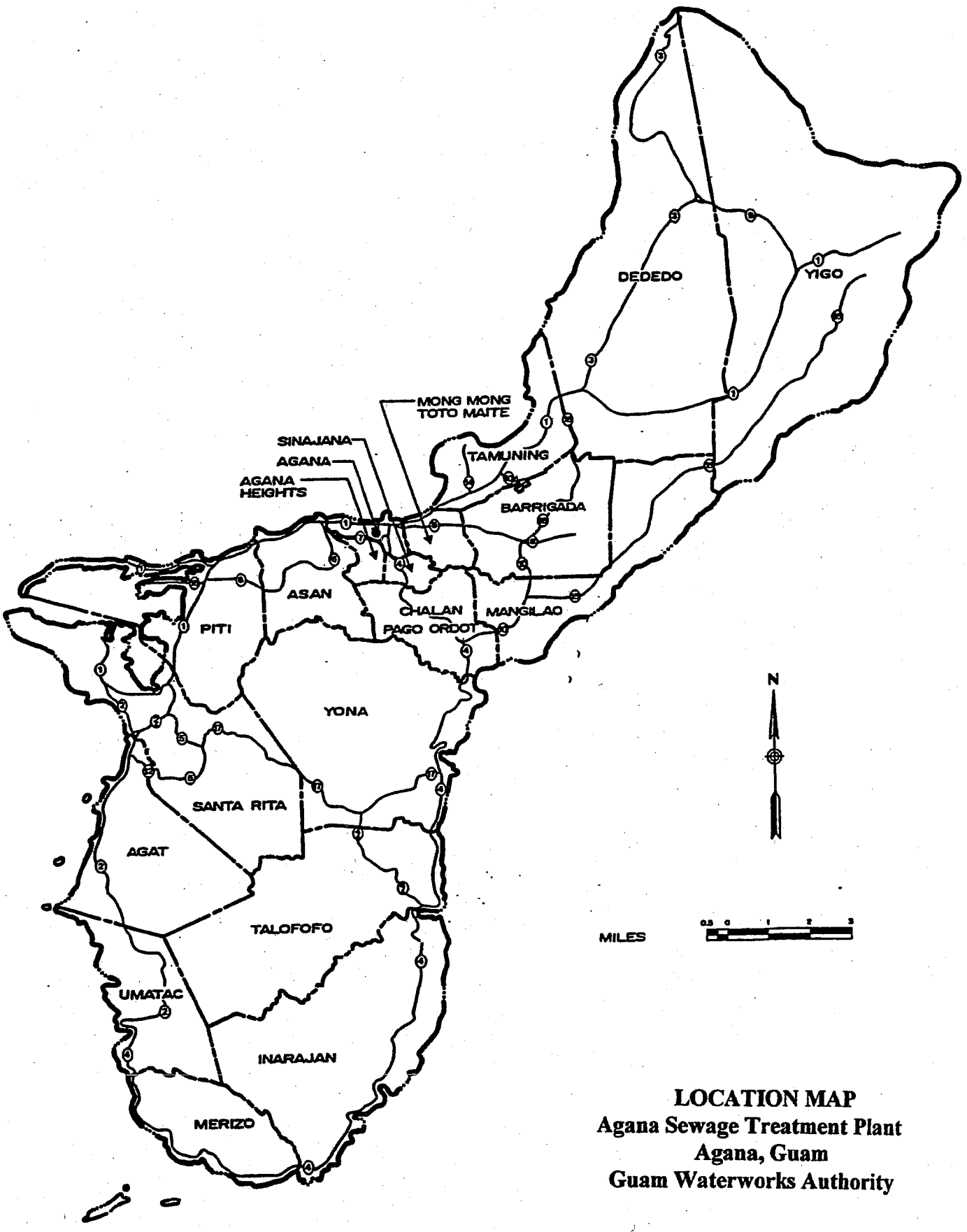
   In the middle of Agana Bay is built a seven acre, 500 by 700 foot primary sewage treatment plant. Figure 1 shows the location of the facility. Figures 2 shows the operating facility layout. Appendix L contains details of the plant's location in the central sewerage system.

   It is designed to treat a daily ultimate average flow of 12 million gallons per day (mgd) and remove 40 to 60 percent of suspended solids (ss) and 25 to 40 percent Biochemical Oxygen Demands (BODs) at a concentration of approximately 207 milligrams per liter (mg/l)ss. The peak design hydraulic capacity of the plant is 21 mgd. Table 1 provides design data for the ASTP.

   The system presently serves the municipalities of Agana, Agana Heights, Asan, Piti, Tamuning, Mongmong-Toto-Maite, Sinajana, Chalan Pago-Ordot and portions of Barrigada, Dededo, Mangilao and Yona. The service area is shown on Figure 3. Appendix L contains the "As Built" record drawing of this sewage collection and disposal system.

   The plant design is intended to satisfy the National Pollution Discharge Elimination System (NPDES) permit and the Water Quality Standards of the Guam Environmental Protection Agency (GEPA). On December 13, 1969, a ruling was approved by the Federal Water Pollution Control Administration (FWPCA) that "The Guam Water Pollution Control Commission in keeping with the policy statements of the Standards of Water Quality for the Waters of the Territory of Guam will accept primary treatment as a minimum for ocean outfalls, provided water current date is available to demonstrate no decrease in water quality will result...The data required will be that which is sufficient to demonstrate that the water currents will not carry material back to shore into the
   inner reef areas."

Figure 1



LOCATION MAP
Agana Sewage Treatment Plant
Agana, Guam
Guam Waterworks Authority

VILLAGE BOUNDARIES

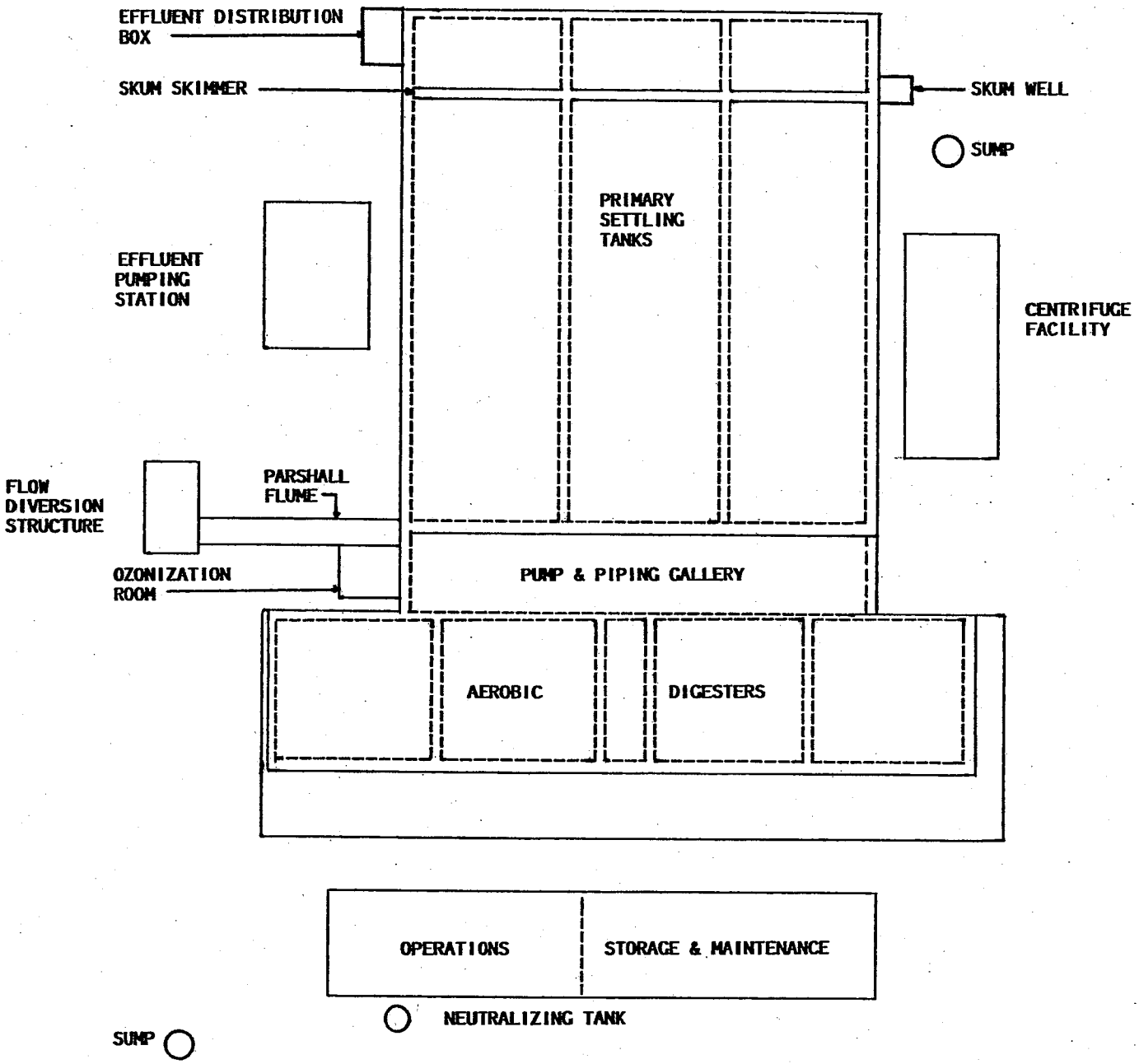
AGA 1789

Design Data

Agana Sewage Treatment Plant

Design Flow	12 mgd average 21 mgd maximum
Primary Clarifiers	
Surface Area	10,700 $ft.^2$
Volume	85,700 $ft.^3$
Chlorine Capacity	3,000 lb./day
Effluent Pumping Capacity	20 mgd
Aerobic Digester, Volume	57,000 $ft.^3$
Mechanical Aerators	6,000 lb./day
Centrifuge	1,500 lb./hour

Source: Metcalf and Eddy, Inc.

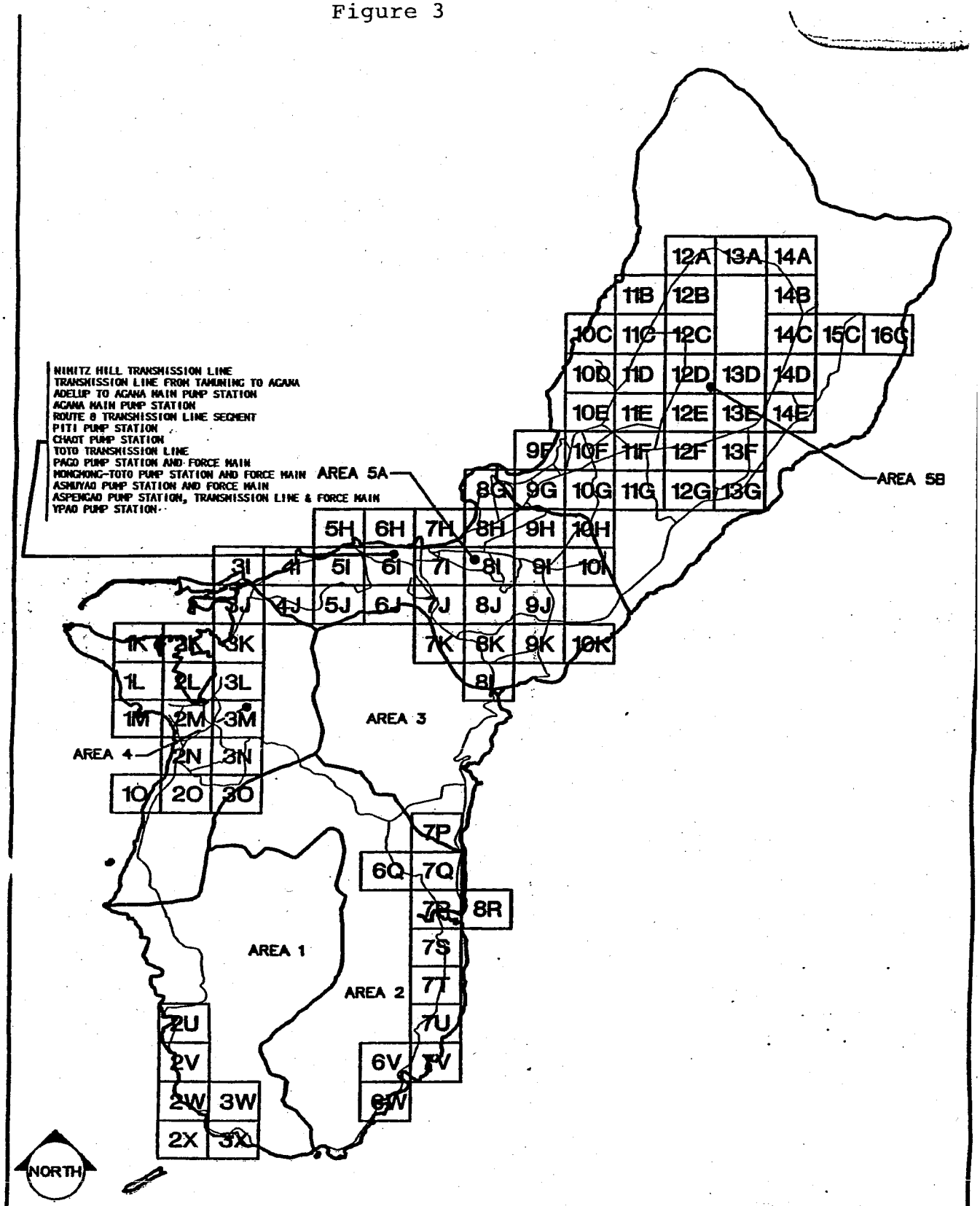


PLOT PLAN

Agana Sewage Treatment Plant

Figure 2

Figure 3



AGA 1792

The treatment process provides comminution of solids, primary sedimentation and pre-chlorination. The treated effluent is discharged through a 3,500 foot log outfall which extends 950 feet beyond the reef to a depth of 85 feet. The sludge collected from the sedimentation tanks undergoes aerobic digestion followed by dewatering in a mechanical centrifuge. The outfall has been operational through the outfall until the Agana treatment facility became operational in 1978.

Between January 1997 and December 1997, an average flow of 8.3 mgd was treated at the Agana treatment plant. Based upon the Bureau of Planning's year 2000 population projections and the data contained in the 1979 Wastewater Facilities Plan, the average daily flow to the Agana facility in the year 2000 is estimated to be 10 mgd. When the proposed "reroute" of the Liguan Terrace; Barrigada Height collector system and Fujita Pump Station was implemented in conjunction with the Sewage Reversion Project, average flows was reduced to 6.0 mgd. It is anticipated that the Agana treatment plant will have ample capacity to treat wastes through the year 2000.

The treatment processes incorporated at this facility include the following:

1. Pretreatment - comminution, screening, grit removal and chlorination.

2. Primary treatment - settling or sedimentation.

3. Sludge treatment - aerobic digesters and centrifugation.

More specifically, the units and facilities provided include:

Two comminutor units, bar screens installed above the comminutors, a grit removal facility, two chlorinators, raw sewage pumps, a parshall flume and a continuous recording device for influent flow measurement, three covered primary rectangular settling tanks for gravity settling of sewage solids, four aerobic digesters, two ozonators to deodorize the air from the settling tanks and aerobic digesters, two centrifuge units with related chemical feed facilities for mechanical dewatering of digested sludge, three effluent pumps, five primary sludge pumps to convey waste sludge from primary settling tanks to digestion tanks, one scum pump to convey scum from the primary settling tanks, and four digester sludge pumps to convey digested sludge to the centrifuge.

Basically, all incoming sewage flows are first passed through the existing comminutors and grit removal units at the existing main pump station. It then flows through a 36-inch pipe into an influent diversion structure. The flow is then measured as it flows through a parshall flume into the primary tanks.

From the primary settling tank the primary treated sewage flows into a pump station where the effluent is pumped into an effluent diversion structure.

The effluent is then discharge through an existing 36-inch outfall for final disposal. The primary sludge collected in the settling tank is pumped to the aerobic digesters. After the sludge is digested, it is dewatered by centrifuges and trucked to a sanitary landfill. Supernatant from the aerobic digester overflow tank and centrate from the centrifuge is returned to the primary settling tanks.

Efficiencies for sewage treatment plants are usually quantitatively assessed by the parameters of suspended solids(ss) and biochemical oxygen demand (BOD). For this plant which employs only primary settling tanks, suspended solids removal of 40 to 60 percent and BOD of 25 to 40 percent may be expected. Flow patterns through the plant is illustrated in Figure 4.

Outfall System

On or about January 12, 1988 heavy wave action from Typhoon Roy severely damaged the 36-inch concrete outfall pipe and its protective concrete-armor stone envelop. The major damage done was the complete destruction of a 48-foot section of the pipe at a location about halfway between the reef and the end of the outfall. At other locations, considerable damage was done to the protective envelope constructed around the outfall pipe. Soon thereafter, negotiations were begun with the Federal Emergency Management Administration (FEMA) to obtain the funding to replace the missing segment and repair the protective envelope to prevent future damage. In July 1988, FEMA funds in the amount of $545,000 were committed to the work, with almost and equal amount of local Guam funds stipulated to repair the envelope damage. At the time, work was progressing on the construction plans, and a report in late August 1988 by Guam EPA that the Agana Bay waters had recently become unacceptable polluted (presumably due to the broken outfall) put this regular project on a fast track to completion.

On September 14, 1988 Governor Joseph F. Ada declared a Public Health Emergency clearing the way for expediting of the work. On September 15, a local marine engineering company (J. Agi and Associates) was retained to assist GWA in a review capacity. On September 19 and 20, plans specification and a video take of an inspection dive of the outfall were given to each of six prospective contractors.

On September 22, four proposals were received for the work, and by September 27, a GWA selection committee had finished its evaluation and negotiations with the two contractors submitting the best proposal. The selected contractor was Healy Tibbitts Construction Company from San Francisco and the contract amount was $1,051,800.00.

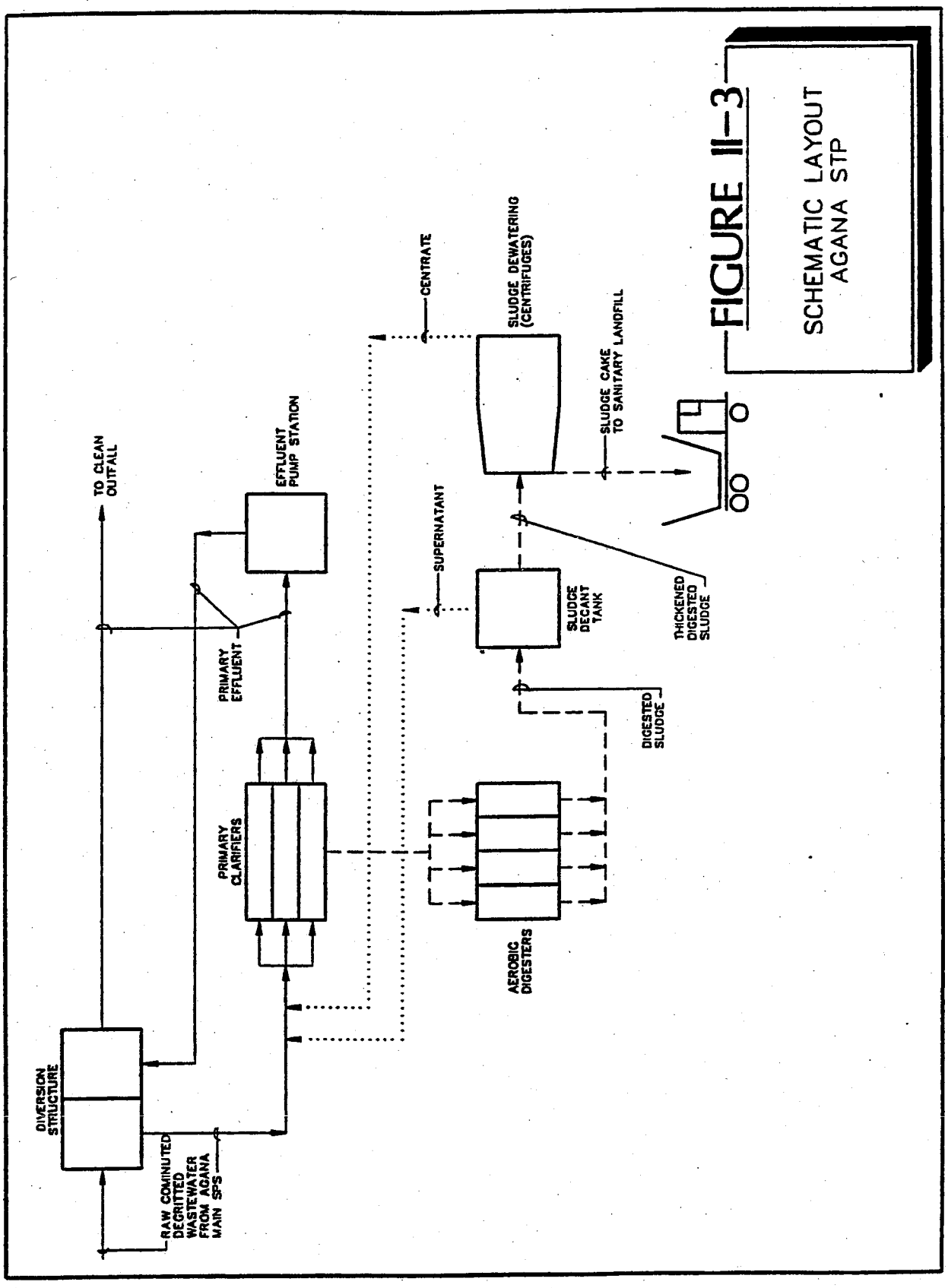


FIGURE II-3
SCHEMATIC LAYOUT
AGANA STP
TO CLEAN OUTFALL
EFFLUENT PUMP STATION
CENTRATE
SLUDGE DEWATERING (CENTRIFUGES)
SLUDGE CAKE TO SANITARY LANDFILL
SUPERNATANT
SLUDGE DECANT TANK
THICKENED DIGESTED SLUDGE
PRIMARY EFFLUENT
DIGESTED SLUDGE
PRIMARY CLARIFIERS
AEROBIC DIGESTERS
DIVERSION STRUCTURE
RAW COMINUTED DEGRITTED WASTEWATER FROM AGANA MAIN SPS

By October 14, contract documents were sufficiently along in the approval process that a Notice to Proceed was also sent by facsimile noting activation on or before October 17, 1988.

Repairs on the outfall were completed on January18, 1989. A joint inspection dive was conducted on January 25 by the construction management firms and the Army Corps of Engineer.

Appendix A contains historic information about the outfall, news clippings and related information about the 1988 repair project. Appendix M provides an engineering plan and profile of the outfall sewer.

The existing outfall is located at latitude 13 degrees 29 minutes 3.3 seconds, longitude 144 degrees 44 minutes 37.1 seconds.

Changes in Service Area

The area served by the ASTP is an urban zone which continues to be a region of expansion.

In addition to the civilian population, there are Federal Government installation in the area, including the Naval Hospital facilities and military personnel within the central area.

Sewage flows from Barrigada Heights, Liguan Terrace, and part of Tumon Bay was diverted to the Northern District Sewage Treatment Plant.

The total flows was dip by 2 mgd at the onset. However, with the developments on hold until the completion of the Camp Watkins infrastructure project and additional expansions in the district collector systems, total flows will be back up to the 8 mgd.

Population estimates for the aforementioned areas are listed below:

Area	Population
Asan-Piti	5,717
Central Guam	46,572
Tamuning	20,948
Yona	6,707
Military	6,964

Figures for the villages were taken from the GWA Rural Islandwide Wastewater Facilities Plan and are the projected population estimates for the year 2000.

The military area population equivalents were calculated based upon an average contribution of 100 gallons per capita per day; military consumption figures (1998) available to GWA were used in this computation. See Appendix B.

3. Effluent Limitations and characteristics

GWA is requesting the same effluent limitations which are currently in effect for the ASTP. These are given in Table 12.

Discharge Monitoring Reports (DMRs) for the period January 1997 to December 1997 are attached as Appendix C. These routine compliance reports summarize the quality and/or quantity of GWA's ASTP discharge and compares them with current permit effluent limitation. The results of this report generally show that GWA is in compliance with the effluent limitations set by USEPA. Deviations from the given limits have occurred but GWA is actively taking steps to correct these situations, i.e. down clarifiers, so that limitations can be met.

Samples for the required Toxicity and Priority Pollutant Scan were collected on the 9th of March for the Agana WWTP. The samples were then immediately sent off to the Montgomery & Watson Labs in Pasadena California. GWA has received E-Mail confirmation that the analysis of the samples are presently in progress. Upon receipt of their findings, GWA will forward your office a copy along with the Authority's corresponding responses to the appropriate sections of the application questionnaire.

4. Effluent Volume

For the term of the modified permit being requested, the projected effluent flow is 10 mgd, the current flow. Daily and Monthly Flow Reports for the period January 1997 to December 1997 are attached as Appendix D.

5. Average Daily Industrial Flow

Wastewaters in this service area are a mixture of industrial, commercial and domestic flows. The industrial contributors are of minor nature and there are presently no existing or known potential users of the systems that could be classified as "significant". As defined by the Federal EPA, these users would have to contribute ten percent or more of the total design hydraulic or pollutant load to the treatment works.

GWA is in the process of mailing out its Industrial Users Survey to all commercial accounts. The results of this survey will then be compiled, analyzed and made public as part of its Public Education Program to help minimize the entrance of

nonindustrial toxic pollutants and pesticides into the island's sewage treatment systems. GWA has developed a plan of action (page M-2) to increase public awareness of the need to properly dispose of waste that may contain toxic substances.

The results of the Industrial Users Survey along with GWA's analysis of its findings will be sent to your office at the earliest.

6. Combined Sewer Overflows

The Government of Guam has separate systems for sewage disposal and storm drainage. No combined sewer overflows occur at the plant. However, during the rainy season, infiltration problems do exist especially in the Tamuning district. GWA has ordered "rain catcher" devices which will be installed into manholes to "catch rain or other inflow" to reduce problems in the system.

Smoke testing and televising of sewer lines is another means of identifying inflow/infiltration sources in the system. Although manpower and equipment constraints prevent the implementation of a full scale project of this nature, isolated areas identified as I/I suspect can be scheduled for investigation and subsequent repairs. This is the short-term approach; long term plans include appropriation of funds for a special I/I investigation and repair in the central sewage system.

7. Outfall/Diffuser Design

Available data on the existing outfall is provided in Appendix M. However, GWA has recently contracted with a local A/E firm to conduct a baseline study of the area immediately around and beyond the existing ocean outfall as a precursor to either extending the existing outfall or constructing an all-new outfall that is longer and deeper. This phase of the work has started and the resulting optimal design will be an outfall that extends to a point were no decrease in receiving water quality will occur and that water currents will not carry material back into the inner reef areas or to shore. (See Appendices G, H and I)

Receiving Water Description

II. B. Receiving Water Description

II.B.1. Are you applying for a modification based on a discharge into the ocean or to saline estuary?

GWA is applying for a modification based on a discharge to the ocean. The receiving waters are coastal waters off West Agana Bay, on the western coast of Guam.

II.B.2. Is your current discharge or modified discharge to stressed waters as defined by 40 CFR 125.58(z)?

The receiving waters at Agana Bay are not stressed. GEPA's Revised Water Quality Standards 1992, classifies the waters in this area as good marine water (M-2). Water in this category must be sufficient to allow for the propagation and survival of marine organisms, particularly shellfish, corals and other reef related resources. Other important and intended uses include mariculture activities, aesthetic enjoyment and compatible recreation inclusive of whole body contact and related activities.

II.B.3. Provide a description and data on the seasonal circulation patterns in the vicinity of your current or modified discharge(s).

For the island of Guam as with most islands in the Central Pacific, the prevalent northeast tradewinds of the area play a major role in generating the enormous North Equatorial Drift Current that sweeps by Guam from east to west (Jones and Randall 1973). This current is responsible for much of the energy that transports water along the coasts. The North Equatorial Current splits on the northeast corner of the island and streams around the South of Guam at Cocos Island and around the North at Ritidian Point. These two currents then move along the west coast and are joined off Apra Harbor and move out into the Philippine Sea. During the rainy season on Guam, the tradewinds often break down and the strength of the North Equatorial Current may be reduced. The typical tradewinds current pattern for Guam's coastal waters is depicted in Figure 5. Huddell *et al.* 1974, reports that NE tradewinds are dominant in all seasons, but are especially pronounced in the winter (Jan- May). During the summer (July - Oct) the effect of the trade winds are diminished and winds from every direction are not uncommon (Figure 6).

The Agana Bay section of coastline is more somewhat exposed to the NE trades. Waves and surf along this coast are often high during the winter months when the majority of the winds are out of the east and northeast. Offshore currents along this section of the coast move in a net westerly direction.

Jones and Randall 1971, conducted drift cross studies across the first submarine terrace, where the present outfall is located. The drift crosses moved westerly past Adelup Pt. They indicate that the effluent passes well clear of Adelup Pt and moves out into the Philippine Sea (Figure 7). Periodic easterly shifts in direction are caused primarily by tidal changes. The easterly components are usually weak and short in duration. The predominant current movement is to the west. Currents ranged from 0 to 0.75 knots. A current meter was anchored to record current direction and velocity at 16 m (52.5 ft). Continuous tapes recorded over 1100 hrs of sampling time from October 1969 to July 1970. Currents ranged from W and NE trough the south (Figure 8). Generally currents are influenced by tidal phase and are south westerly to westerly on flood tides and easterly on ebb tides. Current velocity ranged from 0 to 0.75 knots, with the normal velocity between 0.2 and 0.4 knots. They also conducted surveys to establish water movement across the reef and in the reef flat itself.

During periods of high or low tides, with high surf conditions, water is transported across the reef flat with each advancing wave. The build up of water on the reef flat sets up current patterns determined by the reef flat topography. Current patterns if the West Agana bay reef flat are shown in Figure 9. They aslo noted the potential for pollution from other sources such as the storm water drains located along the shoreline and the Fonte River.

Jones and Randall 1971, also mention drift bottle studies conducted by Pacific Island Engineers in 1951. They released 278 drift bottles at the outfall site. Of those 84% drifted out to sea and 36% went ashore at Asan Pt, some 2 miles west of the outfall.

The U.S. Navy Hydrographic Office conducted a current study in Agana Bay (Huddell *et al.* 1974.) Three current meters were installed and dye and drouge tracking were used during both the winter and summer season. During the winter survey two meters were installed; one on the bottom in 35 ft of water about 100 yards seaward of the reef margin. The second was installed at a depth of 50 ft. The first meter recorded moderate currents (0.2 kts or 0.23 mph) ranging from east to west. Later a strong southwesterly current persisted and the meter failed. The second meter was run for 25 days. Current speeds had a maximum of 0.5 kts (0.58 mph) and were commonly 0.04 (0.046 mph) to 0.08 kts (0.092 mph). These currents were generally flowing east and northeast. During ebb tides moderate to slight currents flowed northeasterly and during flood tides they flowed northwesterly. There was also a period of two days in which a moderate easterly current was observed. During the summer survey, one current meter was set up in Agana Bay on a bottom stand in 65 ft of water. Current flowed primarily to the Northeast with velocities commonly of 0.01 kts (0.012 mph) to 0.04 kts (0.046 mph), with a maximum of 0.36 kts (0.41 mph). As in the winter months the currents were generally northwesterly with the flood tides and northeasterly with the ebb tides. For the dye studies most of the dye moved either easterly or northeasterly. Only two of 13 dye casts moved to the west or south west.

Hudell et al concluded from information gathered from meters stationed at Cabras Island, Hilaan Point and Orote Point, that an offshore southwesterly flow persists along the western coast of Guam. Nearshore flow is controlled by a complicated series of eddies generated from the offshore flow. The location and shape of the eddies is controlled by several factors; wind speed and direction, tidal phase, configuration of the coastline, topography of the bottom, wave height and direction, and the speed and direction of the offshore flow. The extention of the Agana and Tanguission outfalls farther from shore my reduce the influence of these nearshore eddies on the effluent plume. A series of hydrodynamic studies will be conducted to establish the fate of the effluent plume.

Jones, R. S. and R. H. Randall. 1971. An Annual Cycle Study of Biological, Chemical and Oceanographic Phenomena Associated with the Agana Ocean Outfall. University of Guam the Marine Laboratory Technical Report No. 1.

Jones, R. S. and R. H. Randall. 1973. A Study of Biological Impact caused by Natural and Man-Induced Changes on a Tropical Reef. University of Guam, Marine Laboratory Technical Report No.7.

Huddell, H. D., J. G. Willett and G. Marchand, 1974. Nearshore currents and Coral Reef Ecology of the West Coast Of Guam, Mariana Islands. Naval Oceanographic Office, Washington, D.C.

II.B.4. Oceanographic conditions in the vicinity of the current and proposed modified discharge(s). Provide the following:

- ***Lowest percentile current speed***
  0.0 knots

- ***Predominant current speed and direction during four seasons***
  Predominant current speeds from the meter anchored in the vicinity of the outfall were recorded as 0.2 to 0.4 knots to the West. With a maximum of 0.75 knots.

- ***Periods of maximum stratification (months)***
  In the ocean waters around Guam there is a year round permanent thermocline, extending from 120m to more than 400m, in which water temperatures drop from 27° to 8° C (Amesbury, S. S. and M. Babin 1990). Water temperature measured at depths of 0m and 50m did not vary from each other, or vary through out the year by more than 1°C (Figure 10). The thermocline is well below the discharge depths, therefore stratification doesn't effect the effluent plume.

Amesbury, S. S. and M. Babin, 1990. Ocean Temperature Structure and the Seasonality of Pelagic Fish Species Near Guam, Mariana Islands. Micronesica 23(2):131-138).

- ***Density profiles during periods of maximum stratification***
  No stratification, see explanation above.

II.B.5. Do the receiving waters for your discharge contain significant amounts of effluent previously discharged from treatment works for which you are applying for a section 301(h) modified permit?

The receiving waters for the discharge do contain significant amounts of effluent previously discharged from the treatment works. Water quality standards and water quality criteria are met at and beyond the ZID boundary. However, a reading of greater than >400 fecal coliform/ 100 mL were recorded at site E six out of the 18 times that waters have been sampled since 1989. The effluent currently discharged is rapidly diluted, and ambient water conditions generally occur outside the ZID for those parameters presently monitored. Water quality data will be collected as part of the baseline study in the area of any proposed sites for the extension of the Agana outfall to determine if the waters are impacted by the current discharge.

II.B.6. Ambient water quality conditions during the period(s) of maximum stratification: at the zone of initial dilution (ZID) boundary, at other areas of potential impact and at control stations. a. Provide profiles with depth on the following for the current discharge location and for the modified discharge location, if different from the current discharge:

- ***BOD_5 (mg/L)*** (not measured)
- ***Dissolved oxygen***
- ***Suspended solids (mg/L)*** (not measured)
- ***pH***
- ***Temperature (°C)***
- ***Salinity***

- ***Turbidity***
- ***Other significant variables***

As explained above there is no period of stratification. The results presented are from semi-quarterly sampling periods, March 1989 to July 1997, Table 1. The minimum, average and maximum values for each parameter are given on the third page of Table 1. Sampling stations are depicted in Figure 11, and locations are described below. The stations, water quality and bacteriological parameters measured were determined, and required, by the USEPA and Guam EPA. Samples were taken at 3 depths, surface, mid, and Bottom. Sample were collected and analyzed by UOG Marine Lab, from March 1989 until December 1989, after which they were collected and analyzed by GWA staff.

RECEIVING WATER SAMPLING STATIONS

Shoreline Stations

Agana A: 13° 29' 27' N x 144° 44' 28" E
shoreline station 0.5 km W of STP access road (surface only)

Agana B: 13° 29' 29' N x 144° 44' 30" E
shoreline station on STP access bridge at the center culvert (surface only)

Agana C: 13° 29' 31' N x 144° 44' 33" E
shoreline station 0.5 km E of STP at the mouth of the Agana boat basin on the Paseo De Susanna side, half way to the channel marker in *ca.* 0.5 m of water.

Offshore Stations

Agana D: 13° 29' 35' N x 144° 44' 30" E
above the diffusers in 95 ft (29m) of water.
Samples taken at surface, mid (14m), and bottom (28m)

Agana E: 13° 20' 33' N x 144° 44' 30" E
100 m S of D, surface, mid (5m), and bottom (10m)

Agana F: 13° 29' 35' N x 144° 44' 44" E
1000 m E of D, surface, mid (8m) and bottom (16m)

From the Jan 1997 these stations were located in waters at the same depth as station D, and samples were taken at surface, mid (5m), and bottom (15m).

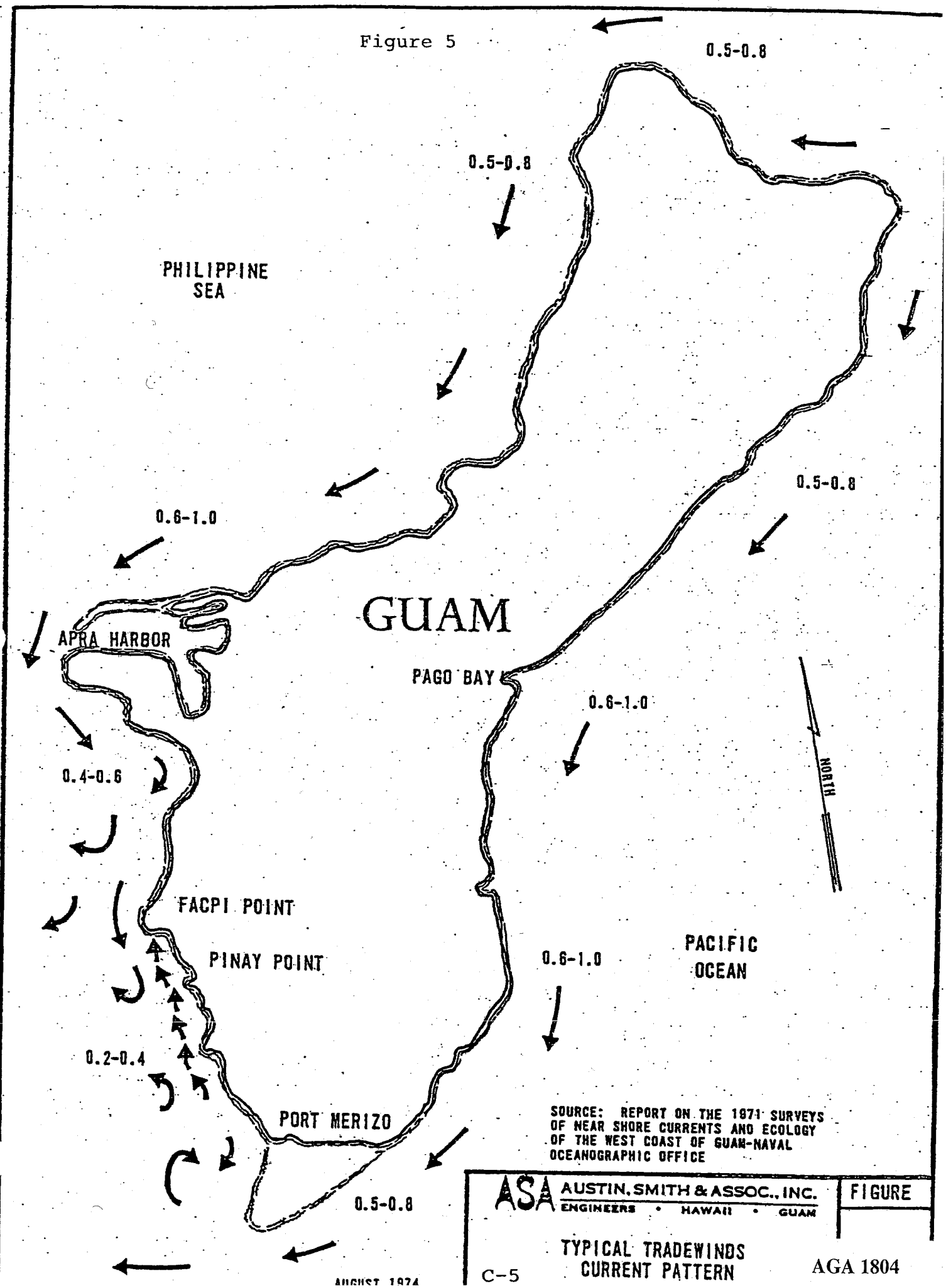
c. Are there other periods when receiving water quality conditions may be more critical than period(s) of maximum stratification?

No.

II.B.7 provide data on steady state sediment dissolved oxygen demand and oxygen demand due to resuspension of sediments in the vicinity of the discharge. (mg/L/day).

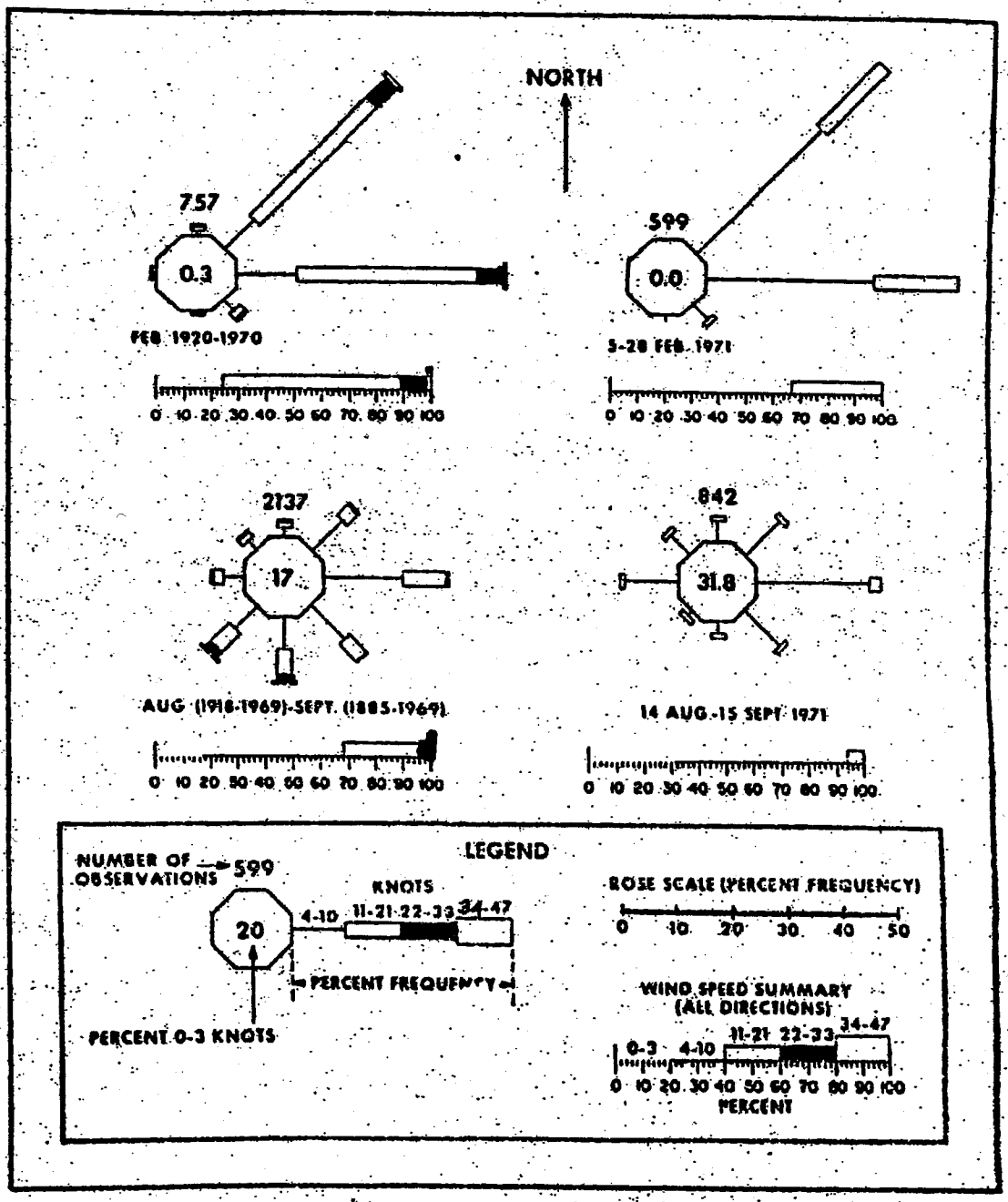
There has been no studies done to date on sediment dissolved oxygen demand.

Figure 5



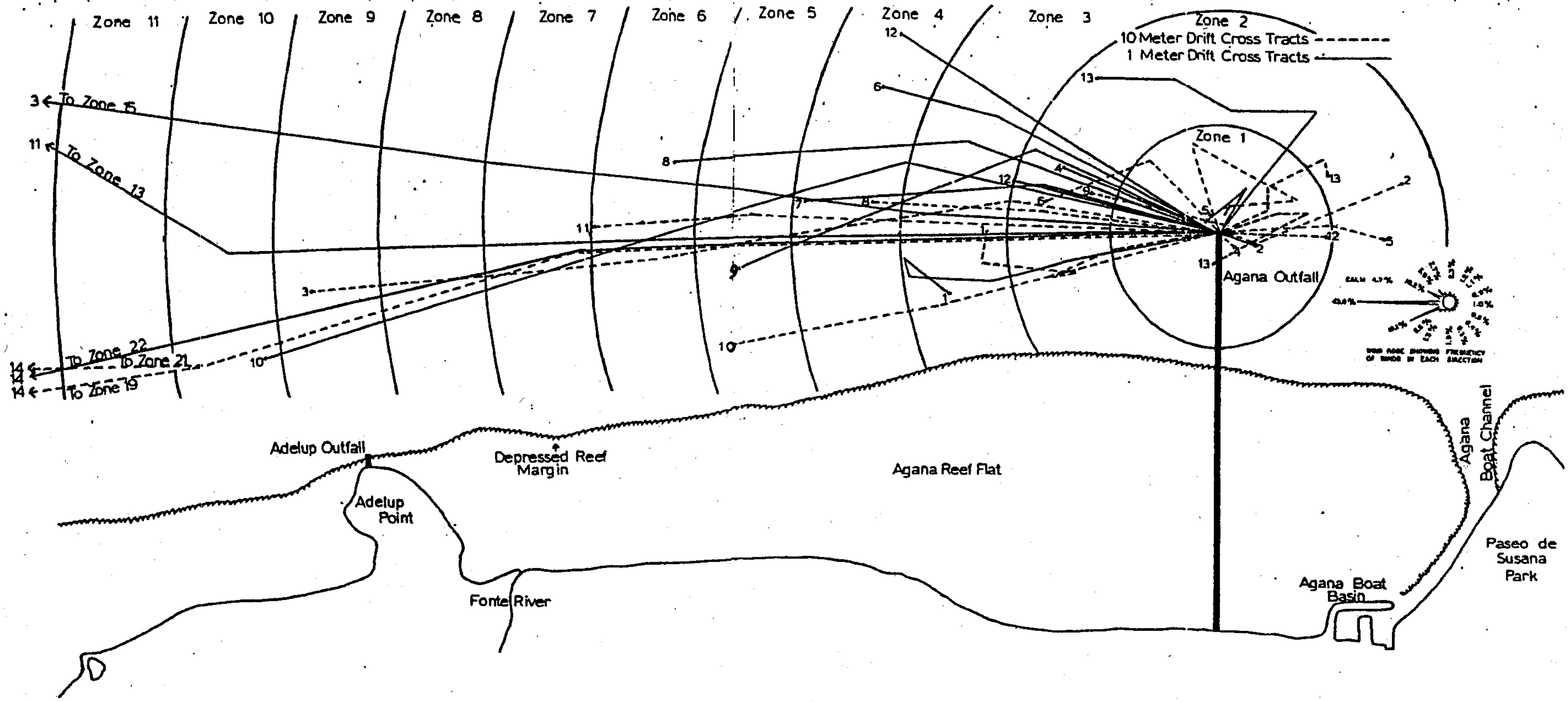
AGA 1804

Figure 6



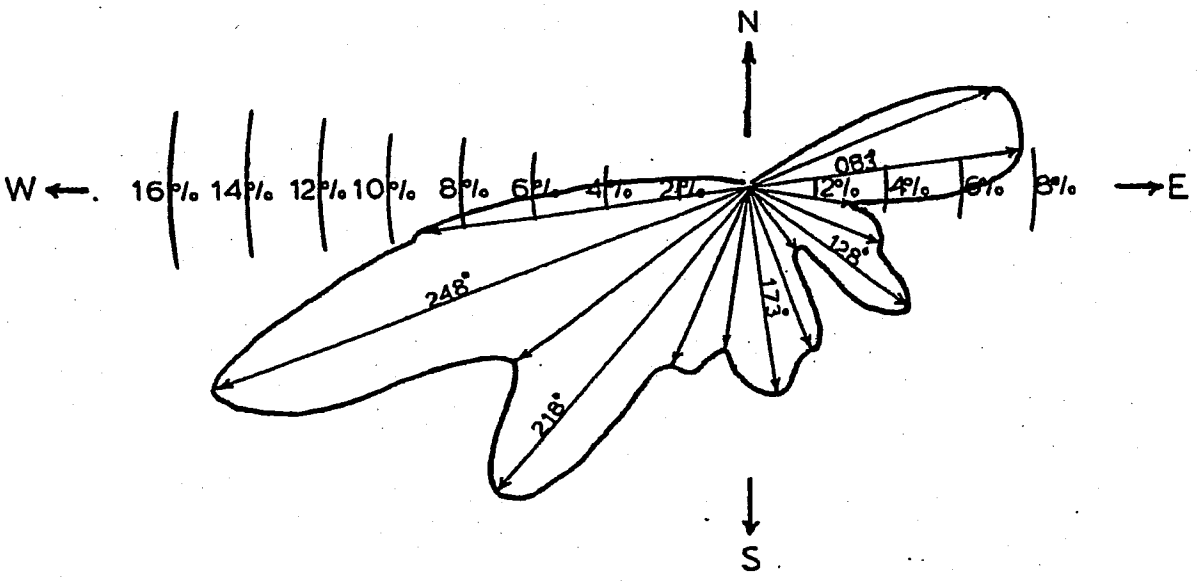
Wind roses of historical data and 1971 data.

Figure 7



OFFSHORE CURRENT STUDY. Water sample results were averaged in each concentric zone. The numbers at the end of the drift tracks show drift cast dates as follow:
(1) January 13, (2) January 27, (3) January 30, (4) February 6, (5) February 16, (6) February 26, (7) March 10, (8) March 16, (9) March 30, (10) April 14, (11) April 28, (12) May 8, (13) May 21, (14) May 26, 1970.

Figure 8



ANALYSIS OF CURRENT DIRECTION. The arrows shows some of the dominant directions of flow. The concentric radii show the percent of the time the current flows in a particular direction. These data are compiled from all the current meter tapes.

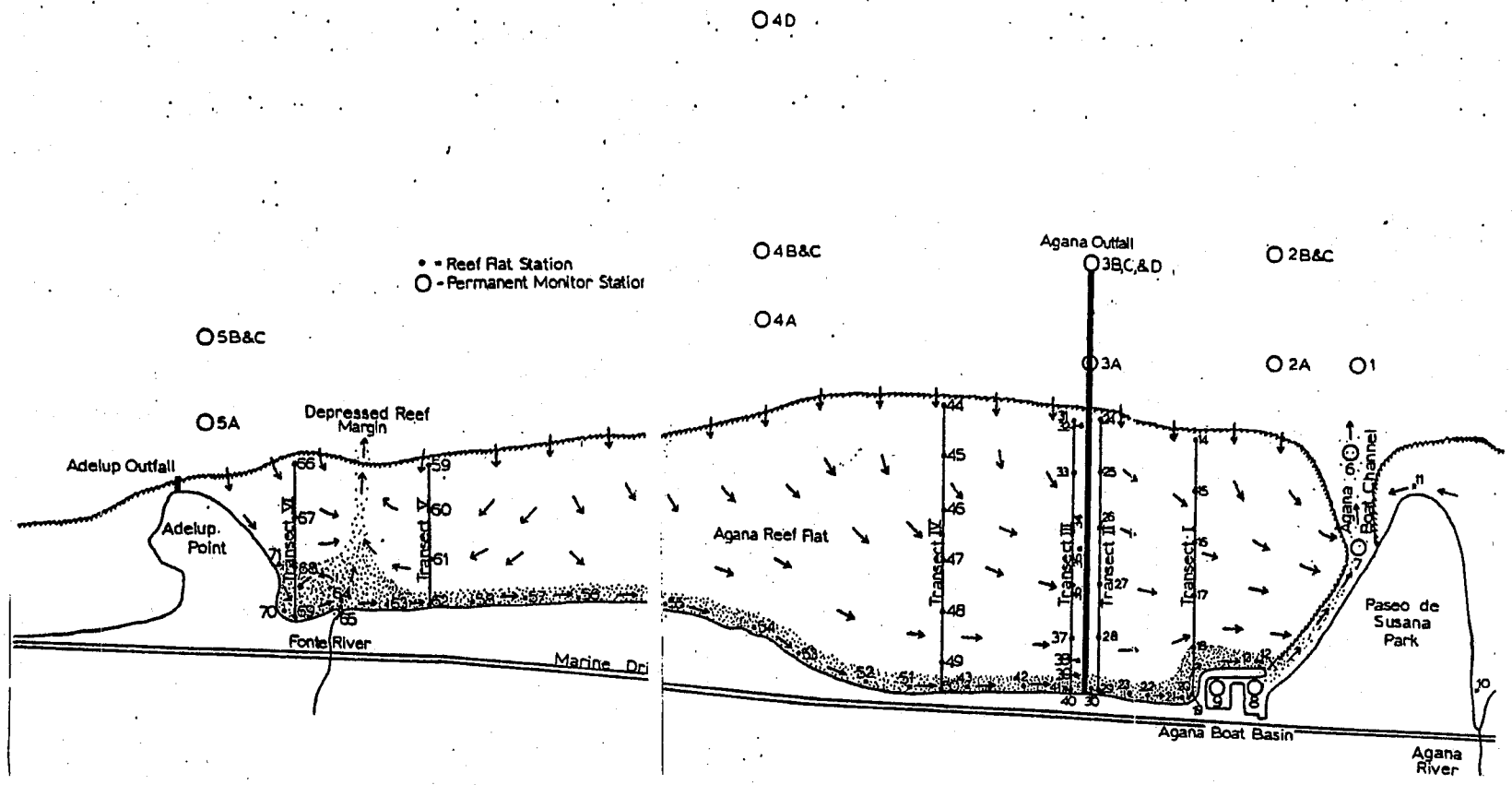
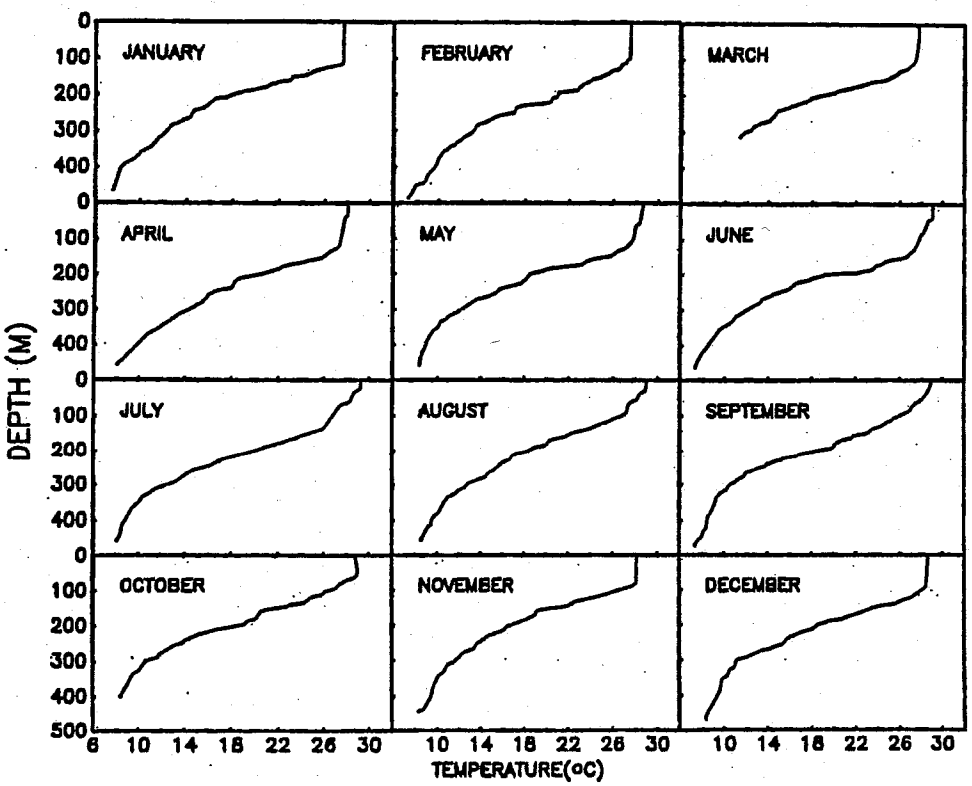


Figure 9

Reef Flat Current Study. The arrows along the reef margins show wave transport of water onto the reef flat platform, the others show the resultant current patterns. The stippled area shows the long shore curren at the beach. Permanent and other monitoring stations are shown

Jones and Randall, 1971.

Amesbury & Babin: Ocean Temperature and Pelagic Fish



Monthly temperature-depth relationships for the ocean waters near Guam. Individual plots are from years with temperature conditions most nearly approximating longterm average conditions for that month: Jan–1972, Feb–1974, Mar–1976, Apr (0–250 m)–1982, Apr (250–475 m) –1981, May–1975, Jun–1970, Jul–1979, Aug–1974, Sep–1974, Oct–1976, Nov–1979, Dec–1971.

Table 1. Water Quality Data for Agana WWTP Receiving waters 1989-1997

PARAMETER	STATION	DEPTH	DATE SAMPLE COLLECTED									
			4/89	6/89	10/89	12/89	3/90	9/90	3/91	5/91	7/91	10/91
Fecal Coliform	D	surface		<100	95000			0	0	1	20	400
FC/100mL *	E	surface		<10	1			0	0	0	20	400
	F	surface		0	0			0	0	0	8	400
temperature	D	surface	27	27.5	29.5	31.0	27.1	29.0	26.8	27.9	27.5	28.1
oC		mid		27.3		31.0	27.0	29.0	26.7	27.9	27.6	28.2
		bottom		27.3	29.5	31.0	26.9	29.0	26.7	27.9	27.7	28.2
	E	surface	27.2	27.5	29.6	31.0	27.1	29.5	26.7	27.9	27.6	28.3
		mid	27.1	27.5	29.8	31.0	27.0	29.0	26.6	27.9	27.6	28.3
		bottom	27.1	27.8	29.8	31.0	26.9	29.0	26.6	27.9	27.5	28.2
	F	surface	27	27.3	29.2	30.5	27.1	29.0	26.6	28.6	28.1	28.1
		mid	27	27.3	29.1	30.7	27.0	29.0	26.6	28.1	28.1	27.8
		bottom	26.9	27.3	29.0	30.4	26.9	29.0	26.6	27.8	28.1	27.8
salinity	D	surface	32.0	35.6	35.5	34.7	35.5	32.0	35.0	34.0	31.0	34.0
ppt		mid				35.1	35.5	34.0	35.0	34.0	32.0	34.0
		bottom			35.9	35.0	35.5	34.0	34.0	34.0	32.0	33.0
	E	surface	33.5	36.0	35.6	35.1	35.5	33.0	35.0	35.0	34.0	35.0
		mid	33.4	36.1	35.7	34.9	35.5	33.0	35.0	35.0	34.0	35.0
		bottom	33.2	35.9	35.8	35.1	35.5	34.0	35.0	35.0	34.0	35.0
	F	surface	33.6	35.8	35.8	34.9	35.5	30.0	35.0	35.0	35.0	35.0
		mid	33.5	36.1	36.0	34.7	35.5	33.0	35.0	35.0	35.0	35.0
		bottom	33.4	36.1	35.8	34.6	35.5	33.0	35.0	35.0	35.0	35.0
pH	D	surface	8.31	8.29	8.12	8.18	8.20	8.15	7.65	8.26	8.89	9.20
		mid			8.14	8.21	8.10	8.26	8.08	8.26	8.23	9.54
		bottom			8.13	8.20	8.10	8.26	8.08	8.32	8.48	9.56
	E	surface	8.38	8.30	8.13	8.18	8.10	8.25	8.07	8.32	8.52	9.58
		mid	8.37	8.32	8.15	8.18	8.10	8.25	8.08	8.31	8.55	9.60
		bottom	8.38	8.31	8.16	8.18	8.10	8.26	8.09	8.31	9.56	9.60
	F	surface	8.38	8.29	8.16	8.17	8.20	8.21	8.38	8.20	9.44	9.66
		mid	8.37	8.30	8.14	8.18	8.16	8.27	8.28	8.18	9.46	9.82
		bottom	8.37	8.30	8.16	8.20	8.15	8.28	8.00	8.18	9.48	9.88
D. O.	D	surface		5.70	6.30	6.20	6.80	6.20	5.66	5.60	3.13	5.16
mg/L		mid		5.80	6.00	6.00	7.10	6.10	5.15	3.36	3.14	5.26
		bottom		5.70	6.20	5.80	7.30	6.30	5.06	3.41	3.17	5.23
	E	surface		5.80	6.15	6.20	6.90	7.40	5.81	2.45	3.38	5.32
		mid		5.80	6.20	6.20	6.20	6.40	5.60	3.54	3.28	5.33
		bottom		5.90	6.20	6.20	7.20	6.80	5.23	4.00	3.22	5.41
	F	surface		5.85	6.09	6.00	5.90	8.40	3.09	3.21	3.23	5.12
		mid		5.90	6.05	5.90	5.60	5.60	4.19	3.49	3.22	5.21
		bottom		5.90	6.09	5.90	5.20	6.30	4.64	3.62	3.26	5.21
Turbidity	D	surface	11.00	11.00	8.00	1.80	0.25	0.25	0.38	0.40	0.25	0.45
NTU		mid	11.00	11.00	11.00	0.80	0.30	0.25	0.53	0.55	0.20	0.60
except for		bottom	11.00	11.00	4.00	0.60	0.40	0.35	0.55	0.60	0.35	0.55
4/89, 6/89,10/89	E	surface	11.00	11.00	11.00	0.50	0.16	0.20	0.20	0.40	0.20	0.40
when secci		mid	11.00	11.00	11.00	0.48	0.24	0.20	0.25	0.40	0.15	0.30
disc was used		bottom	11.00	11.00	11.00	0.45	0.26	0.20	0.32	0.20	0.10	0.30
	F	surface	11.00	11.00	11.00	0.35	0.15	0.70	0.30	0.25	0.15	0.20
		mid	11.00	11.00	11.00	0.35	0.22	0.25	0.32	0.25	0.05	0.20
		bottom	11.00	11.00	11.00	0.40	0.66	0.25	0.32	0.20	0.05	0.20
NOx	D	surface	0.013	0.002	0.011	0.001						
mg/l		mid			0.007	0.000						
		bottom			0.013	0.000						
	E	surface	0.013	0.007	0.013	0.004						
		mid	0.012	0.002	0.009	0.003						
		bottom	0.101	0.003	0.015	0.003						
	F	surface	0.006	0.005	0.011	0.001						
		mid	0.005	0.001	0.019	0.001						
		bottom	0.001	0.001	0.010	0.000						
FRP	D	surface	0.107	0.076	0.049	0.069						
mg/l		mid			0.003	0.008						
		bottom			0.028	0.020						
	E	surface	0.005	0.002	0.009	0.007						
		mid	0.008	0.001	0.002	0.022						
		bottom	0.007	0.000	0.003	0.019						
	F	surface	0.006	0.000	0.001	0.005						
		mid	0.010	0.000	0.004	0.003						
		bottom	0.0271	0.0118	0.0067	0.0078						
Treatment Plant Average Flow (MGD)												

* values of 400 for fecal coliform represent reports of >400FC/100mL

continued over page

Table 1. Water Quality Data for . Agana WWTP Receiving waters 1989-1997

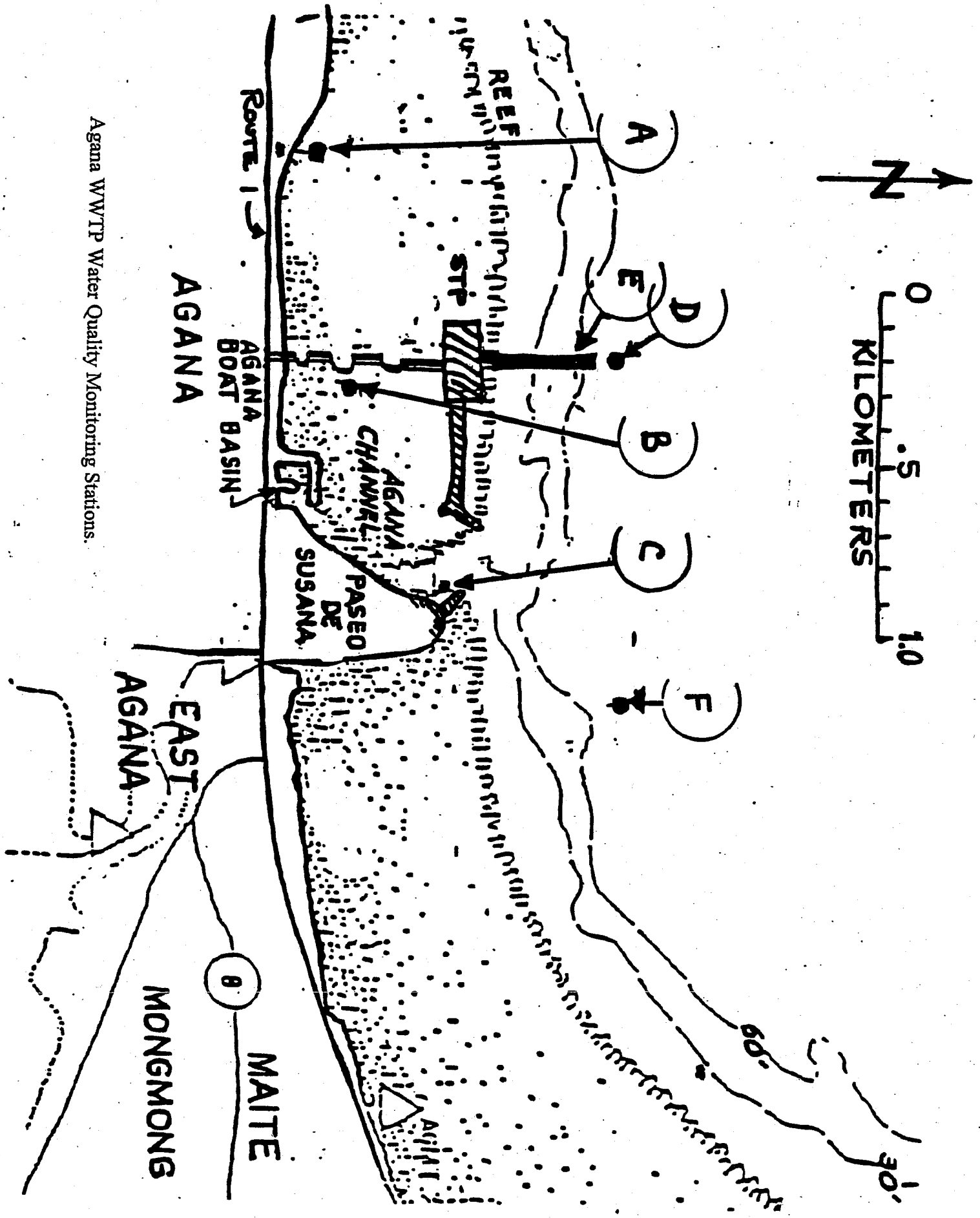
PARAMETER	STATION	DEPTH	DATE SAMPLE COLLECTED									
			2/92	8/92	3/93	4/93	9/93	10/93	6/94	7/94	1/97	5/97
Fecal Coliform	D	surface	15	400	400	30	400	400	400	400	400	400
FC/100mL *	E	surface	5	40	400	0	400	400	400	0	6	32
	F	surface	0	0		0	2	0	400	0	0	0
temperature	D	surface	27.0	27.4	26.0	26.9	28.4	28.6	28.7	31.8	32.0	28.0
oC		mid	27.0	26.6	26.0	26.8	28.0	28.5	28.7	31.5	32.0	26.0
		bottom	27.0	26.6	26.1	26.8	28.1	28.5	28.7	31.5	30.0	26.0
	E	surface	27.0	26.5	26.0	26.8	28.3	28.7	28.7	31.3	31.0	27.0
		mid	27.0	25.5	26.0	26.6	28.3	28.5	28.7	30.7		27.0
		bottom	26.9	25.9	26.1	26.8	28.3	28.5	28.7	30.7		26.0
	F	surface	27.0	25.8	26.0	26.8	28.3	28.6	28.8	29.8	31.0	28.0
		mid	27.0	25.8	26.0	26.8	28.3	28.6	28.8	29.7		28.0
		bottom	27.0	25.8	26.1	26.8	28.3	28.5	28.7	29.8		28.0
salinity	D	surface	34.0	33.0	35.5	35.0	34.0	26.0	23.5	30.0	27.0	29.0
ppt		mid	34.0	33.0	35.5	35.0	34.0	27.0	23.5	31.0	27.0	30.0
		bottom	32.0	32.0	34.0	34.0	34.0	26.5	24.0	30.5	24.0	26.0
	E	surface	34.0	32.0	35.5	35.0	35.0	27.5	23.5	32.0	36.0	32.0
		mid	34.0	32.0	35.5	35.0	35.0	28.0	24.0	30.6		31.0
		bottom	34.0	32.0	35.5	35.0	35.0	28.5	24.0	30.9		31.0
	F	surface	34.0	33.0	35.5	35.0	35.0	29.0	30.0	31.0	36.0	32.0
		mid	34.0	33.0	35.5	35.0	35.0	29.0	30.0	30.5		30.0
		bottom	34.0	33.0	35.5	35.0	35.0	29.0	30.5	31.0		31.0
pH	D	surface	8.17	8.56	8.62	7.64	8.37	7.90	8.44	9.02	8.16	8.24
		mid	8.48	8.63	8.62	8.10	8.68	8.72	8.53	9.04	8.24	8.25
		bottom	8.12	8.64	8.61	8.10	8.61	8.74	8.57	9.02	8.29	8.26
	E	surface	8.08	8.61	8.34	8.07	8.56	8.41	8.50	8.93	8.29	8.27
		mid	8.10	8.63	8.37	8.08	8.55	8.30	8.52	8.90		8.27
		bottom	8.11	8.60	8.36	8.08	8.54	8.50	8.53	8.88		8.28
	F	surface	8.22	8.65	8.43	8.30	8.66	8.41	8.50	9.81	8.28	8.29
		mid	8.19	8.63	8.43	8.30	8.66	8.47	8.50	8.61		8.29
		bottom	8.17	8.62	8.44	8.30	8.65	8.49	8.50	8.68		8.30
D. O.	D	surface	2.46	3.17	4.85	5.68	5.67	1.22**	6.40	3.02	6.90	5.80
mg/L		mid	4.17	3.57	4.76	5.65	5.63	1.21**	6.90	2.96	5.80	5.70
		bottom	4.47	3.68	4.97	5.15	5.69	1.21**	6.60	2.48	5.50	5.80
	E	surface	2.64	3.42	4.97	5.18	4.64	1.19**	7.95	2.98	7.20	5.80
		mid	4.44	3.45	4.86	5.59	5.12	1.29**	6.60	2.75		6.00
		bottom	4.69	3.52	5.22	5.20	5.09	1.12**	6.60	2.83		5.90
	F	surface	2.74	3.31	5.33	5.20	4.92	1.24**	6.30	2.89	7.80	6.00
		mid	4.26	3.37	4.99	5.20	5.15	1.19**	7.90	2.57		6.00
		bottom	4.56	3.44	5.09	5.20	5.35	1.19**	6.80	2.68		6.00
Turbidity	D	surface	0.15	0.25	0.35	0.29	0.20	0.35	0.36	0.25	0.92	1.04
NTU		mid	0.15	0.25	0.30	0.48	0.25	0.41	0.36	0.25	0.60	0.72
except for		bottom	0.25	0.70	0.30	0.48	0.35	0.45	0.85	0.35	0.54	0.96
4/89, 6/89,10/89	E	surface	0.15	0.45	0.20	0.29	0.20	0.35	0.21	0.30	0.64	0.44
when secci		mid	0.15	0.30	0.20	0.29	0.30	0.36	0.45	0.35		0.64
disc was used		bottom	0.25	0.45	0.20	0.29	0.30	0.44	0.33	0.25		0.83
	F	surface	0.15	0.50	0.30	0.29	0.25	0.40	0.30	0.16	0.51	0.46
		mid	0.15	0.40	0.20	0.29	0.20	0.52	0.30	0.29		0.49
		bottom	0.15	0.21	0.20	0.29	0.15	0.42	0.28	0.15		0.49
NOx	D	surface										
mg/l		mid										
		bottom										
	E	surface										
		mid										
		bottom										
	F	surface										
		mid										
		bottom										
FRP	D	surface										
mg/l		mid										
		bottom										
	E	surface										
		mid										
		bottom										
	F	surface										
		mid										
		bottom										
Treatment Plant Average Flow (MGD)												

** values not included in calculations or graphs. These values are too low, the control site also has the same low readings. Probably due to incorrect use or calibration of the DO meter.

Table 1. Water Quality Data for . Agana WWTP Receiving waters 1989-1997

PARAMETER	STATION	DEPTH	DATE	STATISTICAL DATA		
			7/97	MIN.	AVG.	MAX.
Fecal Coliform	D	surface	400			
FC/100mL *	E	surface	400			
	F	surface	400			
temperature	D	surface		26.0	28.3	32.0
oC		mid	29.5	26.0	28.2	32.0
		bottom	29.0	26.0	28.1	31.5
	E	surface	29.0	26.0	28.2	31.3
		mid	29.0	25.5	28.0	31.0
		bottom	29.0	25.9	27.9	31.0
	F	surface	29.0	25.8	28.1	31.0
		mid	29.0	25.8	27.9	30.7
		bottom	29.0	25.8	27.9	30.4
salinity	D	surface	28.5	23.5	32.1	35.6
ppt		mid	29.0	23.5	32.1	35.5
		bottom	29.0	24.0	31.5	35.9
	E	surface	28.0	23.5	33.2	36.0
		mid	29.0	24.0	33.1	36.1
		bottom	28.0	24.0	33.1	35.9
	F	surface	28.0	28.0	33.5	36.0
		mid	29.0	29.0	33.5	36.1
		bottom	29.0	29.0	33.6	36.1
pH	D	surface	8.28	7.64	8.32	9.20
		mid	8.29	8.08	8.44	9.54
		bottom	8.30	8.08	8.44	9.56
	E	surface	8.31	8.07	8.39	9.58
		mid	8.31	8.08	8.40	9.60
		bottom	8.32	8.08	8.46	9.60
	F	surface	8.30	8.16	8.52	9.81
		mid	8.32	8.14	8.48	9.82
		bottom	8.32	8.00	8.47	9.88
D. O.	D	surface	5.90	2.46	5.29	6.90
mg/L		mid	5.90	2.96	5.21	7.10
		bottom	6.10	2.48	5.19	7.30
	E	surface	6.30	2.45	5.29	7.95
		mid	5.90	2.75	5.18	6.60
		bottom	5.90	2.83	5.28	7.20
	F	surface	6.20	2.74	5.14	8.40
		mid	6.20	2.57	5.04	7.90
		bottom	6.00	2.68	5.07	6.80
Turbidity	D	surface	0.22	0.15	1.82	11.00
NTU		mid	0.21	0.15	1.91	11.00
except for		bottom	0.13	0.13	1.66	11.00
4/89, 6/89,10/89	E	surface	1.04	0.15	1.87	11.00
when secci		mid	0.31	0.15	1.92	11.00
disc was used		bottom	0.15	0.10	1.92	11.00
	F	surface	1.95	0.15	1.92	11.00
		mid	0.20	0.05	1.88	11.00
		bottom	0.21	0.05	1.88	11.00
NOx	D	surface				
mg/l		mid				
		bottom				
	E	surface				
		mid				
		bottom				
	F	surface				
		mid				
		bottom				
FRP	D	surface				
mg/l		mid				
		bottom				
	E	surface				
		mid				
		bottom				
	F	surface				
		mid				
		bottom				
Treatment Plant Average Flow (MGD)						

Figure 11



Agana WWTP Water Quality Monitoring Stations.

AGA 1813

D

Biological Conditions

II.C. Biological Conditions

II.C.1 Provide a detailed description of representative biological communities in the vicinity of your current and modified discharge(s)

There is evidence that prior to the construction of the Agana treatment plant in 1979, the reef community in Agana Bay may not have been as diverse as other coastal areas of Guam. According to the Dames and Moore Report 1994, an underwater video taken along the Agana Bay reef zone in 1968 showed no significant coral growth within the entire area. WWII battles had denuded much of the Agana area, and heavy rainfalls have caused extensive erosion and mudslides. These have adversely affected and possibly permanently impacted the Coral Communities (Dr. Richard Randall, personal communication as reported in Dames and Moore, 1994). Randall considers that the video findings in Agana Bay as reflecting ambient conditions that do not support coral growth, and not as a result of any point or non-point source pollution or impact activity.

Jones and Randall 1971 reported that the depth at which the reef front terminates along West Agana Bay is generally 6 to 8 meters. The only significant reef coral community occurs in this zone, and is in sharp contrast with the dead corals of the submarine terrace, seaward slope and second submarine terrace. The corals in these areas were reported as been 90% dead, presumably as a result of a Acantaster planci infestation.

Biological monitoring of the Agana WWTP's was contracted to the University of Guam Marine Laboratory. The surveys were conducted quarterly, from Aug 1989 until Sept 1994, with quarterly reports and yearly summaries submitted to GWA. Three 10 m transects were run parallel to shore, one immediately at the diffusers (0 m) and the other two at 20 m and 50 m distances towards shore from the diffusers (Figure 12). The transects were therefore at progressively shallower depths. However, the individual transect depths are unknown. Transect sites were permanently marked for long term monitoring. No control site surveys were conducted for comparison.

Qualitative observations were made to determine the composition of each site. An estimate of substrate cover was done by using a 10 m chain-link transect method, and the percent cover of various species and benthic groups were estimated. The species of fish present were recorded by a diver swimming the 50 meter line connecting each of the three transects. The reports did not state whether the fish observations were restricted to a distance either side of the 50 m line or whether it was a timed observation, and quantities of each species were not recorded. The GWA biologist conducted a Review and Analysis of Past Biological Monitoring Data for the Agana WWTP, Guam. This report is located in ITEM N. The information below is taken from that report.

A summary of the surveys to estimate percent cover by individual species or benthic groups (*i.e.* Bare Substrate, Turf Algae, Macro Algae, Coralline Algae, Corals and other) along the 0m, 20m and 50m transects are given in Table 2, 3 and 4. In general the area surrounding the diffusers (0 - 50m) was predominantly covered by Bare Substrate and Turf Algae. These two groups in general made up greater than 80% of the cover, with Coral, Coralline Algae, Macro Algae or other live sessile organisms (sponges, ascidians, vermetid molluscs, etc) making up the remaining benthic cover. Regression analysis was performed on the data to establish if there had been any significant changes in the benthic community over the period of time that the surveys took place. Results of the analysis are summarized in Table 5. There were significant increases in Bare Substrate and Coral cover along the 0m, 20m and 50m transects.

Macro Algae cover had a significant increase along the 0m and 20m transects, and Coralline Algae cover also significantly increased along the 0m transect. Turf Algae cover significantly decreased along the 0m transect. All other changes in percentage over cover were non significant.

A summary of the fish species observed over the study period is given in Table 6. The species diversity and number of species in each trophic level did not change significantly over the period of biological monitoring, and are believed to be representative of other coral reef fish communities around Guam (personal communication; Dr Steve Amesbury, Prof. of Ichthyology, UOG Marine Laboratory).

Dames and Moore , 1994. Impact Assessment of Non-Chlorinated Effluent from Agana and Northern District Wastewater Treatment Plants. Public Utility Agency of Guam Report

Jones R.S. and R. H. Randall, 1971. An Annual Cycle Study of Biological, Chemical and Oceanographic Phenomena Associated with the Agana Ocean Outfall. University of Guam the Marine Laboratory Technical Report No. 1.

II.C.2. a. Are distinctive habitats of limited distribution (such as kelp beds or coral reef) located in areas potentially affected by the modified discharge?

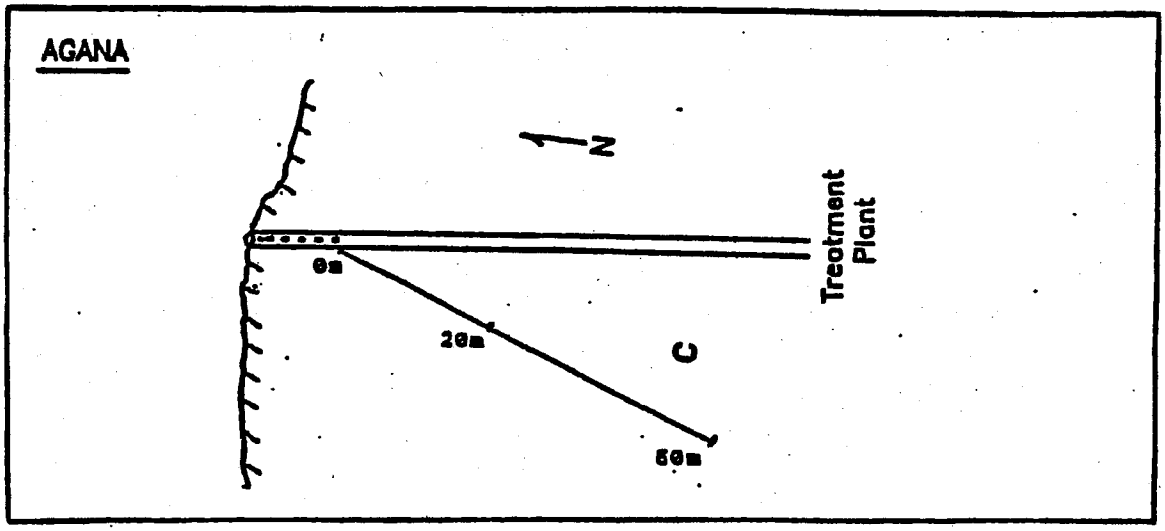
Yes, coral reefs encircle almost the entire island of Guam.

II.C.3. a. Are commercial or recreational fisheries located in areas potentially affected by the discharge?

Yes.

b. If yes, provide information on types, location and value of fisheries

Attached information is from surveys conducted by the Department of Aquatics and Wildlife Resources (DAWR) during 1997.



Location of Biological Monitoring Transects, with sample locations at 0m, 20m and 50m.

Table 2. Species list and percent cover along the 0 meter transect at Agana Outfall

SPECIES OR GROUP	PERCENT COVER															
	8/29/89	11/21/89	4/6/90	6/14/90	10/4/90	12/6/90	8/3/91	12/27/91	4/10/92	8/3/92	12/3/92	3/29/93	8/16/93	1/12/94	5/26/94	9/2/94
Padina sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
Tunicate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00
Soft coral	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00
Favites sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Porites lutea	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Milliopora	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Goniastrea sp.	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Galaxea sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pocillopora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00
Astreopora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00
Halimeda discoidea	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Goniopera sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fungia	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00
Leptastrea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.78	0.00
Cyptastrea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00
Galaxaura sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00
Thelanota ananas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30
Halymenia	0.00	0.00	0.00	0.00	0.00	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dictiota sp.	0.00	0.00	0.00	0.13	1.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Neomeris sp.	0.00	0.00	0.00	1.30	0.00	0.00	0.00	0.53	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
Hydroids	0.00	0.00	0.00	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Favia sp.	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.15	0.39	0.00	0.39	0.13	0.00
Montipora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.78	0.39	0.00	1.43	0.00
Sponge	3.03	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Porites sp.	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	1.05	1.29	0.69	1.04	0.65	2.99	2.47	1.30
Schizotrix sp.	0.00	0.00	0.00	0.00	5.97	1.43	5.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Halimeda sp.	0.00	0.00	0.00	0.00	9.35	5.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Halimeda opuntia	2.76	0.00	0.00	0.26	0.00	0.00	3.95	9.34	6.45	4.03	0.47	1.17	1.82	8.31	6.62	0.26
Coralline Algae	0.00	1.77	0.00	11.95	0.00	3.90	0.00	1.18	0.53	0.00	6.78	4.03	4.94	6.36	10.65	5.19
Bare	17.90	0.00	1.82	1.56	1.69	8.18	9.21	76.72	74.34	53.65	84.44	66.75	76.75	70.39	41.30	4.42
Turf Algae	76.32	97.73	96.62	82.21	81.30	79.22	81.05	11.58	16.84	39.60	7.24	22.47	15.45	11.17	18.57	87.53

Table 3. Species list and percent cover along the 20 meter transect at Agana Outfall

SPECIES OR GROUP	PERCENT COVER															
	8/29/89	11/21/89	4/6/90	6/14/90	10/4/90	12/6/90	8/3/91	12/27/91	4/10/92	8/3/92	12/3/92	3/29/93	8/16/93	1/12/94	5/26/94	9/2/94
Acrhelia horrescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Chrysophycea	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fungia sp.	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Porites lutea	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asteopora	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jania sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ceramiales	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Goniopera sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gracilaria sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00
Sponge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00
Leptoseris	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Enteromorpha sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00
Soft coral	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00
Pocillopora	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pavona sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78
Favia	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.37	0.00
Goniastrea sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.78	0.00	0.13
Padina	0.00	0.00	0.26	0.26	0.00	0.00	0.00	0.00	0.26	0.78	0.00	0.00	0.00	0.00	0.00	0.00
Leptastrea sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.52	0.00	0.26
Culcita sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	0.00	0.00
Porites rus	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	2.08	0.00	1.04	0.26	2.34	0.00	0.00
Neomeris	0.00	0.00	0.00	3.51	0.00	0.00	0.00	0.92	0.13	2.05	0.24	0.00	0.00	0.00	0.74	0.00
Liagora sp.	0.00	1.71	0.00	6.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Galaxaura sp.	2.24	0.79	7.15	0.00	2.21	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00
Montipora sp.	0.00	0.00	0.00	0.00	1.00	2.60	0.00	1.32	0.92	0.00	0.00	0.78	2.73	0.65	4.08	0.00
Porites sp.	0.00	0.00	1.69	0.78	6.10	1.04	0.00	0.00	0.00	0.00	1.89	0.00	0.00	0.00	1.48	1.69
Halimeda discoidea	0.92	0.00	1.82	0.00	0.00	0.00	9.60	6.05	8.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Schizothrix	0.00	0.00	1.95	0.00	31.82	2.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Halimeda sp.	0.00	0.00	0.00	12.60	12.21	14.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.99	0.00	0.00
Coralline Algae	0.00	13.95	1.30	0.00	10.00	0.00	1.20	0.00	0.26	7.02	4.44	4.03	5.71	0.00	1.11	3.90
Halimeda opuntia	0.53	4.61	4.88	0.00	0.00	0.00	0.00	0.00	0.00	19.37	5.93	1.17	12.08	0.00	11.87	10.52
Turf Algae	65.66	73.81	60.88	65.07	13.25	80.00	28.80	8.02	9.47	36.59	49.04	12.99	24.94	12.08	13.73	71.17
Bare	30.53	4.61	19.75	11.56	12.47	0.00	59.40	83.43	79.48	31.47	37.16	78.18	54.29	68.57	66.05	11.43

Table 4. Species list and percent cover along the 50 meter transect at Agana Outfall

SPECIES OR GROUP	PERCENT COVER															
	8/29/89	11/21/89	4/6/90	6/14/90	10/4/90	12/6/90	8/3/91	12/27/91	4/10/92	8/3/92	12/3/92	3/29/93	8/16/93	1/12/94	5/26/94	9/2/94
Chrysophycea	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Faviidae	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stichopus chloronotus.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00
Favites	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00
Pocillopora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00
Gracilaria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00
Herpolitha sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00
Echinostrephus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00
Leptastrea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00
Porites lutea	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Astreopora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.52	0.00	0.00
Desmea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.00
Dictyota	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Echinotrixs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.21	0.00
Goniastrea sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39
Favia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.65	0.00	0.00	0.00	0.78	0.13	0.39
Neomeris sp.	0.00	0.00	0.91	0.39	0.00	0.00	0.00	0.79	0.39	0.52	0.00	0.00	0.00	0.00	0.00	0.00
Halimeda disoidae	2.44	0.00	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Padina sp.	0.00	0.00	2.73	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Montipora sp.	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	2.24	0.26	0.54	0.00	0.00	0.00	0.00	0.26
Porites sp.	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	1.30	1.95	1.56	0.00	1.95
Porites rus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.24	0.00	0.26	0.39	0.00	0.00	1.56	0.00	0.00
Schizotrix sp.	0.00	0.00	0.26	0.00	2.80	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Halimeda sp.	0.00	0.00	0.00	0.00	5.00	8.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liagora	0.19	3.42	14.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coralline Algae	0.00	1.05	1.43	0.00	0.00	0.78	0.66	0.39	1.58	0.39	1.93	1.30	2.21	2.08	1.43	3.64
Galaxaura sp.	8.83	0.92	5.59	5.32	0.00	1.43	0.00	5.66	0.79	0.00	0.15	4.29	1.30	2.60	0.00	0.00
Halimeda opuntia	0.00	3.29	1.30	3.38	0.00	0.00	6.58	6.18	9.21	13.65	5.77	8.57	9.22	10.39	24.16	9.48
Bare	22.19	11.58	22.46	15.46	5.00	9.48	9.34	2.10	30.41	23.78	80.37	60.13	70.65	60.52	56.49	24.42
Turf Algae	66.17	79.07	50.76	74.15	82.21	68.43	83.42	75.01	54.07	58.93	9.39	24.03	13.51	21.30	14.03	59.48

Table 5. Regression analysis results for Agana Biomonitoring. Regression performed on the change in % cover of the six categorie categories over the 61 months that the area was surveyed. (August 1989 to September 1994).

Transect	Bare	Turf Algae	Macro Algae	Coral	Coralline	Other
0 m	+s	-s	+	+s	+s	-
ts	2.708	-3.36	1.132	3.414	3.414	-1.267
20 m	+s	-	+	+s	-	+
ts	2.51	-0.82	-0.76	4.26	-1.4	1.33
50 m	+s	-	-	+s	+	-
ts	3.159	-0.907	-1.332	3.439	0.509	-0.783

s = significant at 95%
+ = positive regression
- = negative regression

Table 6. Agana outfall Fish Species.

shaded boxes represent that species were present.

Fiscal Year	1990				1991				1992				1993				1994				Total
quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	n/16
Acanthuridae	Acanthurinae (Surgeonfishes)																				
Acanthurus blochii						ns					ns				ns				ns		10
Acanthurus nigricans						ns					ns				ns				ns		11
Acanthurus nigrofuscus						ns					ns				ns				ns		15
Acanthurus nigroris						ns					ns				ns				ns		1
Acanthurus olivaceus						ns					ns				ns				ns		2
Ctenochaetus binotatus						ns					ns				ns				ns		3
Ctenochaetus striatus						ns					ns				ns				ns		12
Zebrasoma flavescens						ns					ns				ns				ns		1
Acanthuridae	subfamily Nasinae (Unicornfishes)																				
Naso annulatus						ns					ns				ns				ns		5
Naso hexacanthus						ns					ns				ns				ns		2
Naso lituratus						ns					ns				ns				ns		16
Apogonidae (Cardinalfishes)																					
Apogon spp.						ns					ns				ns				ns		1
Apogon angustatus						ns					ns				ns				ns		3
Balistidae (Triggerfishes)																					
Balistapus undulatus						ns					ns				ns				ns		7
Melichthys niger						ns					ns				ns				ns		5
Melichthys vidua						ns					ns				ns				ns		16
Odonus niger						ns					ns				ns				ns		16
Sufflamen bursa						ns					ns				ns				ns		15
Blenniidae (Blennies)																					
Meiacantus atrodorsalis						ns					ns				ns				ns		2
Carangidae (Jacks; Trevallys)																					
Elagatis binnulatus						ns					ns				ns				ns		1
Chaetodontidae (butterflyfishes)																					
Chaetodon citrinellus						ns					ns				ns				ns		15
Chaetodon ephippium						ns					ns				ns				ns		1
Chaetodon kleinii						ns					ns				ns				ns		8
Chaetodon lunula						ns					ns				ns				ns		1
Chaetodon mertensii						ns					ns				ns				ns		13
Chaetodon punctatofasciatus						ns					ns				ns				ns		1
Chaetodon reticulatus						ns					ns				ns				ns		1
Chaetodon ulietensis						ns					ns				ns				ns		10
Forcipiger flavissimus						ns					ns				ns				ns		6
Forcipiger longirostris						ns					ns				ns				ns		12
Heniochus monoceros						ns					ns				ns				ns		3
Cirrhitidae (Hawkfish)																					
Cirrhitichthys falco						ns					ns				ns				ns		1
Diodontidae (Porcupinefishes)																					
Diodon hystrix						ns					ns				ns				ns		1
Gobiidae (Gobies)																					
Valenciennea strigatus						ns					ns				ns				ns		13
Haemulidae (Sweetlips and Grunts)																					
Plectorhinchus obscurus						ns					ns				ns				ns		3
Hemigaleidae (Whitetip shark)																					
Triaenodon obesus						ns					ns				ns				ns		6
Holocentridae (squirrelfishes)	Holocentrinae (Squirrelfishes)																				
Sargocentron spiniferum						ns					ns				ns				ns		3
Kyphosidae (Rudderfishes; Sea Chubs)																					
Kyphosus sp.						ns					ns				ns				ns		1
Kyphosus cinerascens						ns					ns				ns				ns		4
Labridae (Wrasses)																					
Anampes spp.						ns					ns				ns				ns		2
Bodianus axillaris						ns					ns				ns				ns		1
Cheilinus oxycephalus						ns					ns				ns				ns		10
Cheilinus unifasciatus						ns					ns				ns				ns		15
Cheilio inermis						ns					ns				ns				ns		10
Cirrhilabrus sp.						ns					ns				ns				ns		1
Coris gaimard						ns					ns				ns				ns		6
Epibulus insidiator						ns					ns				ns				ns		2
Halichoeres biocellatus						ns					ns				ns				ns		10
Halichoeres hortulanus						ns					ns				ns				ns		15
Halichoeres margaritaceus						ns					ns				ns				ns		10
Halichoeres marginatus						ns					ns				ns				ns		11

Table 6. Agana outfall Fish Species.

shaded boxes represent that species were present.

Fiscal Year	1990				1991				1992				1993				1994				Total
quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	n/16
Halichoeres melanurus						ns					ns				ns				ns		1
Halichoeres trimaculatus						ns					ns				ns				ns		3
Hemigymnus fasciatus						ns					ns				ns				ns		4
Hemigymnus melapterus						ns					ns				ns				ns		10
Labroides bicolor						ns					ns				ns				ns		14
Labroides dimidiatus						ns					ns				ns				ns		15
Macropharyngogon meleagris						ns					ns				ns				ns		6
Novaculichthys taeniourus						ns					ns				ns				ns		1
Pseudocheilinus octotaenia						ns					ns				ns				ns		3
Pterogogus cryptus						ns					ns				ns				ns		10
Stethojulis bandanensis						ns					ns				ns				ns		4
Stethojulis strigiventor						ns					ns				ns				ns		11
Thalassoma lutescens						ns					ns				ns				ns		15
Lethrinidae (Emperors)																					
Lethrinus harak						ns					ns				ns				ns		1
Lethrinus ramak						ns					ns				ns				ns		1
Monotaxis grandoculus						ns					ns				ns				ns		1
Lutjanidae (Snappers)																					
Aphareus furca						ns					ns				ns				ns		1
Aprion virescens						ns					ns				ns				ns		3
Microdesmidae (Dartfishes)																					
Nemateleotris magnifica						ns					ns				ns				ns		3
Ptereleotris evides						ns					ns				ns				ns		1
Monacanthidae (Filefishes)																					
Pervagor janthinosoma						ns					ns				ns				ns		1
Mugilidae (Mullets)																					
Parupeneus barberinus						ns					ns				ns				ns		10
Parupeneus cyclostomus						ns					ns				ns				ns		1
Parupeneus multifasciatus						ns					ns				ns				ns		10
Pinguipedidae (Sandperches)																					
Parapercis sp.						ns					ns				ns				ns		10
Parapercis clatherata						ns					ns				ns				ns		6
Pomacanthidae (Angelfishes)																					
Centropyge sp.						ns					ns				ns				ns		1
Centropyge flavissimus						ns					ns				ns				ns		14
Centropyge shepardi						ns					ns				ns				ns		10
Pygoplites diacanthus						ns					ns				ns				ns		8
Pomacentridae (Damselfishes)																					
Abudefduf saxatalis						ns					ns				ns				ns		6
Abudefduf sexfasciatus						ns					ns				ns				ns		9
Amphiprion periderion						ns					ns				ns				ns		3
Chryiptera traceyi						ns					ns				ns				ns		5
Chrysiptera glauca						ns					ns				ns				ns		10
Chrysiptera leucopoma						ns					ns				ns				ns		11
Dascyllus trimaculatus						ns					ns				ns				ns		4
Pomacentrus vaiuli						ns					ns				ns				ns		6
Stegastes sp.						ns					ns				ns				ns		1
Scaridae (Parrotfishes)																					
Calototomus carolinus						ns					ns				ns				ns		2
Scarus gibbus						ns					ns				ns				ns		1
Scarus globiceps						ns					ns				ns				ns		11
Scarus schlegeli						ns					ns				ns				ns		11
Scarus sordidus						ns					ns				ns				ns		16
Scatophagidae (Scats)																					
Platax orbicularis						ns					ns				ns				ns		16
Scombridae (Tunas)																					
Gymnosarda unicolor						ns					ns				ns				ns		1
Scorpaenidae (Scorpionfishes)																					
Pterois antennata						ns					ns				ns				ns		3
Serrandiae (Grouper)																					
Cephalopholis miniata						ns					ns				ns				ns		1
Cephalopholis urodeta						ns					ns				ns				ns		5
Epinephelus sp.						ns					ns				ns				ns		1
Epinephelus fasciatus						ns					ns				ns				ns		1
Plectropomus areolatus						ns					ns				ns				ns		1

Table 6. Agana outfall Fish Species.

shaded boxes represent that species were present.

Fiscal Year	1990				1991				1992				1993				1994				Total
quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	n/16
Siganidae (Rabbitfish)																					
Siganus aregenteus						ns					ns				ns				ns		1
Sphyraenidae (Barracudas)																					
Sphyraena forsteri						ns					ns				ns				ns		10
Syngnathidae (pipefishes)	subfamily Syngnathinae (Pipefishes)																				
Corythoichthys sp.						ns					ns				ns				ns		3
Synodontidae (Lizardfishes)																					
Saurida gracilis						ns					ns				ns				ns		1
Tetraodontidae (puffers)																					
Canthigaster solandri						ns					ns				ns				ns		4
Cathigaster valentini						ns					ns				ns				ns		2
Zanclidae (Moorish Idol)																					
Zancluls cornutus						ns					ns				ns				ns		7
total number of species	39	27	48	44	42	ns	56	47	51	46	ns	47	43	38	ns	38	38	37	ns	38	

Numberof fish species that fall under each trophic level.

Fiscal Year	1990				1991				1992				1993				1994			
quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Herbivore	14	11	8	8	8	ns	15	15	15	16	ns	16	12	11	ns	11	11	11	ns	10
Carnivore	18	10	24	21	21	ns	29	22	25	23	ns	24	23	20	ns	20	20	19	ns	19
Invertivore	16	8	23	20	20	ns	27	22	24	23	ns	23	22	19	ns	19	19	19	ns	18
Planktivore	5	2	8	7	7	ns	4	5	4	3	ns	3	3	3	ns	3	3	3	ns	3
Omnivore	1	1	1	1	1	ns	0	0	0	0	ns	0	0	0	ns	0	0	0	ns	0
Corallivore	1	3	6	7	4	ns	7	5	7	5	ns	5	4	4	ns	4	4	4	ns	4

FACSIMILE TRANSMITTAL SHEET

DATE: 19 February 1998

NUMBER OF PAGES (INCLUDING THIS PAGE): 3

****

TO:
NAME: JoAnne Boyd
ROUTING: Guam Waterworks Authority
TELEPHONE: 637-2592 (FAX)
(COMMERCIAL)
SUBJECT: Inshore Catch Estimates for Agana Boat Basin and Tanguisson

****

FROM:
NAME: Todd Pitlik
ROUTING: Division of Aquatic & Wildlife Resources (DAWR)
TELEPHONE: (671) 734-6570 (FAX)
(671) 735-3986 (COMMERCIAL)

****

MESSAGE:

Hi JoAnne,

I came up with an estimated total of fish harvested from locations 8, 9, 10, and 92 (Fig. 1). The total estimated harvest of finfish and invertebrates for FY97 in these areas was 2.9 mt (not including manahak). The total annual harvest was determined from 51 surveyed locations with an average of 735 kg (2% of islandwide harvest) per location were harvested in FY97. I was not able to generate specific expansions due to results with unacceptable confidence intervals from the use of only 4 locations. However, approximately 99% of our annual Atulai (*Selar crumenophthalmus*) harvest comes from the Boat Basin (loc 9) and it was

approximately 995 kg in FY97. Gerry Davis did not think the offshore results would be of any use to your project due to the catch being derived from the outer banks and FADs. Let me know if this info will suffice and if you have any more questions.

Sincerely,

Todd J. Pitlik

Todd J. Pitlik

Fisheries Biologist

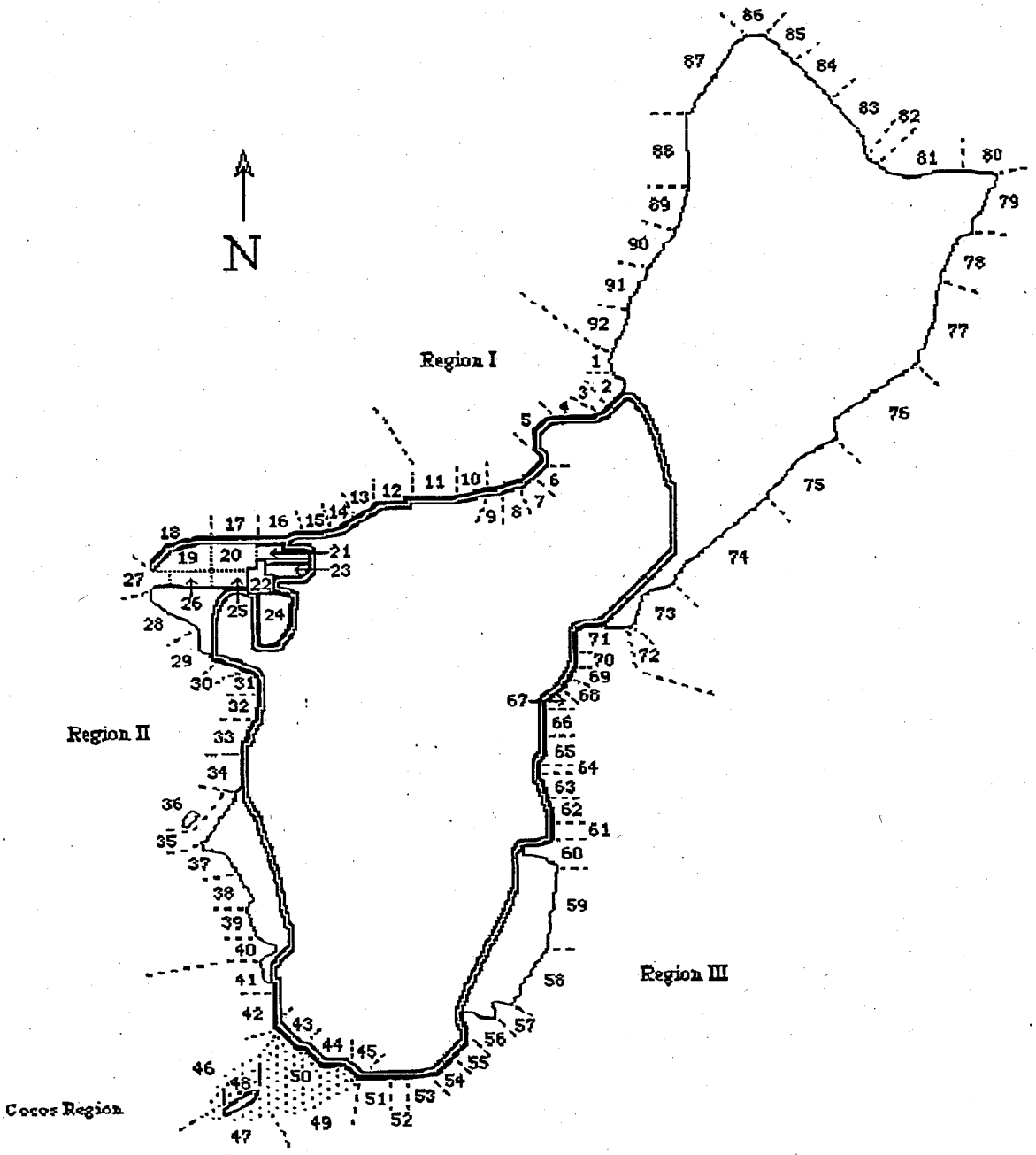


Figure 1. Inshore Fisheries "Participation Survey" Route and Location Codes.

Table 7

Table 1. Combined estimated inshore participation, effort, and total harvest (kg) for all methods during the day and night in FY97.

METHOD	Persons	Gears	Trips	Per-Hrs	Gear-Hrs	Catch	Finfish	Inverts	CPUE**
Hook & Line	44,774	44,158	25,697	155,038	153,318	15,033	14,940	93	0.15 wd
Cast Net	10,055	8,826	7,734	23,063	20,246	7,518	7,500	18	0.78 wen
Gill Net	7,637	3,581	2,410	28,103	13,138	6,111	5,763	347	0.87 wed
Surround Net	0	0	0	0	0	0	0	0	0.0
Spear Snorkel	2,829	2,455	1,370	5,910	5,083	3,410	2,594	815	0.84 wn
Spear Scuba	36	36	32	37	37	39	36	3	1.32 wen
Drag Net	160	29	29	267	49	79	79	0	1.67 wn
Hooks & Gaffs	731	938	469	1,376	1,659	433	0	433	0.28 wd
Other*	2,323	2,323	1,407	3,996	3,996	4,864	647	4,217	2.12 wd
TOTAL	68,545	62,344	39,147	217,789	197,525	37,486	31,560	5,925	0.16

*Other methods typically includes: gleaning, hand nets, traps, and spears.
**CPUE (kg/gh) summary includes either the greatest weekday (wd) or weeknight (wn) or weekend day (wed), weekend night (wen) values listed in Tables 2 and 3. The greatest CPUE value for hook and line was region 3.

Table 2. Estimated inshore participation, effort, and total harvest (kg) for all methods during the day in FY97.

METHOD	Persons	Gears	Trips	Per-Hrs	Gear-Hrs	Catch	Finfish	Inverts	CPUE**
Hook & Line	30,180	30,148	18,361	110,557	110,652	12,098	12,008	90	0.15 wd
Cast Net	9,989	8,759	7,672	22,932	20,115	7,457	7,456	1	0.54 wd
Gill Net	5,628	2,660	1,626	19,567	9,253	4,686	4,447	239	0.87 wed
Surround Net	0	0	0	0	0	0	0	0	0.0
Spear Snorkel	1,348	1,063	785	2,959	2,304	1,473	829	644	0.69 wed
Spear Scuba	0	0	0	0	0	0	0	0	0.0
Drag Net	0	0	0	0	0	0	0	0	0.0
Hooks & Gaffs	731	938	469	1,376	1,659	433	0	433	0.28 wd
Other*	1,668	1,668	928	2,572	2,572	4,664	616	4,048	2.12 wd
TOTAL	49,545	45,235	29,841	159,962	146,555	30,812	25,357	5,454	0.21

*Other methods typically includes: gleaning, hand nets, traps, and spears.
**CPUE (kg/gh) summary includes either the greatest weekday (wd) or weekend day (wed) values. The greatest CPUE value for hook and line was region 3

Table 7

Table 3. Estimated inshore participation, effort, and total harvest (kg) for all methods during the night in FY97.

METHOD	Persons	Gears	Trips	Per-Hrs	Gear-Hrs	Catch	Finfish	Inverts	CPUE**
Hook & Line	14,593	14,010	7,336	44,481	42,666	2,935	2,932	3	0.12 wn
Cast Net	66	66	61	131	131	61	44	17	0.78 wen
Gill Net	2,009	921	784	8,536	3,886	1,424	1,316	108	0.63 wn
Surround Net	0	0	0	0	0	0	0	0	0.0
Spear Snorkel	1,481	1,392	585	2,951	2,778	1,936	1,765	171	0.84 wn
Spear Scuba	36	36	32	37	37	39	36	3	1.32 wen
Drag Net	160	29	29	267	49	79	79	0	1.67 wn
Hooks & Gaffs	0	0	0	0	0	0	0	0	0.0
Other*	655	655	479	1,423	1,423	200	31	169	0.14 wd
TOTAL	19,000	17,109	9,306	57,826	50,970	6,674	6,203	471	0.13

*Other methods typically includes: gleaning, hand nets, traps, and spears.

**CPUE (kg/gh) summary includes either the greatest weeknight (wn) or weekend night (wen) values. The greatest value for hook and line was region 3.

Table 7

Table 4. FY97 combined day and night catch composition for the top ten species and families of finfish harvested. Juvenile *Caranx ignobilis, C. melampygous, C. papuensis,* and *C. sexfasciatus* (i'e' ≤ 200mm), *Mulloides flavolineatus* (ti'ao ≤ 100mm), and *Siganus spinus* (mañåhak), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the day and night catch (31,560 kg).

SPECIES	Harvest	
	kg	%
Naso unicornis	3,454.57	10.95
Siganus spinus	3,397.28	10.76
Acanthurus triostegus	1,973.18	6.25
Lethrinus harak	1,170.58	3.71
Caranx i'e'	1,047.54	3.32
Selar crumenophthalmus	994.94	3.15
Liza vaigiensis	963.62	3.05
Mulloides ti'ao	798.58	2.53
Mulloides flavolineatus	768.74	2.44
Caranx ignobilis	618.85	1.96
TOTAL ANNUAL COMBINED CATCH	15,187.88	48.12

FAMILY	Harvest	
	kg	%
Acanthuridae	6,835.24	21.66
Carangidae	4,662.48	14.77
Siganidae	3,650.93	11.57
Lethrinidae	2,193.78	6.95
Mullidae	1,943.47	6.16
Mugilidae	1,785.86	5.66
Lutjanidae	1,437.95	4.56
Gerreidae	1,049.82	3.33
Labridae	1,006.37	3.19
Scaridae	854.19	2.71
	25,420.09	80.55

Table 5. FY97 day catch composition for the top ten species and families of finfish harvested. Juvenile *Caranx ignobilis, C. melampygous, C. papuensis,* and *C. sexfasciatus* (i'e' ≤ 200mm), *Mulloides flavolineatus* (ti'ao ≤ 100mm), and *Siganus spinus* (mañåhak), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total day catch (25,357 kg).

SPECIES	Harvest	
	kg	%
Naso unicornis	3,154.85	12.44
Siganus spinus	2,976.54	11.74
Acanthurus triostegus	1,689.77	6.66
Lethrinus harak	944.00	3.72
Liza vaigiensis	880.03	3.47
Mulloides ti'ao	764.30	3.01
Caranx i'e'	742.14	2.93
Mulloides flavolineatus	652.82	2.57
Gerres oblongus	563.68	2.22
Caranx ignobilis	558.11	2.20
TOTAL ANNUAL DAY CATCH	12,926.24	50.98

FAMILY	Harvest	
	kg	%
Acanthuridae	6,110.36	24.10
Siganidae	3,187.36	12.57
Carangidae	3,005.71	11.85
Lethrinidae	1,728.74	6.82
Mullidae	1,726.38	6.81
Mugilidae	1,615.97	6.37
Lutjanidae	963.25	3.80
Gerreidae	876.82	3.46
Labridae	822.45	3.24
Scaridae	617.89	2.44
	20,654.93	81.46

Table 7

Table 6. FY97 night catch composition for the top ten species and families of finfish harvested. Juvenile *Caranx ignobilis*, *C. melampygous*, *C. papuensis*, and *C. sexfasciatus* (i'e' ≤ 200mm), *Mulloides flavolineatus* (ti'ao ≤ 100mm), and *Siganus spinus* (mañåhak), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total night catch (6,203 kg).

SPECIES	Harvest	
	kg	%
Selar crumenophthalmus	840.55	13.55
Siganus spinus	420.74	6.78
Caranx i'e'	305.40	4.92
Naso unicornis	299.72	4.83
Acanthurus triostegus	283.41	4.57
Lutjanus argentimaculatus	243.27	3.92
Lethrinus harak	226.58	3.65
Caesio caerulaurea	203.32	3.28
Caranx sexfasciatus	200.25	3.23
Lutjanus fulvus	189.89	3.06
TOTAL ANNUAL NIGHT CATCH	3,213.13	51.80

FAMILY	Harvest	
	kg	%
Carangidae	1,656.77	26.71
Acanthuridae	724.88	11.69
Lutjanidae	474.70	7.65
Lethrinidae	465.04	7.50
Siganidae	463.57	7.47
Holocentridae	293.43	4.73
Scaridae	237.19	3.82
Mullidae	217.09	3.50
Caesionidae	207.33	3.34
Labridae	183.92	2.97
	4,923.92	79.38

Table 7

Table 7. Comparison of the combined day and night catch composition for the top species and families of finfish harvested in FY93 and FY97. Juvenile *Caranx ignobilis, C. melampygous, C. papuensis,* and *C. sexfasciatus* (i'e' ≤ 200mm), *Mulloides flavolineatus* (ti'ao ≤ 100mm), and *Siganus spinus* (mañâhak), are listed separately from the intermediate to adult size classes.

SPECIES	Harvest (kg)		% Δ
	FY93	FY97	
Mulloides flavolineatus	4,438.47	768.74	↓83
Acanthurus triostegus	2,305.25	1,973.18	↓14
Lethrinus xanthochilus	2,154.46	436.07	↓80
Siganus spinus	2,143.29	3,397.28	37↑
Myripristis berndti	2,041.87	96.20	↓95
Naso unicornis	1,971.48	3,454.57	43↑
Crenimugil crenilabis	1,675.97	377.73	↓77
Kyphosus cinerascens	1,482.58	226.19	↓85
Lethrinus obsoletus	1,298.21	222.40	↓83
Mulloides ti'ao	1,196.56	798.58	↓14
TOTAL ANNUAL COMBINED CATCH	20,708.14	11,750.94	↓43

FAMILY	Harvest (kg)		% Δ
	FY93	FY97	
Acanthuridae	7,296.15	6,835.24	↓06
Mullidae	6,818.88	1,943.47	↓72
Lethrinidae	4,539.39	2,193.78	↓52
Mugilidae	3,609.74	1,785.86	↓51
Siganidae	3,239.59	3,650.93	37↑
Holocentridae	2,801.69	545.64	↓81
Carangidae	2,189.94	4,662.48	43↑
Scaridae	1,659.54	854.19	↓49
Kyphosidae	1,507.71	472.61	↓69
Lutjanidae	1,480.96	1,437.95	↓03
	35,143.59	24,382.15	↓47

% Δ reduction (↓)or % Δ increase (↑) of species and family totals (kg) from FY93-97.

Table 7

Table 9. FY97 day and night catch composition for the top ten species of finfish harvested by hook and line method. Juvenile *Caranx ignobilis, C. melampygous, C. papuensis,* and *C. sexfasciatus* (i'e' ≤ 200mm), are listed separately from the intermediate to adult size classes. Finfish harvest percentages were derived from the total day (12,008 kg) and night (2,932 kg) hook and line catch.

Day Species	Harvest	
	kg	%
Naso unicornis	2,997.31	24.96
Lethrinus harak	758.63	6.32
Liza vaigiensis	631.76	5.26
Caranx ignobilis	558.11	4.65
Caranx melampygous	530.69	4.42
Caranx i'e'	518.60	4.32
Decapterus macrosoma	430.47	3.58
Abudefduf sexfasciatus	419.54	3.49
Aprion virescens	391.25	3.26
Lethrinus xanthochilus	368.81	3.07
Total Top Ten Hook & Line Catch	7,605.17	63.33
Total Combined Hook & Line Catch	9,719.95	65.06

Night Species	Harvest	
	kg	%
Selar crumenophthalmus	840.55	28.67
Caranx i'e'	277.65	9.47
Lutjanus argentimaculatus	234.05	7.98
Caranx sexfasciatus	189.47	6.46
Lethrinus harak	143.42	4.89
Lutjanus fulvus	142.80	4.87
Decapterus macrosoma	103.68	3.54
Lethrinus obsoletus	62.92	2.15
Caranx ignobilis	60.74	2.07
Sphyraena barracuda	59.50	2.03
	2,114.78	72.13

Table 10. FY97 day and night catch composition for the top ten species of finfish harvested by gill net method. Juvenile *Caranx ignobilis, C. melampygous, C. papuensis,* and *C. sexfasciatus* (i'e' ≤ 200mm), *Mulloides flavolineatus* (ti'ao ≤ 100mm), and *Siganus spinus* (mañåhak), are listed separately from the intermediate to adult size classes. Percentages were derived from the total day (4,447 kg) and night (1,316 kg) gillnet catch.

Day Species	Harvest	
	kg	%
Siganus spinus	597.84	13.44
Gerres oblongus	561.85	12.63
Valamugil seheli	328.24	7.38
Mulloides flavolineatus	323.19	7.27
Liza vaigiensis	242.71	5.46
Leiognathus equulus	219.24	4.93
Crenimugil crenilabis	214.31	4.82
Gerres acinaces	190.18	4.28
Myripristis murdjan	189.20	4.25
Caranx papuensis	178.94	4.02
Total Top Ten Gill Net Catch	3,045.70	68.49
Total Combined Gill Net Catch	4,008.35	61.41

Night Species	Harvest	
	kg	%
Acanthurus triostegus	187.66	14.26
Caesio caerulaurea	167.79	12.75
Gerres acinaces	147.82	11.23
Siganus spinus	100.06	7.60
Mulloides flavolineatus	84.18	6.40
Crenimugil crenilabis	71.86	5.46
Liza vaigiensis	56.55	4.30
Hyporhamphus acutus	56.55	4.30
Lethrinus harak	54.25	4.12
Diodon hystrix	35.93	2.73
	962.65	73.15

Table 7

Table 11. FY97 day and night catch composition for the top ten species of finfish harvested by snorkel spear method. Finfish harvest percentages were derived from the total day (829 kg) and night (1,765 kg) snorkel spear catch.

Day Species	Harvest	
	kg	%
Naso tuberosus	108.10	13.04
Scarus sordidus	92.48	11.16
Scarus microrhinos	83.69	10.10
Kyphosus cinerascens	74.62	9.00
Diodon hystrix	62.77	7.57
Synanceia verrucosa	62.77	7.57
Naso lituratus	57.12	6.89
Acanthurus triostegus	47.42	5.72
Lutjanus fulvus	41.29	4.98
Naso unicornis	35.50	4.28
Total Top Ten Spear Snorkel Catch	665.76	100.00
Total Combined Spear Snorkel Catch	1,843.68	71.07

Night Species	Harvest	
	kg	%
Siganus spinus	312.53	17.71
Naso unicornis	299.56	16.97
Cheilinus trilobatus	127.38	7.22
Acanthurus triostegus	95.75	5.42
Epinelphelus merra	89.56	5.07
Scarus psittacus	73.41	4.16
Naso lituratus	54.57	3.09
Scarus ghobban	49.44	2.80
Parupeneus barberinus	39.53	2.24
Acanthurus lineatus	36.19	2.05
	1,177.92	66.74

E

State and Federal Laws

II. D. State and Federal Laws [40 CFR 125.61 and 125.62(a)(1)]

II.D.1. Are there water quality standards applicable to the following pollutants for which a modification is requested:

- Biochemical oxygen demand or dissolved oxygen?
- Suspended solids, turbidity, light transmission, light scattering' or maintenance of the euphotic zone?
- pH of the receiving water?

Yes, for all listed.

II.D.2. If yes, what is the water use classification for your discharge area?

Good marine water (M-2)

What are the applicable standards for your discharge area for each of the parameters for which a modification is requested?

See II.B.2.

Provide a copy of all applicable water quality standards or a citation to where they can be found.

Revised Guam Water Quality Standards, 1992 (Appendix E)

II.D.3. Will the modified discharge: [40 CFR 125.59(b)(3)]

- Be consistent with applicable State coastal zone management program(s) approved under the Coastal Zone Management Act as amended, 16 U.S.C. 1451 et seq? [See 16 U.S.C. 1456(c)(3)(A)]

Yes.

- Be located in a marine sanctuary designated under Title III of the Marine Protection, Research, and Sanctuaries Act (MPRSA) as amended, 16 U.S.C. 1431 et seq., or in an estuarine sanctuary designated under the Coastal Zone Management Act as amended, 16 U.S.C. 1461?

No.

- Be consistent with the Endangered Species Act as amended, 16 U.S.C. 1531 et seq.? Provide the names of any threatened or endangered species that inhabit or obtain nutrients from waters that may be affected by the modified discharge. Identify any critical habitat that may be affected by the modified discharge and evalute whether the modified discharge will affect threatened or endangered species or modify a critical habitat. [See 16 U.S.C. 1536(a)(2)]

None.

II.D.4. Are you aware of any State or Federal laws or regulations (other than the Clean Water Act or the three statutes identified in item 3 above) or an executive order which is applicable to your discharge? If yes, provide sufficient information to demonstrate that your modified discharge will comply with such law(s), regulation(s), or order(s). [40 CFR 125.59 (b)(3)]

No.

GWA has forwarded a copy of its permit application package (relevant sections) to the Bureau of Planning for review. The Bureau is the clearinghouse for all federally funded programs and as such, obtains comments from agencies who's programs may be impacted by planned activities such as wastewater discharges into ocean waters. Letters were delivered to Guam's Bureau of Planning, Department of Agriculture, and the Environmental Protection Agency requesting for consistency determinations with their respective programs. Responses to these letters will be forwarded to U.S.E.P.A. upon receipt. These comments will address consistency with applicable State Coastal Zone Management Program(s) approved under the Coastal Zone Management Act as amended, the modified discharge's consistency with marine sanctuary regulations and with the Endangered Species Act, and consistency with water quality standards. Copies of these letters are attached as Appendix J.

Regulations under Guam's Water Pollution Control Act are applicable. A copy of this Act is attached as Appendix F.

Physical Characteristics of Discharge

F

III.A. Physical Characteristics of the Discharge

III.A.1. What is the critical initial dilution for your current and modified discharge(s) during 1) the period(s) of maximum stratification? and 2) any other critical periods(s) of discharge volume/composition, water quality, biological seasons, or oceanographic conditions?

There is no significant periods of stratification or any other critical period. There is no stratification of the waters above the diffusers except that caused by the discharge itself. The effluent is low density (non saline) and because of this the effluent rises rapidly to the surface where it flows horizontally in the top 1 m of surface water. The depth of water above the diffusers is 26 m to 29 m (85 ft to 95 ft).

In November 21, 1990 transmittal from Susan Cox regarding Priority Pollutant Scan Results, the initial dilution values for the Agana District Plant was given as 47:1

III.A.2. What are the dimensions of the zone of initial dilution for your modified discharge(s)

According to the Amended Section 301(h) Technical Support Document the dimensions for the zone of initial dilution (ZID) can be considered to include the bottom areas and water column above the area that circumscribed by the distance d from any point of the diffuser.

d = depth of water above deepest point of discharge = 29 m
L = length of diffuser section = 12 m (40 ft)

ZID width = 2d	ZID length = L	ZID area = 2d x L
= 58 m	= 12 m	= 2320 m^2

III.A.3. What are the effects of ambient currents and stratification on dispersion and transport of the discharge plume/wastefield ?

The effluent plume rises rapidly to the surface and dissipates over 1 m depth. Matson (1990) concluded that complete dilution occurs in the top 1 meter of water, and that the effluent dissipates with the surface currents. Currents run predominantly to the west and are generally in an obliquely offshore direction.

NE tradewinds are dominant in all seasons, but are especially pronounced in the winter (Jan.- May). During the summer (July - Oct.) the effect of the trade winds are diminished and winds from every direction are not uncommon. Transportation of the discharge across the reef by wind driven surface currents are in frequent. The near shore current generally runs to the west, currents to the east are weaker and are short in duration. The currents are generally in an obliquely offshore direction. High fecal coliform numbers do occur at the shoreline stations especially during the rainy season, but the source is likely to be from the stormwater culverts situated along the shoreline in Agana Bay. On rare occasions currents may move onshore when there is heavy wave assault from the North.

Matson E.A., 1990. Effects of the Agat, Agana, and Northern District Wastewater Effluents on Receiving Water Quality. Marine Laboratory Technical Report No. 93.

III.A.4. **only small discharges must respond**

III.A.5. Sedimentation of Suspended Solids

a. What fraction of the modified discharge's suspended solids will accumulate within the vicinity of the modified discharge?

b. What are the calculated area(s) and rate(s) of sediment accumulation within the vicinity of the modified discharge(s) ($g/m^2/yr$)?

c. What is the fate of settleable solids transported beyond the calculated sediment accumulation area?

The tabulations for sediment deposition are based on the method for large discharges outlined in Appendix B-I of the Amended Section 301(h) Technical Support Document, EPA 842-b-94-007, Sept 1994. The quantitative prediction of seabed accumulation is based only on the processes of deposition and decay.

Prediction of Deposition

A portion of the settled solids is inert, the organic fraction of the settled solids is a primary concern. For primary or advanced primary discharge 80 percent of the suspended solids are organic and 20 percent are inorganic.

Settling velocities for the effluent were not available, therefor suggested values from appendix B-I were used.

primary or advance primary effluent

5 percent have $V_s \geq 0.1$

20 percent have $V_s \geq 0.01$

30 percent have $V_s \geq 0.006$

50 percent have $V_s \geq 0.001$

remainder of solids settle so slowly that they are assumed to remain suspended in the water column indefinitely.

Current speeds used were:

Upcoast	5 cm/sec
Downcoast	5 cm/sec
Onshore	3 cm/sec
Offshore	3 cm/sec

Bottom Slope:

Onshore	0.09 m/m
Offshore	0.34 m/m

Height of rise of plume is 24.9 m

Mass emission Rate = 2178 kg/day

The settleable organic components by group and maximum settling distances for each group are given in Table 8. The deposition rates and accumulation rates for each contour are given in table 9. The highest steady state accumulation was 27 g/m^2 in a 0.27 km^2 area surrounding the outfall. A detailed bathymeteric map was not available to plot the predicted steady state sediment accumulation around the outfall. Figure 7 is plotted on the Guam , Ritidian Point Quadrangle Map.

Table 8. Tabulations of Settleable Organic Components by Group and Maximum Settling Distance by Group.

Mass emmission Rate = M_T = 2173 kg/day
Organic Component = M_o = 0.8 M_T for primary effluent

Percent by Settling Velocity Group	Organic Component by group	Maximum Settling Distance from Outfall[a] (meters) Upcoast	Downcoast	Onshore	Offshore
Primary Effluent					
5 (V_s = 0.1 cm/sec)	0.04 M_T = 87 kg/day	1245	1245	202	67
20 (V_s = 0.01 cm/sec)	0.16 M_T = 347 kg/day	12450	12450	267	73
30 (V_s = 0.006 cm/sec)	0.24 M_T = 522 kg/day	20750	20750	271	73
50 (V_s = 0.001 cm/sec)	0.40 M_T = 869 kg/day	124500	124500	276	73
	sum = 0.84 M_T or 1825 kg/day				

[a] The distance D is calculated as: D =
where:

V_a = Ambient velocity = 5 cm/sec upcoast and downcoast (default), and 3 cm/sec onshore and offshore (default)
H_T = Average trapping level of plume, measured above the bottom = 17.29 m
V_s = Appropriate settling velocity by group for primary discharges.

If the bottom slope is 5 percent or greater, D should be calculated as follows:

$$D = \frac{H_T}{S + \frac{V_s}{V_a}}$$

where:

S = slope, m/m

Table 9. Tabulations of Deposition Rates and Accummulation Rates by Contour.

Organic Mass Component by Group	Bottom Area	Mass Deposition Rate, by group	Total Organic Deposition Rate Within Area ($g/m^2/day$)	Accumulation (g/m^2) Steady-State	90-day
Primary Effluent					
0.04 M_T = 87 kg/day	87000 m^2	0.16 $g/m^2/day$	0.27 $g/m^2/day$	27	16
0.16 M_T = 347 kg/day	347000 m^2	0.05 $g/m^2/day$	0.11 $g/m^2/day$	11	7
0.24 M_T = 522 kg/day	522000 m^2	0.04 $g/m^2/day$	0.06 $g/m^2/day$	6	3
0.40 M_T = 869 kg/day	869000 m^2	0.01 $g/m^2/day$	0.01 $g/m^2/day$	1	1

Compliance with Water Quality Standards

G

III.B. Compliance with Applicable Water Quality Standards and CWA 304(a)(1) water quality criteria [40 CFR 125.61(b) and 125.62(a)].

III.B.1. What is the concentration of dissolved oxygen immediately following initial dilution for the period(s) of maximum stratification and any other critical periods(s) of discharge volume/composition, water quality, biological seasons, or oceanographic conditions?

Dissolved oxygen has been measured directly in the effluent boil, at bottom, mid and surface depths, starting in 1989. The results of these measurements are given in Table 1, section II.B. The D.O. readings have varied during this time . From June 1989 until April 1991 readings were above 75% saturation after initial dilution (75% saturation ranges from 5.2 to 7.4 mg/L). However, from May 1991 until October 1993 D.O. readings ranged from 2.5 to 5.6 mg/L, averaging 4.4 mg/L in the surface water and 4.3 mg/L in the mid and bottom waters. The control site also had low D.O. readings, ranging from 2.7 to 5.4 mg/L, averaging 4.1 mg/L in the surface waters and 4.4 mg/L in the mid and 4.5 mg/L in the bottom waters. All 3 stations, including the control station had low D.O. readings, and low D.O. readings were also recorded during this period at both Tanguisson and Agat. It is likely that these readings are due to meter failure, poor calibration or sampling techniques. From June 1994 until present the readings have been well above 75% D.O. saturation. There is no indication that the D.O. in the waters in the zone of initial dilution (station D), or in the near fields (station E) have been adversely impacted by the discharge, when compared to the readings obtained from the control station (E).

III.B.2. What is the farfield dissolved oxygen depression and resulting concentration due to BOD exertion of the wastefield during period(s) of maximum stratification any other critical periods(s) ?

There are no periods of maximum stratification or any other critical periods. The farfields have not been monitored in the past. However, the D.O. readings taken at station E, which is located approximately 100 m West of the boil, do not indicate that there has been any adverse dissolved oxygen depression due to the discharge (Table 1, section II.B.). Readings were similar to those found at the control station.

III.B.3. What are the dissolved oxygen depressions and resulting concentration near the bottom due to steady sediment demand and resuspension of sediments?

The water readings taken at the boil (station D) and in the nearfields (station E) do not indicate that there are adverse depressions in the D.O. of the waters near the bottom, when compared to the D.O. readings of bottom waters at the control site (Table 1, section II.B.). However, a study on D.O. depression due to steady sediment demand has not been conducted.

III.B.4. What is the increase in receiving water suspended solids concentration immediately following initial dilution of the modified discharge(s)?

Suspended solids have not been monitored in the receiving waters. However, turbidity has been measured at three depths, bottom, mid and surface, at the three monitoring stations since 1989. There has been no incidences of adverse increases in turbidity (above 1 NTU of ambient), as outlined in the Guam Water Quality Standards.

III.B.5. What is the change in receiving water pH immediately following initial dilution of the modified discharge(s) ?

Again there has been little or no change in receiving water pH from that of the ambient waters. The receiving waters after initial dilution and the ambient waters average at around pH. 8.3.

III.B.6. Does (will) the modified discharge comply with applicable water quality standards for:

- *Dissolved Oxygen?*
- *Suspended Solids or surrogate standards?*
- *pH?*

Past monitoring of the receiving waters for these parameters has not indicated that the discharge has caused any adverse conditions when compared to the readings obtained from the ambient waters at the control station. There was a period when low D.O. readings that did not comply with the water quality standards (<75% D.O. saturation) recorded from May 1991 until October 1993. However, the ambient waters were also recorded as having similar low D.O. levels. This leads me to believe that these readings were due to incorrect meter operation, calibration or sampling. No D.O. readings below 75 % have been recorded in the last year, and except for fecal colifom, all water quality standards have been meet. Suspended solids have not been part of the parameters measure in the past. However, turbidity readings at all locations and depths have been within the Guam Water Quality Standards as are pH.

III.B.7. Provide data to demonstrate that all applicable State water quality standards, and all applicable water quality criteria established under Section 304(a)(1) of the Clean Water Act for which there are no directly corresponding numerical applicable water quality standards approved by EPA, are met at and beyond the boundary of the ZID under critical environmental and treatment plant conditions in the waters surrounding or adjacent to the point at which your effluent is discharged.

The results of the water quality monitoring conducted since 1989 are given in Table 1. Section II.B. There are occasions when readings indicate that water quality standards are not meet, such as the period of D.O. readings below 75% saturation (May 1991 until October 1993), and pH above pH 9.0 (1991). The same high pH and low D.O readings were recorded at the Northern District receiving water stations on these dates, and are likely to be due to meter failure or incorrect calibration. When receiving water results are compared to the results of ambient waters at the control station, they are very similar.

In the offshore receiving waters fecal coliform densities at the effluent boil (station D) were generally >400 FC/ 100 ml. The numbers of fecal coliform at station E (100 m west of station D and predominantly down current) were also often recorded as being >400 FC/100 ml. On several occasions high numbers of fecal coliform were also recorded at the shoreline stations A, B and C. In June, 1997 extended sampling at the shore line and reef line was started in order to assess if the fecal pollution at the shoreline stations was due to effluent flowing over the reef, or whether its was from non point sources such as stormwater. Stormwater is discharged onto the reef flat at several culverts along the Agana Bay shoreline. The location of these stations are shown in Figure 9. The results of the shoreline samples are given in Table 9. Station A

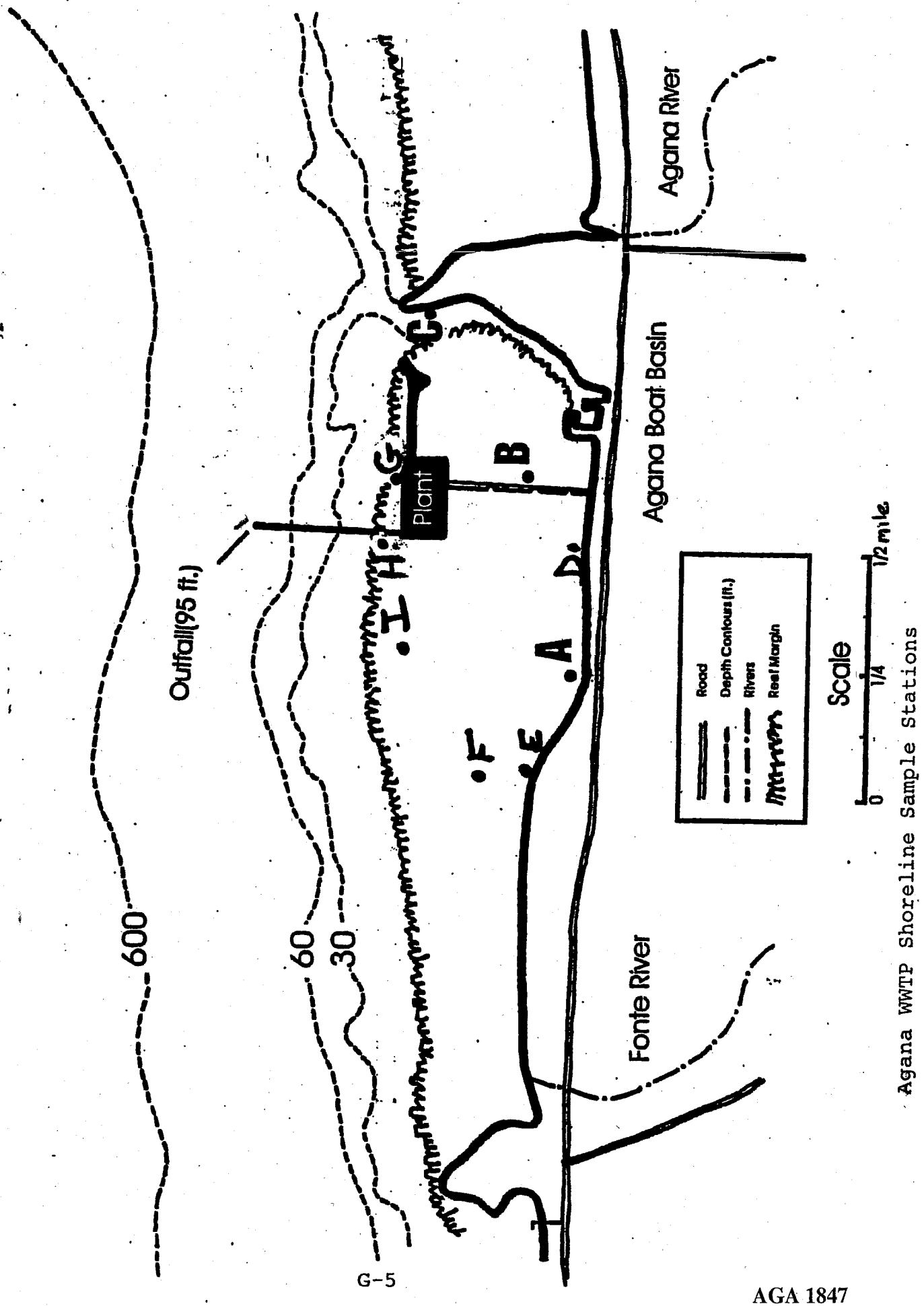
especially often had elevated levels of fecal coliform. Although the extended surveys have only been conducted for a short period, it is obvious that the shoreline stations have higher levels of fecal coliform. The three stations located near the reef crest (stations: G, H and I) generally had less than 2 FC/ 100 mL. The occurrence of elevated levels of fecal coliform at the shoreline stations also coincided with periods of increased rainfall. It therefore seems that non point source pollution is the cause of fecal contamination along the Agana Bay shoreline.

II.B.8. Provide the determination required by 40 CFR 125.61(b)(2) for compliance with all applicable provisions of State law, including water quality standards or, if the determination has not yet been received, a copy of a letter to the appropriate agency(s) requesting the required determination.

GWA has forwarded a copy of its permit application package (relevant sections) to the Bureau of Planning for review. The Bureau is the clearinghouse for all federally funded programs and as such, obtains comments from agencies who's programs may be impacted by planned activities such as wastewater discharges into ocean waters. Letters were delivered to Guam's Bureau of Planning, Department of Agriculture, and the Environmental Protection Agency requesting for consistency determinations with their respective programs. Responses to these letters will be forwarded to U.S.E.P.A. upon receipt. These comments will address consistency with applicable State Coastal Zone Management Program(s) approved under the Coastal Zone Management Act as amended, the modified discharge's consistency with marine sanctuary regulations and with the Endangered Species Act, and consistency with water quality standards. Copies of these letters are attached as Appendix J.

Regulations under Guam's Water Pollution Control Act are applicable. A copy of this Act is attached as Appendix F.

Figure 14



Agana WWTP Shoreline Sample Stations

Table 10

Number of Fecal Coliform per 100 mL at Agana Bay Shoreline and Reef Flat sample Stations

SAMPLE	STATION								
DATE	A	B	C	D	E	F	G	H	I
2/26/90	23	60	93						
3/13/90	4	25	5						
8/2/90	0	0	3						
9/3/90	0	0	0						
11/6/90	13	12	8						
12/19/90	0	5	23						
1/16/91	250	0	2						
2/27/91	0	0	0						
3/13/91	3	0	4						
4/30/91	>400	50	10						
5/15/91	>400	60	5						
6/19/91	0	0	1						
7/30/91	0	0	6						
8/14/91	>400	>400	22						
9/5/91	>400	>400	45						
10/14/91	>400	28	>400						
11/11/91	2	26	>400						
12/26/91	97	68	66						
7/6/94	63	15	0						
8/2/94	20	1	1						
10/4/94	81	10	5						
11/1/94	22	10	6						
12/8/94	62	35	10						
1/5/95	12	6	3						
2/15/95	0	0	0						
3/30/95	0	0	0						
4/27/95	>400	>400	>400						
5/18/95	>400	40	6						
6/15/95	0	0	0						
7/10/95	0	0	0						
8/1/95	16	10	13						
9/7/95	6	3	1						
10/5/95	0	0	0						
11/27/95	0	0	0						
12/95	0	0	0						
1/11/96	0	0	0						
2/5/96	3	1	1						
3/21/96	3	7	1						
5/17/96	0	2	8						
6/24/96	9	7	6						
8/22/96	24	18	19						
9/29/96	0	3	3						
10/18/96	5	0	3						
11/28/97	5	1	4						
12/19/96	6	20	59						
1/21/97	113	1	>400						
2/27/97	51	0	10						
3/13/97	15	0	3						
4/10/97	0	0	1						
5/8/97	20	9	39						
6/24/97	111	4	1	36	3	1	0	2	1
7/29/97	6	0	4	1	0	0	0	0	0
8/26/97	>400	10	27	69	>400	45	2	1	0
9/25/97	1	2	0	0	1	0	1	0	0
10/27/97	>400	3	3	2	>400	0	1	0	0
11/20/97	2	5	19		12	0	1	0	1

Station locations
A West Agana Bay Shoreline
B Central Causeway Channel
C Boat Basin channel
D Shoreline between A and causeway
E 200m west of A
F 100 m from shoreline at E
G Reef line 100m east of outfall
H Reef line adjacent to outfall
I Reef line 100m west of outfall

Impact in Public Water Supplies

H

III. C. Impact on Public Water Supplies.

III.C.1. Is there a planned or existing public water supply (desalinization facility) intake in the vicinity of the current or modified discharge?

No.