Invitation For Multi-Step Bid

BID No.: GWA 2006-15

PERFORMANCE MANAGEMENT CONTRACT

FOR THE

GUAM WATERWORKS AUTHORITY WASTEWATER TREATMENT PLANTS, WASTEWATER COLLECTION SYSTEM AND WASTEWATER LIFT STATIONS

Volume III

System Technical Description

MAY 2006

1. Introduction

1.1. Purpose

The purpose of this Technical Description is to provide technical information about the Wastewater Division to prospective BIDDERs of the Performance Management Contract (PMC) solicitation. This document provides general information on the system's design, historical performance, operation, maintenance activities, future maintenance, capital requirements and condition assessment.

The technical description of the Wastewater Division System relies upon the input from experienced and knowledgeable system, corporate and support personnel. The information contained in this Technical Description is the Guam Waterworks Authority's best effort at organizing, documenting and describing in their best words the overall condition of the system equipment. All efforts have been taken to represent the status of the system as accurately as possible to the prospective proponents. However, although every effort has been taken to represent the system's condition in a fair manner, not every item or actual condition of some equipment can be represented in this document.

1.2. Assumptions and Scope

The review of the description, history and condition of the facilities and its major equipment and systems was accomplished by reviewing a collection of Comprehensive Performance Evaluation studies conducted by several local companies, working with Master Plan organizers updating facility and equipment status, as well as discussions with key operations and management personnel. Currently GWA is developing an updated Master Plan through Brown & Caldwell, incorporating the Wastewater Division. The draft of this plan was published on the GWA website (http://www.guamwaterworks.org/) on April 11, 2006 and it is anticipated that the final plan will be completed by June/July 2006. This document includes information as obtained and drafted for the Master Plan. The review includes but is not limited to an assessment of the System's design and layout, capacity, system redundancy and equipment operations and maintenance (O&M) history.

Historical performance indicators regarding capacity, reliability, availability and permit requirements were also reviewed where available. Key station description, historical and condition assessment documents, drawings and procedures were reviewed to gain insight to the System's overall condition.

The historical documentation of equipment and systems review was not intended to be all inclusive, but rather to provide a reasonable perspective of the operating and maintenance history of the Wastewater Division. The technical review is intended to be a factual description of the facilities and refrains from offering conjecture or opinion, except where clearly identified. It is assumed that prospective proponents of this PMC will conduct their own verifying due diligence effort.

1.3. System Description

The Wastewater Division is wholly owned and operated by the Guam Waterworks Authority. GWA operates seven wastewater treatment plants, five of which have NPDES permits. The system also includes approximately 235 miles of sewer collection lines, approximately 5,590 manholes, and 72 pump stations located throughout the island which are operated and maintained by GWA employees.

1.4. Conclusions

In June 2003 GWA was issued a Stipulated Order by the U.S. Environmental Protection Agency (EPA) which cited major issues regarding water quality and wastewater systems. It summarized required repairs needed for treatment facilities, identified lack of procedures and adequate inventory, as well as enforced operations certification requirements.

Of the treatment facilities currently in operation, an assessment of major equipment each facility indicate the systems to be in poor to moderate condition. In the case of the Agat, this site is inadequate to accommodate actual load most especially during high rainfall periods.

GWA has initiated repairs and development of required documentation and procedures as required by the Stipulated Order. Recent approved bond funds was a major milestone in initiating major repair/rehabilitation projects, such as the Agana Treatment Plant. Other projects to be funded through the bond funds can be found in section 5.9 of this document. Cumulative quarterly reports in response to the Stipulated Order are submitted to U.S. EPA and also posted on the GWA website: http://www.guamwaterworks.org/

2. Site Description and Characteristics

2.1. General Location

The GWA Wastewater Division is located on the island of Guam. Guam is the largest and southernmost island of the Marianas archipelago. The westernmost possession of the United States since 1898, the island is at 13.48° north latitude and 144.45° east longitude. Guam is approximately 1,500 nm southeast of Tokyo; 2,100 nm southeast of Hong Kong; 1,500 nm east of Manila; and 3,100 nm northwest of Sydney; 6,000 nautical miles (nm) west of San Francisco; 3,700 nm west-southwest of Honolulu.

The island is composed of both volcanic material and limestone base seabed material from coral deposits.

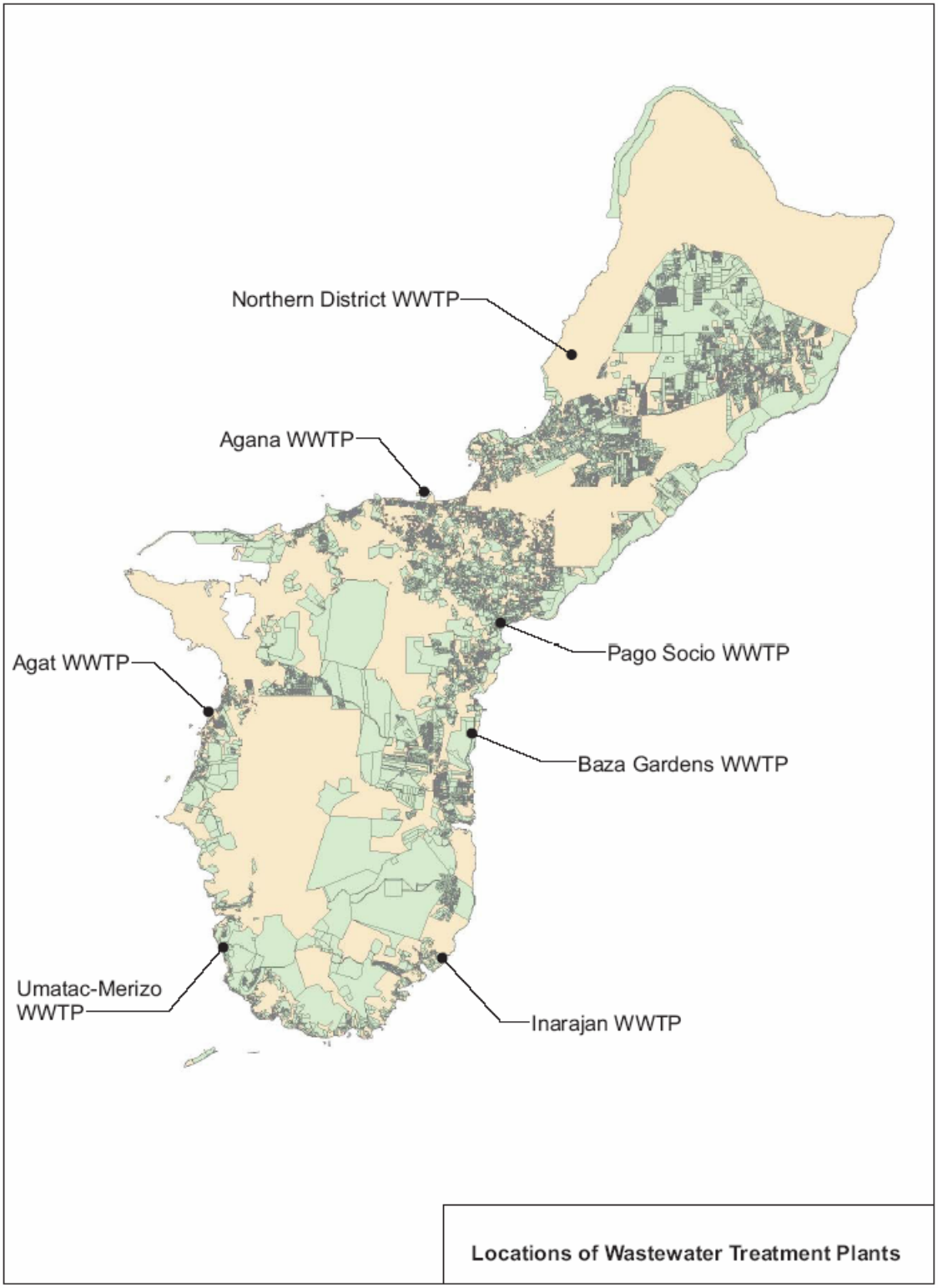
Guam's climate is tropical marine; generally warm and humid, moderated by northeast trade winds. Guam's temperature ranges between 73 and 90 degrees Fahrenheit (23 and 32 degrees Celsius). It has a mean annual temperature of 81 degrees (27 degrees C). May and June are the hottest months of the year. However, there is little seasonal temperature variation.

The coolest and least humid months, December through February, are marked by prevailing westerly trade winds. The average humidity varies from an early morning high of 86% to an afternoon low of 72%. The high moisture content of the atmosphere during the rainy season, combined with the warm temperatures, contributes to the rapid deterioration of manufactured materials through rust, rot and mildew.

The average yearly rainfall ranges between 90 and 110 inches (229 and 279 cm). There are two seasons, the dry and the rainy. The dry season (fanumnangan) lasts from December through June. The rainy season (fanuchanan) prevails within the remaining months. Guam's subterranean water lens supplies fresh water far in excess of the island's present needs.

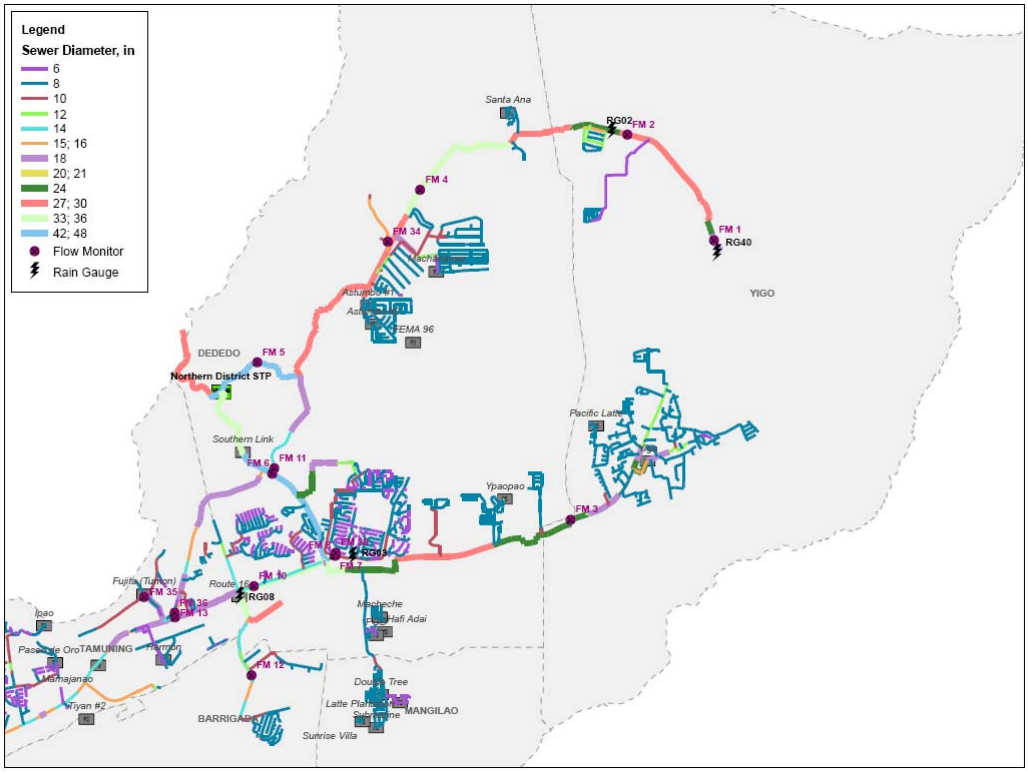
2.2. Site Location and Description

The following maps provide general locations for Waterwater treatment facilities and pump stations and sewer lines.

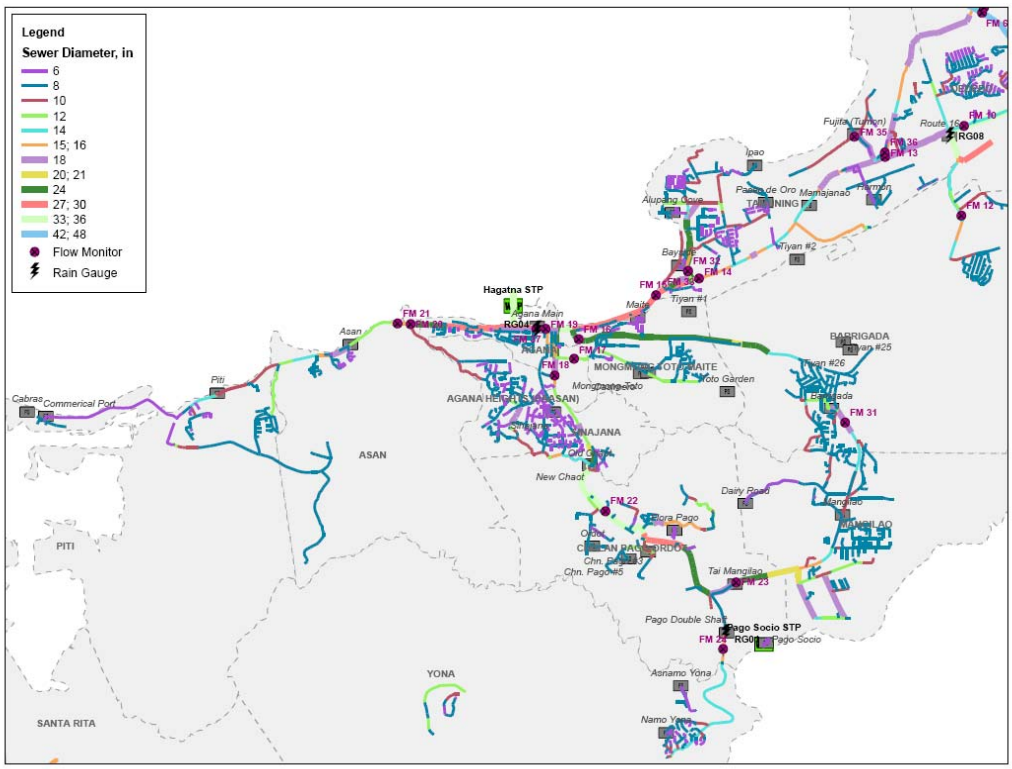

Northern District WWTP
Agana WWTP
Agat WWTP
Pago Socio WWTP
Baza Gardens WWTP
Umatac-Merizo WWTP
Inarajan WWTP
Locations of Wastewater Treatment Plants

2.3. Collection Line Interface

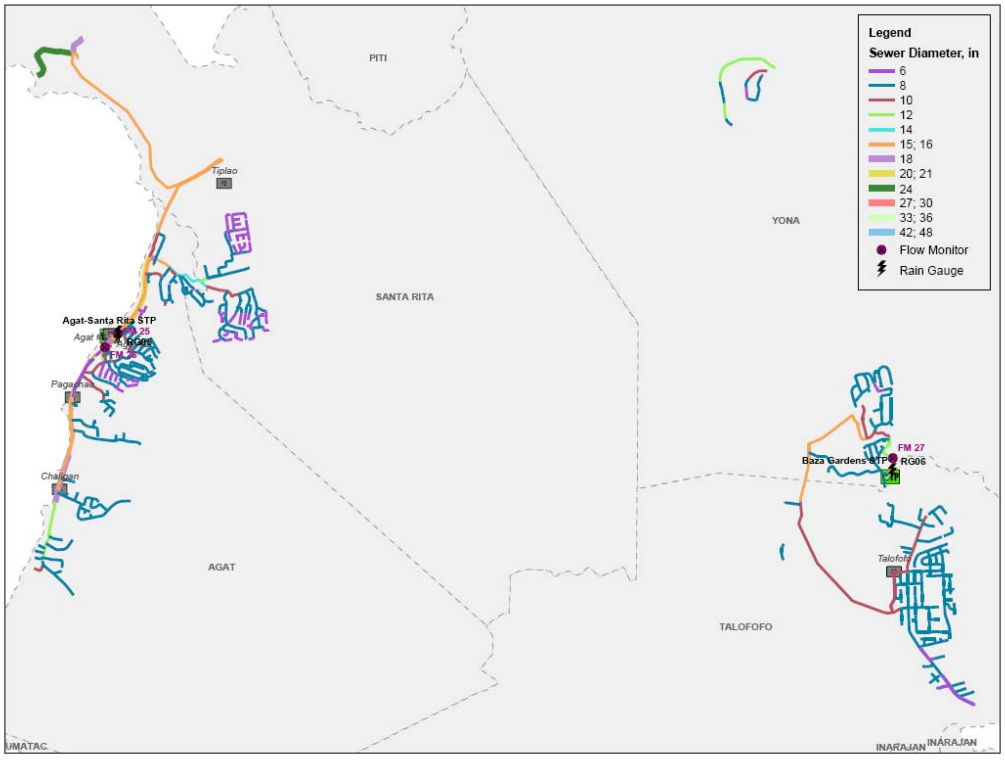
North District STP Sewer Network



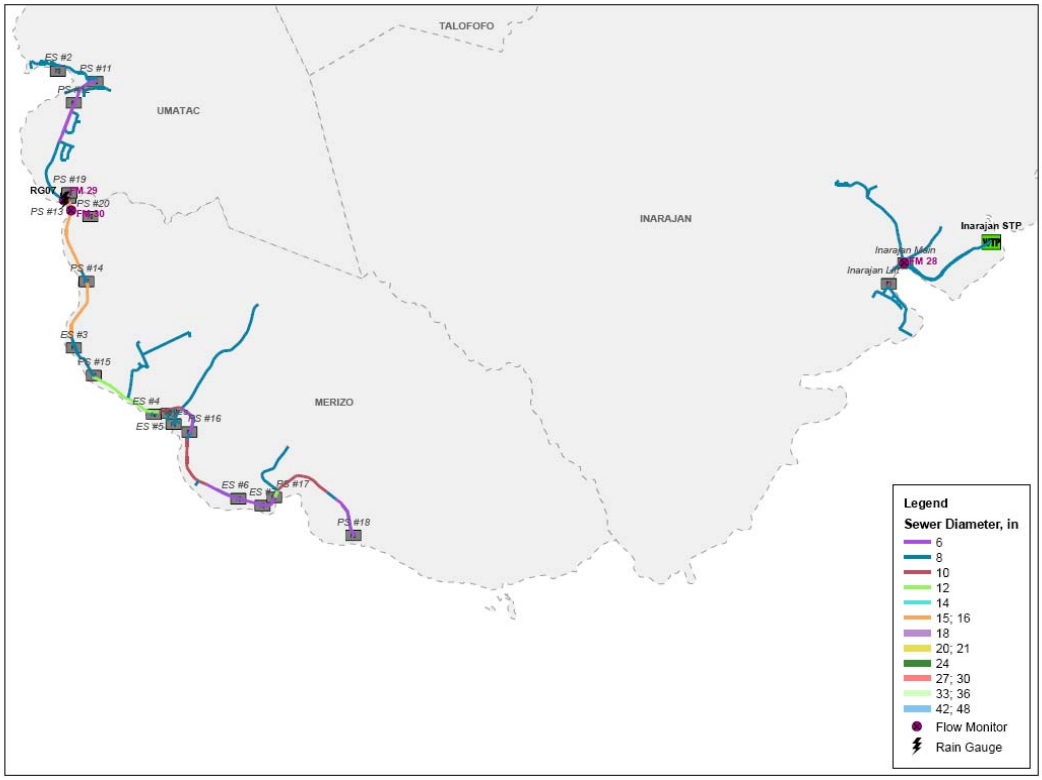
Hagatna STP Sewer Network



Agat-Santa Rita and Baza Gardens Sewer Networks



Umatac-Merizo and Inarajan Sewer Networks



2.4. Community

The island has a population of approximately 156,000 people excluding tourists. Tourism, the number one business of Guam, adds approximately 15,000 people to the island's total at any given time.

The United Stated military has a presence on the island. The Andersen Air Force base is located at the island north end. The US Navy has a small operation only two miles from the Cabras site.

The US Navy turned over the operation of the shipyard to a private contractor. The private contractor has a multi-year contract to operate the shipyard, primarily in support of the Navy ship repair. This facility has a tremendous variety of maintenance equipment and capabilities as would be expected of a remote ship repair facility. This facility if utilized properly could be a strategic asset to the PMC contractor that maintenance alliances and services may be developed to support various aspects of the facilities maintenance needs.

The GWA wastewater personnel are government employees. The employees earn vacation based on time worked and seniority.

GWA employees are encouraged to support various community activities such as government-sponsored programs, parades and events such as the South Pacific Games held on Guam in 1999.

A variety of local vendors supply important services to the site as follows:

- Rental Equipment;
- Electrical and Mechanical Parts;
- Motor Rewinding Services;
- Various Tools and Consumable Materials;
- Janitorial Services;
- Welding and Machining Supplies;
- Hardware Supplies;
- Construction Equipment;
- The Former US Navy Shipyard Maintenance Facilities with Machining and Repair Capacity.

GWA employees are active with the following community affairs: Liberation Day (GWA sponsored float in parade), Labor Day Government of Guam Picnic, Military Reserves, and associated island wide clean-up activities. GWA sponsors *Fitness & Wellness* program where an employee can use three hours of the normal base 40 hours each week to exercise and receive normal pay.

2.5. Site Map

Site maps will be provided upon request and as deemed appropriate through Homeland Security.

2.6. Site infrastructure

2.6.1. Utilities

Each treatment facility's utilities include potable water, electric power, communications and sewage discharge lines.

2.6.1.1. Domestic Water

Domestic potable water is provided at most facilities. Pump stations that do not have water include North Reyes, Latte Plantation, Santa Ana, Pacific Latte Estates, Astumbo 1, Astumbo 2, Ejector 2 and Ejector 7.

2.6.1.2. Electrical

Electrical power is metered and supplied by Guam Power Authority.

GPA has been working closely with GWA personnel to address voltage and power quality issues to ensure equipment integrity.

2.6.1.3. Emergency Generator

Treatment facilities are equipped with backup generator, however, Northern District Treatment facility does require replacement of cables. At this time the generator at this location cannot be used to power this site. Only 61 of the pumping stations are equipped with generators. These generators generally provide complete power backup for the pumping stations.

2.6.1.4. Communications System

The treatment facilities are equipped with telephones and there are a limited number of I-Connect hand held radios available for staff use. Collection pumping stations do not have telephones. Operation personnel (rovers) equipped with I-Connect hand held radios for communication with other operation and dispatch personnel.

2.7. Incident Mitigation Capabilities

GWA has developed an Emergency response plan which was submitted to EPA under the Stipulated Order requirements in November 2005. This plan addresses various hazards

which include natural disasters and man-made emergencies, including terrorist attacks. The plan is included as a Supporting Document to this Volume.

2.8. Security Operations

GWA wastewater facilities are not manned with security guards. All GWA facilities have perimeter cyclone fencing with entrance gates. Pumping stations are generally not manned but roving personnel are required to inspect equipment, conduct readings, as well as report any vandalism or theft incidents.

Station personnel are responsible for:

- Station access and control;
- Emergency incident and alarm response;
- Incident investigation;
- Station vehicle and locker control.

2.9. Support Structures and Facilities

This section provides a description of the following support facilities:

- Central Laboratory Facility
- Warehouse operations
- Parts inventory storage
- Peripheral facilities
- GPA Central Maintenance and other support facilities

Wastewater compliance testing for NPDES permits is performed at the GWA Central Laboratory which is located at the Agana Treatment Plant . The facility is equipped with Analytical balance, autostill, constant temp incubator, dessicator, dissolved oxygen meter, filtration unit, magnetic stirrer, muffle furnace, pH meter, refrigerator, salinity meter, turbidimeter, uv sterilization unit, water bath, colony counter, VWR Drying oven, and UV lamp and can perform the following tests: Biochemical oxygen demand; ph, settleable solids; suspended solids; fecal coliform; enterococci; dissolved oxygen; turbidity and temperature. Currently, GWA has other analyses performed at the Water Energy Research Institute (WERI) Laboratory including total phosphates, orthophosphates, total nitrogen, nitrate nitrogen, kjeldahl nitrogen and ammonia nitrogen; and at the SGS Laboratory to conduct oil and grease tests. GWA maintains an annual contract with Montgomery Watson Laboratory located in California that tests for metal, pesticides and whole effluent toxicity. The Central Laboratory reports to the Laboratory Services Administrator and is currently staffed with a Biologist I and Laboratory Technician II. The Laboratory Services Administrator reports to the Assistant General Manager of Compliance.

The treatment plants maintain inventory and spare parts within their facilities to include some materials and supplies for pumping stations. However, most of GWA's parts are

stored within a central warehouse facility located 578 North Marine Drive Tamuning, Guam (behind GWA's administrative offices). The warehouse is operated by a Buyer Supervisor and two (2) storekeepers and is accessible during regular work hours from 7:30 a.m. to 4:30 p.m. Monday thru Friday. Warehouse staff are on stand-by to support operations during non-working hours. Equipment and supplies may also be stored at the treatment plants and pump stations as space allows.

There is a Memorandum of Understanding between GWA and Guam Power Authority (GPA), which allows support between the two utility agencies through a work order cost tracking system for reimbursable labor and material costs. GPA has supported GWA with additional mechanical maintenance support through the Central Maintenance section. The Central Maintenance Building is equipped with lathes, drill press, welding machines, machine tools and other special tooling to support power plant maintenance. Central Maintenance staff includes welders, machinists, and mechanics. In addition to this support, GPA electricians, fleet mechanics, instrument technicians and engineers have also provided GWA support through the MOU process.

2.10. Regulatory Issues

2.10.1. Stipulated Order for Preliminary Relief (SO)

On June 5, 2003, EPA issued an Order to GWA due to water and wastewater system violations of regulatory requirements. EPA and GWA identified specific deliverables for GWA to address noted violations and concerns about plant/station equipment that have specific timelines for completion.

GWA has initiated actions to respond to the Order, however, not all timelines have been met and GWA will be working with PMC to establish priority projects and to assist with development of procedures, training and certification of staff as well as address inventory to ensure their completion.

2.10.2. Guam Environmental Protection Agency (GEPA)

GEPA monitors water quality, whether drinking water or bodies of water that support local wildlife and are used for recreational purposes and enforces Clean Water Act standards. An additional function of this regulatory agency is that it administers the Operator Certification Program for personnel.

2.10.3. Clean Water Act (CWA)

Guam wastewater systems are governed by the Clean Water Act and monitored and enforced by EPA and GEPA. Section 303(d) of the CWA identifies five water bodies that must address water quality issues. They are:

- Tumon
- Northern Guam Lens Aquifer
- Ugum River
- Pago River and Bay

- Agana River and Bay

2.10.4. National Pollution Discharge Elimination System (NPDES)

Five of seven Wastewater Treatment Plants have NPDES permits. These permits establish effluent limits and require regular monitoring and report of influent and effluent. All five permits have expired and new permit applications are pending approval. Copies of the permits are provided as supporting documents to this Volume.

2.10.5. Sanitary Sewer Overflow (SSO) Program

EPA has proposed the Sanitary Sewer Overflow program which will establish specific regulations to minimize or reduce overflows. GWA is working with a consultant to prepare for anticipated program and will be incorporated into the Master Plan

3. Treatment Plants

The following process descriptions, drawings, and condition assessments are taken from Comprehensive Performance Evaluations and from research compiled and drafted by Brown and Caldwell for the development of the GWA Master Plan.

Station and equipment condition assessments completed by Brown and Caldwell in February-March 2005 are also included to provide an overall sense of equipment status.

The following are the ratings for functionality and physical condition:

Equipment Physical Condition Rating

Rating Scale	Description
0	Not Applicable
1	Equipment integrity severely compromised by corrosion and/wear.
2	Moderate to high risk of failure
3	Visible degradation of equipment, but acceptable
4	Well-maintained, like new condition of equipment

Equipment Functionality Rating

Rating Scale	Description
0	Not Applicable
1	Equipment is not currently functioning for its intended use.
2	Equipment is in service but function is highly impaired.
3	Equipment functions asthis asset class. intended, maintenance frequencies and tasks as expected for
4	Equipment functions as intended, by maintenance frequencies and tasks exceed those expected for this asset

	class.

3.1. Agat

The Agat WWTP was built in 1972 and is classified as a Class II WWTP as defined by the Guam EPA Water and Wastewater Regulations, September 25, 1978. This plant provides secondary treatment using the contact stabilization process. The treated effluent combines with the U.S. Navy's Apra Harbor WWTP effluent and is discharged to the ocean through the Tipalao Bay Outfall. GWA has an executed agreement that establish the conditions for discharge through the Navy outfall. Ocean disposal for the Agat WWTP is regulated through the National Pollution Discharge Elimination System (NPDES) Permit No. GU0020222, issued April 16, 2001. An application for a permit renewal has been submitted by GWA and the existing permit has been extended administratively while the application is under review by EPA.

The original design average daily flow is 0.75 mgd with a peak flow of 2.2 mgd, however there is no accurate flow measurement equipment to provide current average flow data.

The September 2004 Comprehensive Performance Evaluation for the Agat Wastewater Treatment Plant is provided as a supporting document for this Volume.

3.1.1. Treatment Process

This plant uses a contact stabilization process producing secondary treatment. The effluent from this treatment facility is sent to the Philippine Sea via Tipalao Bay. Influent into the plant is from approximately 1500 sewer connections.

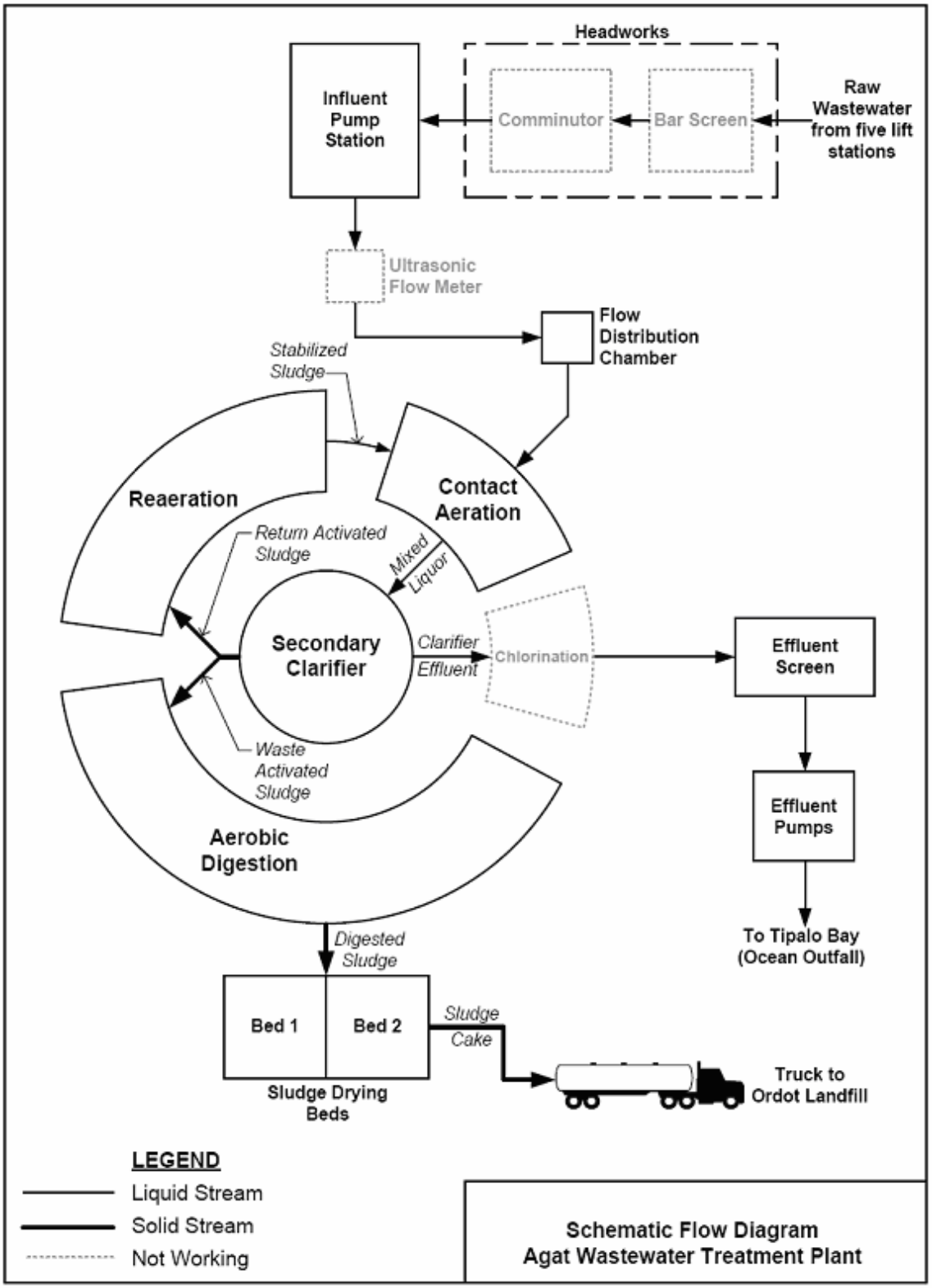
Liquid Stream**:**

- Raw influent passes through an approximately 1-inch opening manually cleaned barscreen and is pumped to the distribution chamber inlet box and contact basin by the influent pump station.
- Mixed liquor from the reaeration basin is mixed with raw influent in the contact basin and is aerated prior to flowing to the secondary clarifier.
- The clarified effluent flows through the chlorine contact chamber to the effluent screens/pump station to Tipalo Bay outfall.
- Return sludge from the secondary clarifier is conveyed to the reaeration basin by an airlift pump.

Solids Stream**:**

- Waste sludge from the secondary clarifier is transferred to the aerobic digester by an airlift pump, stabilized, thickened.

- Thickened digested sludge is dried on the sludge drying beds and the dried solids disposed of at the landfill (not currently being performed, currently sludge is trucked to Northern District STP for processing).


Headworks
Influent Pump Station
Comminutor
Bar Screen
Raw Wastewater from five lift stations
Ultrasonic Flow Meter
Flow Distribution Chamber
Stabilized Sludge
Reaeration
Contact Aeration
Return Activated Sludge
Mixed Liquor
Secondary Clarifier
Clarifier Effluent
Chlorination
Effluent Screen
Effluent Pumps
To Tipalo Bay (Ocean Outfall)
Waste Activated Sludge
Aerobic Digestion
Digested Sludge
Bed 1
Bed 2
Sludge Drying Beds
Sludge Cake
Truck to Ordot Landfill
LEGEND
Liquid Stream
Solid Stream
Not Working
Schematic Flow Diagram
Agat Wastewater Treatment Plant

3.1.2. Operations Summary

During a review period from January 2004 thru March 2005 the Agat WWTP was essentially out of compliance with the NPDES permit requirements 100% of the time. All of the discharge parameters from the information we obtained including: 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, and enterococci exceeded the maximum limits established in the NPDES permit with the exception of pH. The BOD_5 influent concentrations (~221 mg/L) were on the high side for typical wastewater. Although the average influent flow rate or review period indicates 2-4 times higher than the design flow (0.75 mgd) the flow data is suspect due to the flow meter was not functioning during the time period of reporting. It is also noted that some of the equipment did not function properly indicating that proper operation and maintenance practices have not been performed.

The following is a table of the recent influent and effluent characteristic review performed by Brown & Caldwell. Data is from DMR reports from January 2004 to March 2005.

Parameter	Average	Range	Permit Limitation	Non-Compliance Frequency
Monthly Average				
Flow (mgd)	1.9	1.0 – 2.9	None	
Inf. BOD_5(mg/L)	220.8	155 - 290	None	
Eff. BOD_5(mg/L)	84.3	58 – 108	30.0	100 %
BOD_5Removal Rate (%)	60.5	40.8 – 65.5	85.0	100 %
Inf. BOD_5(lb/day)	3,560.8	1,305 – 5,662	None	
Eff. BOD_5(lb/day)	1,273.7	677 – 1,979		100 %
Inf. Suspended Solids (mg/L)	97.2	67 – 170	None	
Eff. Suspended Solids (mg/L)	63.4	44 – 89	30.0	100 %
TSS Removal Rate (%)	33.6	15.0 – 47.6	85.0	100 %
Inf. Suspended Solids (lb/day)	1,372.8	890 – 2,181	None	
Eff. Suspended Solids (lb/day)	910.0	567 – 1,215		100 %
Eff. Fecal Coliform (CFU/100 mL)	24,192.0	24,192 – 24,192	200.0	100 %
Eff. Enterococci (CFU/ 100 mL)	8,529.4	600 – 32,535	35.0	100 %
Eff. pH	7.3	6.9 – 7.6	6.0-9.0	0 %
Daily Maximum				
Flow (mgd)	2.3	1.0 – 3.8	None	
Inf. BOD_5(mg/L)	269.5	205 – 323	None	

Eff. BOD_5(mg/L)	99.3	68 – 121	None	
Inf. BOD_5(lb/day)	4,312.8	1,811 – 8,760	None	
Eff. BOD_5(lb/day)	1,567.8	771 – 3,320	None	
Inf. Suspended Solids (mg/L)	124.5	84 – 292	None	
Eff. Suspended Solids (mg/L)	78.8	58 – 112	None	
Inf. Suspended Solids (lb/day)	1,734.9	1,101 – 2,882	None	
Eff. Suspended Solids (lb/day)	1,159.8	634 – 1,758	None	
Eff. Fecal Coliform (CFU/100 mL)	24,192.0	24,192 – 24,192	None	
Eff. Enterococci (CFU/ 100 mL)	13,614.2	1,200 – 37,840	57.0	100%

3.1.3. Condition Assessment

The following is a condition assessment performed by Brown & Caldwell.

Agat WWTP Condition Assessment

Process	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Pretreatment	Traveling Screen 1				x		X[1]				
	Traveling Screen 2				x		X[1]				
Influent Pumping	Raw Sewage Pump 1				x					x	
	Raw Sewage Pump 2				x		X[1]				
	Sump Pump				x					x	
Secondary Treatment	Aeration Tank			x					x		
	Blower 1					x				x	
	Blower 2		x				x				
	Blower 3					x				x	
Effluent Pumping	Effluent Pump 1			x			x				
	Effluent Pump 2			x			x				
	Effluent Pump 3				x				x		
Digestion	Drying Beds			x					x		
Other	Drying beds underdrains			x					x		
	Ball gear drive		x						x		
	Flow meter			x					x		
	Prop meter?			x					x		

[1] Good condition but not operational.

3.2. Agana

The Agana WWTP was commissioned in1979 and provides a primary treatment level. This plant is classified as a Class III WWTP as defined by the Guam EPA Water and Wastewater Regulations, September 25, 1978. The Agana WWTP was built on a man-made island located in the west Agana Bay area. The platform structures and treatment

facilities were designed to protect them from typhoons and severe weather conditions. The effluent from this facility is disposed of through an ocean outfall regulated under NPDES Permit No. GU0020087 including a section 301(h) waiver to allow the discharge of primary treated effluent.

The original design average and peak capacity are 12 mgd and 21 mgd respectively.

3.2.1. Treatment Process

The major process units consist of three large rectangular primary clarifiers to remove suspended solids from the raw sewage and four aerobic digesters to stabilize the solids removed by the primary clarifiers.

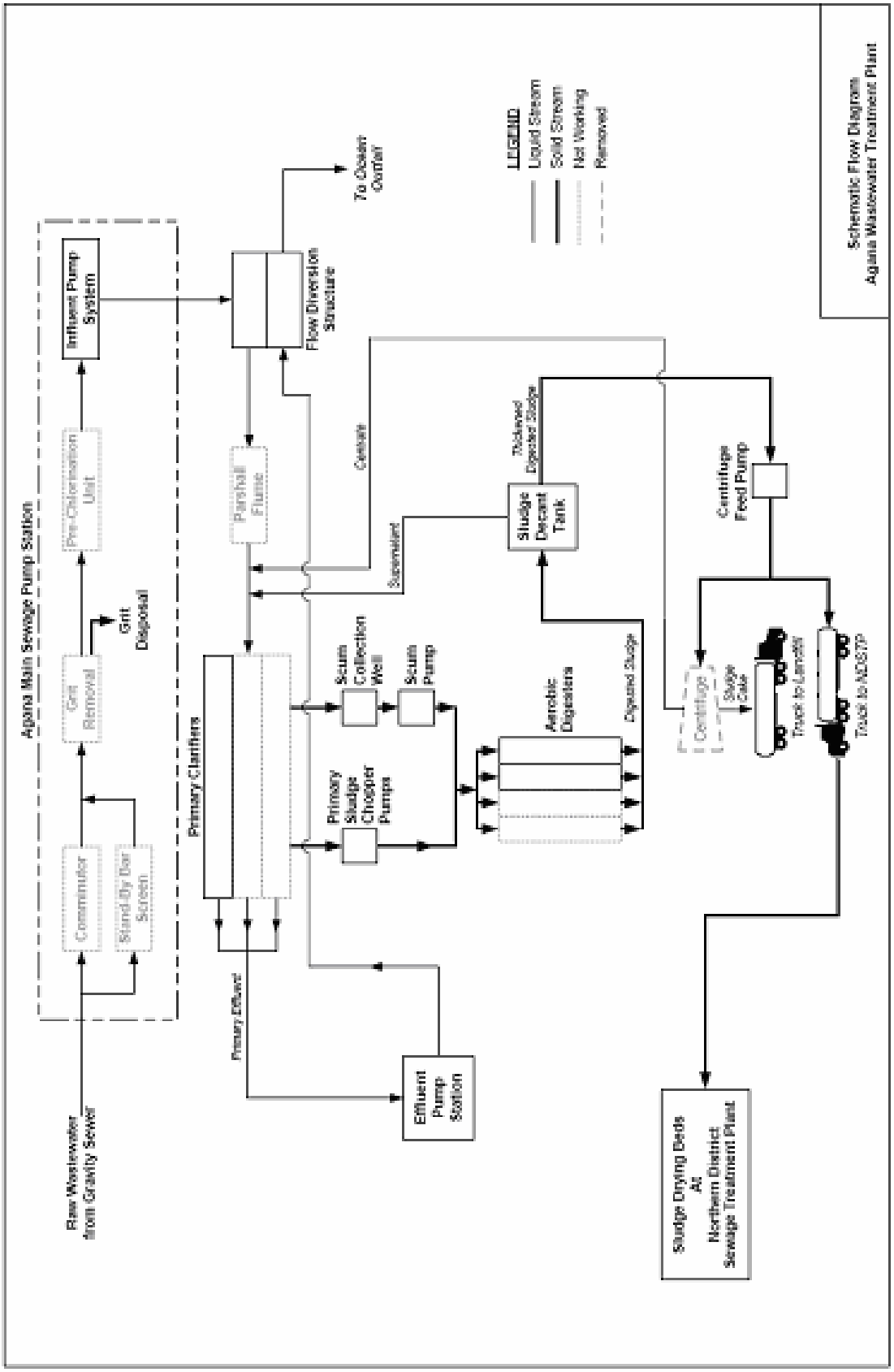
Liquid Stream:

- Raw wastewater from gravity sewer enters the Agana Main Sewage Pump Station and was designed to pass through a comminutor, grit removal system, and prechlorination unit before flowing into the pump station wet wall. Currently none of these units are functioning. The influent pump station is located on the coast approximately 0.25 miles from the treatment plant.
- The raw wastewater is pumped via a 36-inch force main to the plant Flow Diversion Structure allowing flow to proceed either to the plant for treatment or to bypass treatment and go directly to the ocean outfall during an emergency.
- From the diversion structure the wastewater flows through a Parshall flume into three long rectangular primary clarifiers which are operated with chain and flight sludge and scum collector units. During the period of January 2004 to March 2005 only one out three clarifiers was in service.
- Effluent is delivered to the ocean outfall by gravity under normal conditions, or if needed, a booster pump is available for use during high tides.

Solids Stream:

- Primary sludge and scum are removed and pumped from the primary clarifiers to the four aerobic digesters.
- Digested sludge is transferred from the aerobic digesters to a sludge decant tank. Supernatant from the sludge decant tank is returned to the inlet of primary clarifiers.

- Currently the sludge dewatering equipment (centrifuges) is inoperable and contents of the sludge decant tank is trucked to the Northern District for dewatering.


Schematic Flow Diagram
Agana Wastewater Treatment Plant
LEGEND
Liquid Stream
Solid Stream
Not Working
Removed
Agana Main Sewage Pump Station
Influent Pump System
Flow Diversion Structure
To Ocean Outfall
Pre-Chlorination Unit
Parshall Flume
Effluent
Supernatant
Thickened Digested Sludge
Sludge Decant Tank
Centrifuge Feed Pump
Grit Removal
Grit Disposal
Comminutor
Stand-By Bar Screen
Primary Clarifiers
Scum Collection Well
Scum Pump
Primary Sludge Chopper Pumps
Aerobic Digesters
Digested Sludge
Centrifuge
Sludge Cake
Truck to Landfill
Truck to NDSTP
Primary Effluent
Effluent Pump Station
Raw Wastewater from Gravity Sewer
Sludge Drying Beds At Northern District Sewage Treatment Plant

3.2.2. Operations Summary

The monthly average and daily maximum results reported during the period of January 2004 to March 2005 are summarized in the following table of influent and effluent characteristics. Based on the monthly average results, not all of the NPDES permit limits were achieved.

Based on this review the following has been noted regarding operations at the Agana Wastewater Treatment Plant:

- **.** 58% of the monthly average BOD5 and TSS effluent concentrations did not meet the NPDES requirements.
- The maximum monthly averages of BOD5 and TSS concentrations are 80 mg/L and 60 mg/L respectively.
- None of monthly average BOD5 effluent mass loading rates (lb/d) exceeded the limit of 8,011 lb/d (100% compliance).
- 72% of the TSS effluent mass loading rate (lb/d) reports are within the permit requirements (6,008 lb/d).
- Although all of the monthly average flow rates are less than the design flow of 12 mgd, the daily maximum flow rate exceeds the permitted daily maximum flow rate (12 mgd) in 25% of the reports.
- The permit requirements for monthly average and daily maximum effluent settleable solids concentration are 1 ml/L and 2 ml/L respectively, 75% of the monthly average results reported and 58% of the daily maximum results exceed the permit limits.
- Based on the BOD5 influent characteristics, the average of monthly average BOD5 concentration (~205 mg/L) is in the normal range for typical wastewater characteristics.

Parameter	Average	Range	Permit Limitation	Non-Compliance Frequency
Monthly Average				
Flow (mgd)	8.7	6.9 - 9.8	None	
Inf. BOD_5(mg/L)	205.3	124 – 252	None	
Eff. BOD_5(mg/L)	85.4	61 - 114	80.0	58 %
BOD_5Removal Rate	55.4	16.8 - 68.9	None	
Inf. BOD_5(lb/day)	15,162.8	6,780 - 20,122	None	
Eff. BOD_5(lb/day)	6,101.3	4,262 - 7,729	8,011.0	0 %
Inf. Suspended Solids (mg/L)	94.2	67 - 131	None	
Eff. Suspended Solids (mg/L)	66.7	45 - 103	60.0	58 %

TSS Removal Rate	29.1	6.8 - 45.1	None	
Inf. Suspended Solids (lb/day)	6,622.7	5,033 - 7,422	None	
Eff. Suspended Solids (lb/day)	4,724.4	2,641 - 6,628	6,008.0	8 %
Eff. Settleable Solids (mL/L)	2.1	0.8 - 6.0	1.0	75 %
Eff. pH	7.3	7.1 - 7.5	7.0-9.0	0 %
Daily Maximum				
Flow (mgd)	10.8	7.8 - 14.4	12.0	25 %
Inf. BOD_5(mg/L)	240.7	140 - 295	None	
Eff. BOD_5(mg/L)	100.2	66 - 143	160.0	0 %
Inf. BOD_5(lb/day)	18,541.3	7,431 – 24,066	None	
Eff. BOD_5(lb/day)	7,431.3	5,941 – 9,010	16,022.0	0 %
Inf. Suspended Solids (mg/L)	107.5	76 - 156	None	
Eff. Suspended Solids (mg/L)	82.7	54 - 120	120.0	0 %
Inf. Suspended Solids (lb/day)	8,009.8	6,180 – 9,327	None	
Eff. Suspended Solids (lb/day)	5,951.8	3,349 – 9,000	12,016.0	0 %
Eff. Settleable Solids (mL/L)	4.1	1.0 - 20.5	2.0	58 %

3.2.3. Condition Assessment

Agana WWTP Condition Assessment

Process	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Primary Treatment	Clarifier 1			x					x		
	Clarifier 2		x				x				
	Clarifier 3		x				x				
	Sludge Pump 1	x					x				
	Sludge Pump 2		x					x			
	Sludge Pump 3			x					x		
	Sludge Pump 4			x					x		
	Sludge Pump 5		x				x				
Digestion	Aerobic Digester 1		x				x				
	Aerobic Digester 2		x				x				
	Aerobic Digester 3			x					x		
	Aerobic Digester 4				x				x		
	Thickener tank			x					x		
	Centrifuge Feed Pump 1		x				x				

	Centrifuge Feed Pump 2		x						x		
Thickening chemical feed	Thickener Feed Pump 1		x				x				
	Thickener Feed Pump 2		x				x				
	Thickening Tank 1		x				x				
	Thickening Tank 2		x				x				
Dewatering	Centrifuge 1		x				x				
	Centrifuge 2		x				x				
	Dewatering Pump 1			x					x		
	Dewatering Pump 2		x						x		
Effluent Pumping	Pump 1		x				x				
	Pump 2		x					x			
Odor Control	Blower	x					x				
2 sump pumps - Pump/Pipe bldg and Centrifuge bldg				x					x		

3.3. Baza Gardens

The Baza Gardens WWTP is a Class II wastewater treatment plant as defined by the September 25, 1978, Guam EPA Water and Wastewater Regulations. Its original design capacity is 0.6 mgd. The treated effluent is discharged to the Togcha River which flows into the Pacific Ocean. The Baza Gardens WWTP was put into service in 1975. It is a steel packaged treatment plant which uses the extended aeration process, to meet a secondary treatment objective.

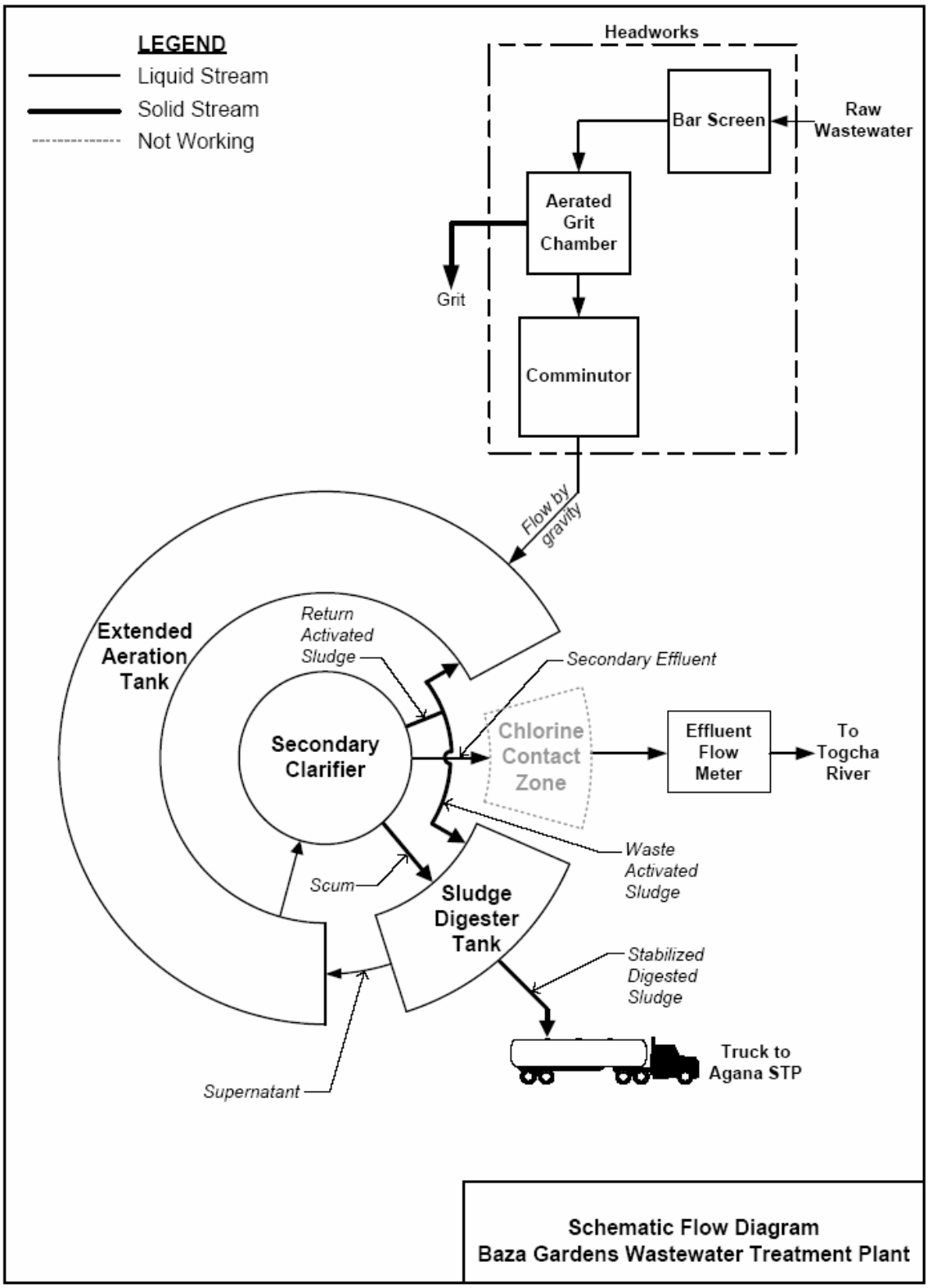
3.3.1. Treatment Process

Liquid Stream:

- Raw wastewater from the influent pump station is delivered to the headworks and passes sequentially through a manual barscreen, aerated grit chamber, and comminutor.
- Following the preliminary treatment the wastewater flows by gravity into the extended aeration tank, where it is mixed with RAS from the secondary clarifier to form mixed liquor and receives aeration.
- The mixed liquor passes to the secondary clarifier and the clarified effluent flows to the chlorine contact tank. Currently, chlorination is not practiced. Surface scum from the clarifier is sent to the aerobic digestion tank.

Solids Stream:

- Waste activated sludge is stabilized in the aerobic digestion tank.
- Following the chlorine contact tank, the treated effluent is discharged by gravity to the Togcha River which ultimately flows to the Pacific Ocean.
- Stabilized digested sludge in the aerated digester is thickened and then pumped into a tanker truck for disposal at the Northern District WWTP. The supernatant from the aerobic digestion tank is sent back to the extended aeration tank.



3.3.2. Operations Summary

During the period of January 2004 to March 2005, the monthly average parameters for the Baza Gardens WWTP effluent generally did not meet the NPDES permit requirements (NPDES Permit No.GU0020095). The monthly average BOD_5 concentrations, mass loading rates, and removal rates had 100% non-compliance during the period of consideration. Compliance for TSS maximum monthly average effluent parameters ranged from 8% to 42% during the observed period. The daily maximum and monthly average E-coli effluent concentrations were out of compliance with the permit limits 100% of the time due to the fact that no disinfection is performed.

The monthly average flow rate ranges from 0.447 to 0.551 mgd. The BOD_5 monthly average concentration is approximately 186 mg/L. Although the monthly average flow rates are within the design range and monthly average BOD_5 influent concentrations are within the typical range for residential wastewater, this facility still had a high level of non-compliance.

In addition to the above, the following was also observed:

- The effluent turbidity is consistently above the NPDES permit limit.
- The effluent level of E. coli is consistently above the NPDES permit limit for maximum daily and maximum monthly average. Concentrations are typically two orders of magnitude greater than the limit specified in the permit.
- The maximum daily effluent levels of orthophosphate (mg/l and lb/day) are consistently above the NPDES permitted limit.
- The maximum daily effluent levels of nitrate-nitrogen (mg/l and lb/day) are consistently above the NPDES permitted limit.

Parameter	Average	Range	Permit Limitation	Non-Compliance Frequency
Monthly Average				
Flow (mgd)	0.499	0.447 - 0.551	None	
Inf. BOD_5(mg/L)	185.8	162 - 236	None	
Eff. BOD_5(mg/L)	53.4	44 - 74	30.0	100 %
BOD_5Removal Rate	71.2	66.8 - 76.6	85.0	100 %
Inf. BOD_5(lb/day)	769.3	676 - 1,020	None	
Eff. BOD_5(lb/day)	222.8	165 - 322	150.0	100 %
Inf. Suspended Solids (mg/L)	104.7	65 - 179	None	
Eff. Suspended Solids (mg/L)	16.7	8 - 45	30.0	17 %
TSS Removal Rate	83.1	47.7 - 94.4	85.0	42 %
Inf. Suspended Solids (lb/day)	425.2	283 – 708	None	
Eff. Suspended Solids (lb/day)	67.6	26 – 175	150.0	8 %
Eff. E-coli (CFU/100 mL)	19,476.7	11,597 - 24,192	126.0	100 %
Eff. Enterococci (CFU/ 100 mL)	4,233.1	203 - 32,367		

Eff. pH	7.6	7.1 - 7.8	6.5-8.5	0 %
Daily Maximum				
Flow (mgd)	0.612	0.506 - 0.750	None	
Inf. BOD_5(mg/L)	226.6	172 – 326	None	
Eff. BOD_5(mg/L)	71.0	48 – 113	None	
Inf. BOD_5(lb/day)	946.9	784 – 1,384	None	
Eff. BOD_5(lb/day)	294.4	190 – 495	None	
Inf. Suspended Solids (mg/L)	130.7	84 – 288	None	
Eff. Suspended Solids (mg/L)	35.8	12 – 172	None	
Inf. Suspended Solids (lb/day)	528.9	347 – 1,102	None	
Eff. Suspended Solids (lb/day)	143.3	47 – 668	None	
Eff. E-coli (CFU/100 mL)	24,192	24,192 - 24,192	406.0	100 %
Eff. Enterococci (CFU/ 100 mL)	11,739	410 - 96,060		
Eff. Orthophosphate (PO_4-P) (mg/L)	1.1	0.5 - 1.9	0.1	100 %
Eff. Orthophosphate (PO_4-P) (lb/day)	4.9	1.9 – 8.0	0.5	100 %
Eff. Nitrate-Nitrogen (NO_3-N) (mg/L)	2.6	0.1 – 12.3	0.5	75 %
Eff. Nitrate-Nitrogen (NO_3-N) (lb/day)	11.1	0.6 - 52.5	2.5	67 %
Eff. Turbidity (NTU)	13.1	4.0 – 40.9	1.0	100 %

3.3.3. Condition Assessment

Baza Gardens WWTP Condition Assessment

Process	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Pretreatment - Grit Removal - Screening	Pump, Air Lift					x					x
	Comminutor				x					x	
Secondary Treatment	Blower 1					x					x
	Blower 2				x					x	
	Blower 3					x					x
	Clarifier		x					x			
Effluent Disposal	Meter, Default			x					x		
	Outfall, Default										
Disinfection	Cl_2 Ejectors				x					x	
	Cl_2Scale 1			x					x		
	Cl_2Scale 2			x					x		
	HVAC		x				x				
	Cl_2gas detectors				x					x	
Electrical Generation	Generator (250 kW)		x				x				

3.4. Umatac-Merizo

The Umatac-Merizo WWTP was built in 1981 and is a Class II wastewater treatment plant as defined by the September 25, 1978, Guam EPA Water and Wastewater Regulations. It employs an aerated facultative lagoon and overland percolation systems to achieve a secondary treatment objective. This treatment facility was designed to serve approximately 4,000 people living in the Umatac and Merizo areas. The initial design of this plant provided for wastewater treatment by the facultative lagoon, followed by effluent polishing by the overland flow system, with final effluent disposal into the Toguan River. The Toguan River is connected to Toguan Bay in the Philippine Sea. However, the Umatac-Merizo WWTP has been, and is currently, operated on a zero discharge scheme where disposal is accomplished by evapotranspiration and percolation in the overland flow system. Because of the original stream discharge disposal concept the facility applied for and received an NPDES permit (No. GU0020273), issued in September 7, 2000.

The treatment facilities were originally designed for a flow rate of 0.391 mgd. From January 2004 to March 2005, the plant received a monthly average flow ranging from 0.34 to 0.48 mgd with zero effluent discharge reported. If the overland flow system cannot entirely dispose of the effluent (typically during and immediately after heavy rainfall events), a discharge to the Toguan River will be generated. GWA is required to report any effluent discharges to the river to Guam EPA.

3.4.1. Treatment Process

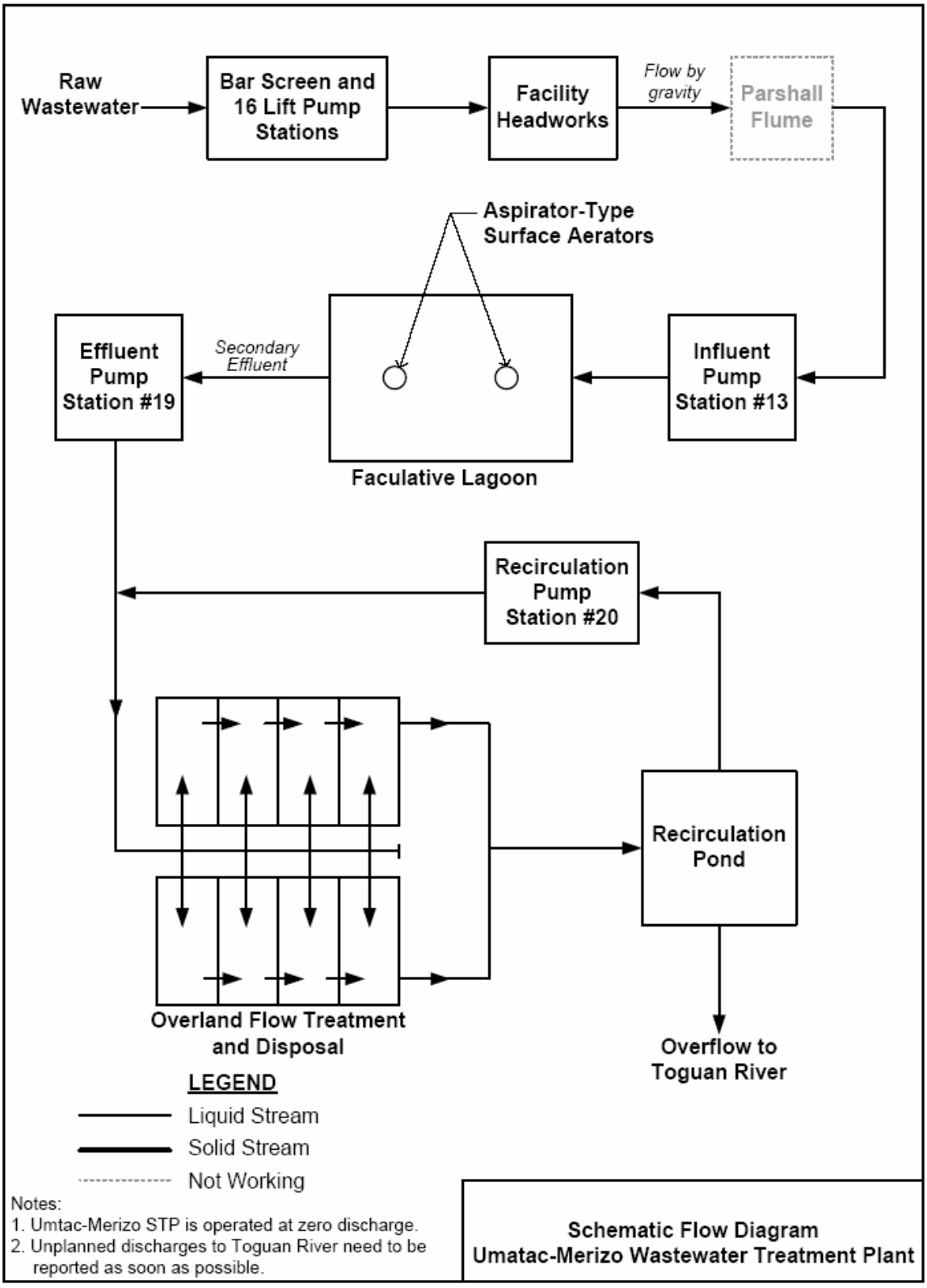
Liquid Stream:

- Flow enters the influent pump station (Pump Station #13) by gravity through a Parshall flume and is pumped to the aerobic facultative lagoon.
- Influent entering the lagoon causes the treated effluent to overflow to the effluent pump station which is pumped to the overland flow disposal system, located in the hills above about 1 mile away and at an elevation approximately 100 to 150 ft above sea level.
- The overland flow system consists of two parallel terraced grass fields, including a distribution piping system. The distribution system is valved, and the system is operated, such that the terraced disposal fields are alternated. Treatment and disposal occurs through evapotranspiration and percolation processes as the treated lagoon effluent flows down through the field.
- Any remaining effluent not removed by the overland flow disposal system is collected by a concrete interceptor ditch at the bottom of the hill and returns to a recirculation pond and is pumped back to the top of the overland flow disposal system.

- If the recirculation pond overfills, it will overflow a weir to the Toguan River.

Solids Stream:

- Sludge accumulation from the bottom of the aerated facultative lagoon is dredged when it is necessary, although no record were found showing that it has ever been dredged to date.


Raw Wastewater
Bar Screen and 16 Lift Pump Stations
Facility Headworks
Flow by gravity
Parshall Flume
Aspirator-Type Surface Aerators
Effluent Pump Station #19
Secondary Effluent
Influent Pump Station #13
Faculative Lagoon
Recirculation Pump Station #20
Recirculation Pond
Overland Flow Treatment and Disposal
Overflow to Toguan River
LEGEND
Liquid Stream
Solid Stream
Not Working
Notes:
1. Umtac-Merizo STP is operated at zero discharge.
2. Unplanned discharges to Toguan River need to be reported as soon as possible.
Schematic Flow Diagram
Umatac-Merizo Wastewater Treatment Plant

3.4.2. Operations Summary

Because Umatac-Merizo WWTP is a zero discharge facility effluent reports were not available. However, according to the available information from GWA quarterly wastewater operations and maintenance progress reports, some accidental discharges occurred one week in February 2004 and 3 days in October between 20th and 22nd, 2004. In addition it was noted that discharges to the river occur following periods of heavy rainfall. The following table summarizes basic parameters required by the NPDES Permit including flow rate, BOD5, TSS, E-coli, enterococci, and pH from January 2004 to March 2005 (no data was available between October 2004 and December 2004). This data was obtained from the GWA Discharge Monitoring Reports which are submitted to Guam EPA quarterly. Under normal operating conditions as a "zero-discharge" facility the NPDES permit limits are not applicable.

Parameter	Average	Range	Permit Limitation	Non-Compliance Frequency
Monthly Average				
Flow (mgd)	0.398	0.340 - 0.480	None	
Inf. BOD_5(mg/L)	218.8	192 – 259	None	
Eff. BOD_5(mg/L)			30.0	
BOD_5Removal Rate (%)				
Inf. BOD_5(lb/day)	677.8	575 - 811	None	
Eff. BOD_5(lb/day)			98.0	
Inf. Suspended Solids (mg/L)	70.3	44 - 101	None	
Eff. Suspended Solids (mg/L)			30.0	
TSS Removal Rate (%)				
Inf. Suspended Solids (lb/day)	224.1	146 - 338	None	
Eff. Suspended Solids (lb/day)			98.0	
Eff. E-coli (CFU/100 mL)			126.0	
Eff. Enterococci (CFU/100 mL)				
Eff. pH			6.5-8.5	
Daily Maximum				
Flow (mgd)	0.516	0.440 - 0.670	None	
Inf. BOD_5(mg/L)	250.1	169 - 359	None	
Eff. BOD_5(mg/L)			None	
Inf. BOD_5(lb/day)	878.5	623 – 1,458	None	
Eff. BOD_5(lb/day)			None	

Inf. Suspended Solids (mg/L)	131.5	74 - 420	None	
Eff. Suspended Solids (mg/L)			None	
Inf. Suspended Solids (lb/day)	491.6	201 – 1,573	None	
Eff. Suspended Solids (lb/day)			None	
Eff. E-coli (CFU/100 mL)			406.0	
Eff. Enterococci (CFU/100 mL)				
Eff. Orthophosphate (PO_4-P) (mg/L)			0.1	
Eff. Orthophosphate (PO_4-P) (lb/day)			0.33	
Eff. Nitrate-Nitrogen (NO_3-N) (mg/L)			0.5	
Eff. Nitrate-Nitrogen (NO_3-N) (lb/day)			1.6	
Eff. Turbidity (NTU)			1.0	

3.4.3. Condition Assessment

Umatac-Merizo WWTP Condition Assessment

Process	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Influent Pumping	Parshal Flume Q meter				x				x		
	Pump 1				x				x		
	Pump 2				x		x				
	Wet Well				x					x	
Secondary Treatment	Mixer 1				x					x	
	Mixer 2				x					x	
	Pond, Lagoon				x				x		
Booster Pumping	Pump 1			x						x	
	Pump 2		x				x				
Effluent Disposal	Pump 1				x					x	
	Basin 1				x					x	
	Basin 2				x					x	

3.5. Northern District

The Northern District WWTP was commissioned in 1979 and it is a primary treatment plant. It is located in the northwestern coast of the island as shown in Figure 8.1. A chain-link fence surrounds the entire treatment plant to prevent wildlife from entering the plant. The original average design flow capacity is 12.0 mgd, with a peak design flow capacity of 27.0 mgd.

Wastewater entering the Northern District WWTP comes from the northern area, including U.S. Naval Facilities and Andersen Air Force Base. Additional wastewater from pumpers and vacuum trucks which collect wastewater from residential and commercial cesspools and septic tanks, and other pump stations. In addition, solids from Baza Gardens WWTP and Agana WWTP are also processed at the plant. The Northern District WWTP disposes of primary treated effluent through an ocean outfall into the Philippine Sea. Effluent limitations for discharge into the sea are provided under NPDES Permit No.GU0020141 issued in June 30, 1986 by USEPA, including requirements under section 301(h) which allows for the discharge of primary treated effluent. Although the permit expired on June 30, 1991, it has been administratively extended while the reapplication is under review. A

3.5.1. Treatment Process

Liquid Stream:

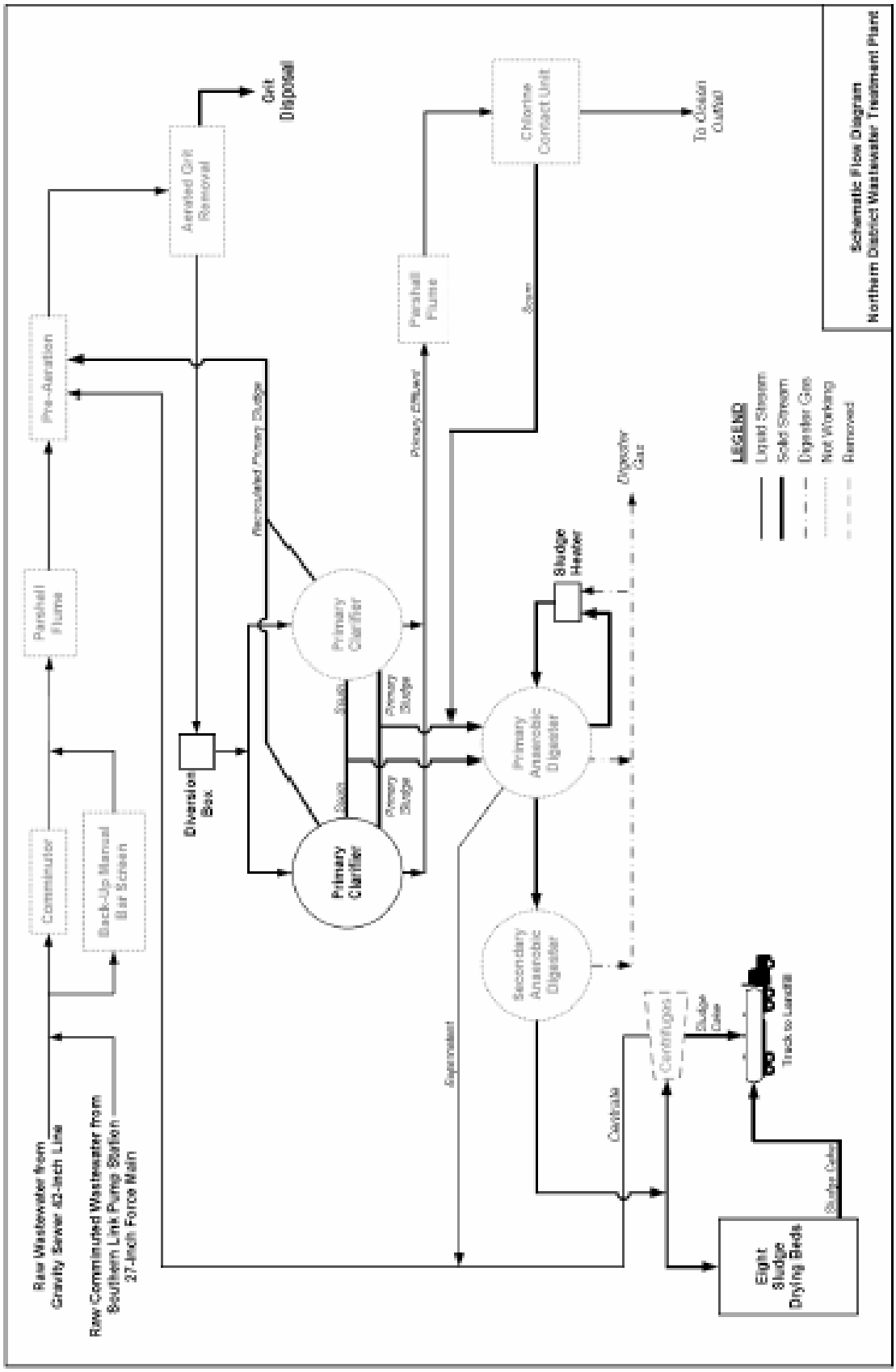
- Raw wastewater influent comes from a 42-inch gravity line and raw comminuted wastewater from the Southern Link Pump Station's 27-inch force main. After arriving at the WWTP the wastewater is chopped up by a comminutor, then flows through a Parshall flume (equipped with an ultrasonic level sensor for flow measurement, although currently not operational), followed by two rectangular preaeration tanks, then is split to two rectangular aerated grit removal tanks, before flowing into the flow divider box and on to the primary clarifiers. As of the summer of 2005 new grit system blowers were being installed, but none of the other preliminary treatment systems were operable such that flow passed through the back-up manually cleaned barscreen adjacent to the comminutor. The original design provided for odor control for the headworks building ventilation to be treated by ozonation, although this system is inoperable.
- Downstream of the preliminary treatment, wastewater from the divider box is designed to feed the two circular primary clarifiers.
- The effluent from both primary clarifiers is combined and flows to the chlorine contact tank, passing through an effluent Parshall flume before entering the two parallel chlorine contact tanks.
- Final effluent from the chlorine contact tanks then flows into a 48-inch transmission line which leads to the 30-inch ocean outfall.

Solids Stream:

- Four air-operated diaphragm pumps are installed as primary sludge pumps to transfer the primary clarifier sludge to the primary anaerobic digester.
- From the primary digester the stabilized sludge is pumped into the secondary anaerobic digester tank for thickening. None of the gas

recirculation or sludge heating and recirculation systems is presently functional.

- The secondary sludge is designed to be pumped to two sludge dewatering centrifuges.
- Eight sludge beds are also available for sludge drying. Since the dewatering systems (centrifuges) are not operational, the drying beds are used exclusively.


Schematic Flow Diagram
Northern District Wastewater Treatment Plant
LEGEND
Liquid Stream
Solid Stream
Digester Gas
Not Working
Removed
Raw Wastewater from Gravity Sewer 42-Inch Line
Raw Comminuted Wastewater from Southern Link Pump Station 27-Inch Force Main
Comminutor
Back-Up Manual Bar Screen
Parshall Flume
Pre-Aeration
Aerated Grit Removal
Grit Disposal
Diversion Box
Primary Clarifier
Primary Clarifier
Recirculated Primary Sludge
Scum
Scum
Primary Sludge
Primary Sludge
Primary Effluent
Parshall Flume
Chlorine Contact Unit
To Ocean Outfall
Scum
Digester Gas
Sludge Heater
Primary Anaerobic Digester
Secondary Anaerobic Digester
Supernatant
Centrate
Centrifuge
Sludge Cake
Truck to Landfill
Sludge Cake
Eight Sludge Drying Beds

3.5.2. Operations Summary

The monthly average and daily maximum reported information for flow rate, BOD5, TSS, settleable solids, and pH are shown in Table 8-11. There is a definite discontinuity between the design rated flow capacity of this plant (12 mgd) and the NPDES limits, (6.0 mgd). The reason for the difference between the design flow rate and the daily maximum flow rate limit in the permit is because the permit is based on only one primary clarifier in operation; whereas, the design assumed that two clarifiers would always be in operation. Based on the 6 mgd permitted flow, many of the parameters exceeded the NPDES permit limits. The data were obtained from the GWA Discharge Monitoring Reports during the period of January 2004 to March 2005 except for the three months from October 2004 to December 2004 where no data was available.

The monthly average and daily maximum flow rate ranges from 8.9 to 9.6 mgd and 9.4 to 9.8 mgd, respectively. Figure 8-46 shows the monthly average and daily maximum reported flow rates The average of the monthly average and daily maximum flow rates are about 9.3 and 9.6 mgd, respectively. Based on the permit limit of 6 mgd, the influent flow rates reported during this period are consistently above the permit limit. The averages of the monthly averages of BOD5 and TSS effluent concentrations are calculated to be 85.7 mg/L and 62.6 mg/L respectively. Both of these parameters exceed the permit limits. The removal rate based on the monthly average effluent BOD5 ranges from 25.4% to 69.4% with an average of 59.8%. It was noted that one reported data (March 2005) for the monthly average effluent TSS removal rate has a negative value of -27.6%, as shown in Table 8-11. This may be a result of sampling error, laboratory error, and disturbance of accumulated settled solids in the system which was picked up in the effluent sample.

Parameter	Average	Range	Permit Limitation	Non-Compliance Frequency
Monthly Average				
Flow (mgd)	9.3	8.9 - 9.6	None	
Inf. BOD5 (mg/L)	221.1	130- 306	None	
Eff. BOD5 (mg/L)	85.7	60 - 126	85.0	42 %
BOD5 Removal Rate (%)	59.8	25.4 - 69.4		
Inf. BOD5 (lb/day)	17,082.7	10,388 - 23,540	None	
Eff. BOD5 (lb/day)	6,874.3	5,053 - 9,877	4,256.0	100 %
Inf. Suspended Solids (mg/L)	108.3	63 – 278	None	
Eff. Suspended Solids (mg/L)	62.6	32 – 125	50.0	50 %
TSS Removal Rate (%)	38.3	-27.6 - 66.0		
Inf. Suspended Solids (lb/day)	8,406.3	4,923 - 22,124	None	
Eff. Suspended Solids (lb/day)	4,847.7	2,439 - 10,068	2,504.0	92 %

Eff. Settleable Solids (mL/L)	0.8	0.3 - 1.5	1.0	33 %
Eff. pH	7.5	6.8 - 8.1	7.0-9.0	0 %
Daily Maximum				
Flow (mgd)	9.6	9.4 - 9.8	6.0	100 %
Inf. BOD5 (mg/L)	272.1	161 - 521	None	
Eff. BOD5 (mg/L)	102.3	74 - 178	170.0	8 %
Inf. BOD5 (lb/day)	21,036.2	12,716 – 40,429	None	
Eff. BOD5 (lb/day)	8,092.7	5,957 – 13,775	8,512.0	25 %
Inf. Suspended Solids (mg/L)	170.7	80 - 672	None	
Eff. Suspended Solids (mg/L)	78.2	46 - 152	100.0	25 %
Inf. Suspended Solids (lb/day)	13,333.4	6,272 – 53,243	None	
Eff. Suspended Solids (lb/day)	6,085.8	3,491 – 11,916	5,008.0	42 %
Eff. Settleable Solids (mL/L)	1.6	0.3 - 5.0	2.0	17 %

3.5.3. Condition Assessment

Northern WWTP Condition Assessment

Process	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Pretreatment	Aeration Tank		x					x			
	Blower 1					x	x				
	Blower 2					x	x				
	Degritting Tank1		x				x				
	Degritting Tank2		x				x				
	Grit Removal					x	x				
	Mixing Tank			x					x		
	Screening, comminutor	x					x				
	Ozonator	x					x				
Primary Treatment	Clarifier 1		x					x			
	Clarifier 2			x					x		
	Primary Sludge Pump 1	x					x				
	Primary Sludge Pump 2				x					x	
	Primary Sludge Pump 3	x					x				
	Primary Sludge Pump 4	x					x				
	Sludge grinder 1			x			x				
	Sludge grinder 2			x			x				
	Sludge grinder 3			x			x				
	Sludge grinder 4			x			x				
	Scum Pump 1			x					x		

	Scum Pump 2				x		x				
	Sludge Recirculation Pump 1			x					x		
	Sludge Recirculation Pump 2			x					x		
	Sump pump			x					x		
Disinfection	Meter, Default	x					x				
	Chlorine contact basin		x				x				
	Effluent pumps 1, 2	x					x				
	Scum pump, 1, 2	x					x				
Digestion - Primary Anaerobic Digestion	Boiler		x				x				
	Blower, GAS EX	x					x				
	Centrate well			x					x		
	Pump 1			x					x		
	Pump 2		x				x				
	Motor, GAS EX	x					x				
	Tank, Mid-Grade										
	Recirculation Pump 1			x					x		
	Recirculation Pump 2			x					x		
Process	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Digestion - Primary Anaerobic Digestion (cont.)	Sump pump1			x					x		
	Water seal pump1	x					x				
	Water seal pump 2	x					x				
	Digester mechanical mixer 1, 2, 3, 4	x					x				
- Secondary Anaerobic Digester	Blower, GAS EX	x					x				
	Motor, GAS EX	x					x				
	Tank, Mid-Grade										
	Digester transfer pumps 1	x					x				
	Digester transfer pumps 2			x					x		
	Digester mechanical mixer 1, 2, 3, 4	x					x				
Dewatering	Centrifuge 1		x				x				
	Centrifuge 2		x				x				
	Hoist		x				x				
	Centrifuge Feed Pump 1		x				x				
	Centrifuge Feed Pump 2			x					x		
	Polymer pump and motor		x				x				
	Polymer chemical 1, 2 feed pumps		x				x				
	Drying Bed 1				x					x	
	Drying Bed 2				x					x	
	Drying Bed 3				x					x	
	Drying Bed 4				x					x	

	Drying Bed 5				x					x	
	Drying Bed 6				x					x	
	Drying Bed 7				x					x	
	Drying Bed 8				x					x	
	ChemicalPump 1 Feed Thickener Feed		x					x			
	ChemicalPump 2 Feed Thickener Feed		x					x			
	Chemical Feed Tanks Thickening Mixing Tank 1		x					x			
	Chemical Feed Tanks Thickening Mixing Tank 2		x					x			

3.6. Inarajan

The Inarajan WWTP is a secondary wastewater treatment facility employing an aerobic lagoon treatment system. This STP is located in the southern part of the island in the Inarajan area. The Inarajan WWTP was built in 1989, with a design capacity of 0.191 mgd. Since effluent disposal is through percolation, there is no requirement for an NPDES permit. Major unit processes include four aerated lagoons, three percolation basins, and six sludge drying beds. Other additional equipment are a weir box, two dosing chambers, a decant well, and portable pumps. Besides the treatment units onsite facilities including rest rooms, a generator room, an office, and laboratory.

3.6.1. Treatment Process

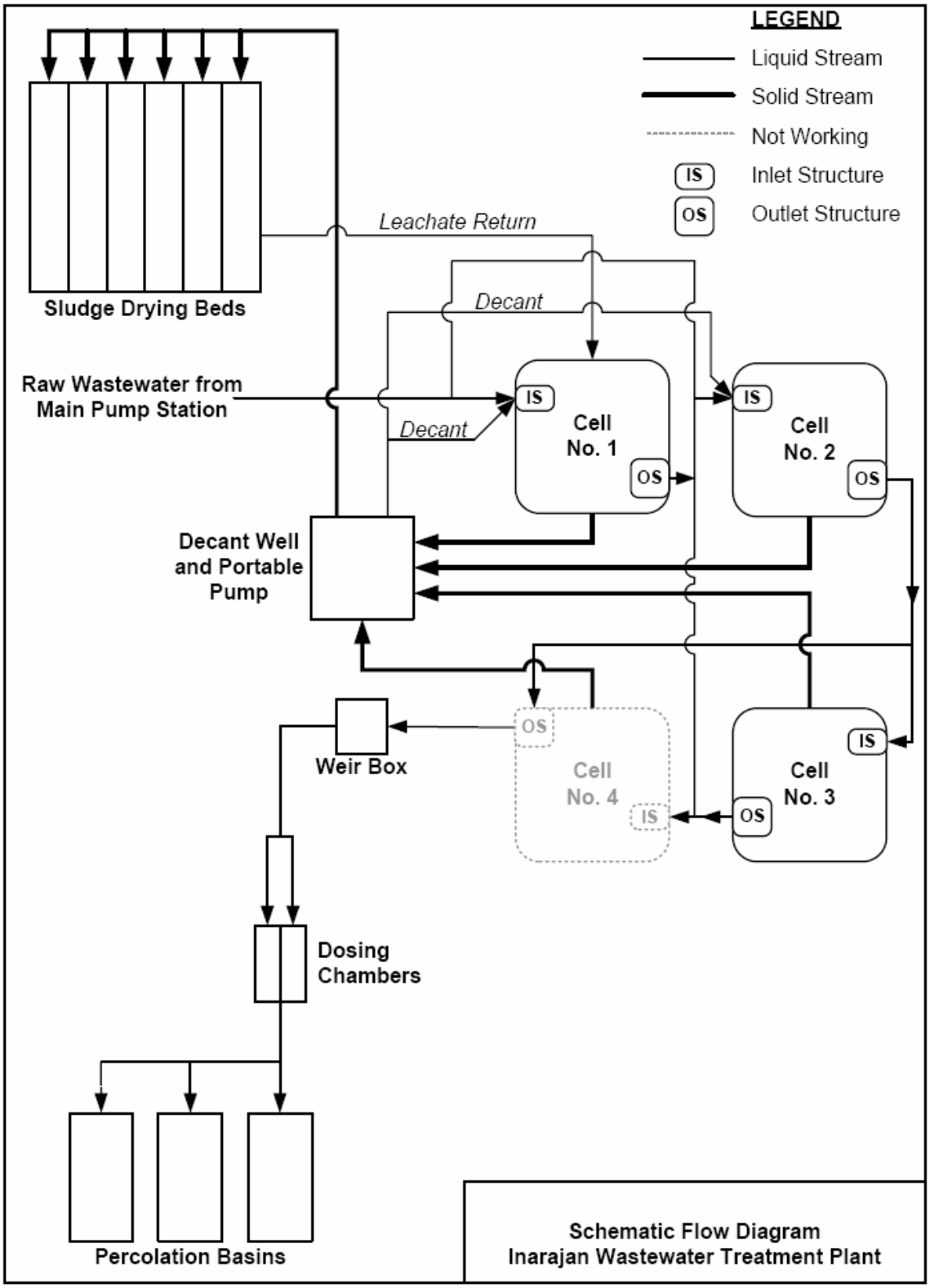
Liquid Stream:

- Raw influent from the influent pump station flows to four aerated lagoons via an 8inch force main. The flow is designed to pass through the lagoons in series and exits the last cell to a weir box unit. The cells can also be operated in parallel. This means any cell can be completely isolated for maintenance purpose. In the summer of 2005, 3 of the 4 cells were in operation, since operations felt only three cells were required by the low flows. Each cell is aerated by using mechanical surface aerators. The treated wastewater flows through the weir box and to dosing chambers. A 60degree V-notch weir equipped with an ultrasonic level sensor to measure the influent flow rate (although the meter is not operational). The dosing chambers are designed to alternate flow into each percolation pond.

Solids Stream:

- Solids that accumulate in each lagoon are anaerobically stabilized in the lagoon. The stabilized solids are transferred to the decant well for thickening where they are allowed to settle. The top layer of water is decanted back to cells 1 or 2 and

the thickened waste sludge is pumped to the sludge drying beds. Dried sludge is raked and transported by trucks to the landfill.



3.6.2. Operations Summary

No Discharge Monitoring reports for Inarajan Wastewater Treatment Plant

3.6.3. Condition Assessment

Inarajan WWTP Condition Assessment

Process	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Primary Treatment	Pond 1				x					x	
	Pond 2				x					x	
	Pond 3				x					x	
	Pond 4				x		x				
Effluent Disposal - Metering/ Diverter Box	Valve, Plug 1		x						x		
	Valve, Plug 2		x						x		

3.7. Pago Socio

The Pago-Socio STP was built by a developer to serve 16 homes and dedicated to GWA for operation and maintenance. It is a Class II facility as designated by GEPA. It consists of a packaged aerated treatment unit and a series of six subsurface percolation pits. Currently the aeration system is not operating. GWA plans to convert this system to a pumping station. Flow and wastewater quality data was not available.

3.7.1. Condition Assessment

No condition assessment was completed.

4. Collection System

4.1. Collection Lines and Manholes

The collection system consists of approximately 1,144,000 feet of gravity sewer pipes, 95 force mains that total approximately 109,000 feet, six siphons that total 300 feet and 29 outfalls that total 7,300 feet. There are also approximately 5,590 manholes.

4.1.1. Operations/Maintenance Summary

GWA has not performed CCTV on collection lines. Lines are generally cleaned out during overflow incidents. Pumper trucks are contracted by local companies to remove and perform cleanout of clogged areas.

During heavy rains, crews and pumper trucks are dispatched to critical areas, such as Agat, which has reoccurring overflow due to inadequate wastewater treatment processing in that area.

4.1.2. Condition Assessment

A comprehensive evaluation of critical manholes was by Brown and Caldwell and GWA collection personnel. The following table summarizes some of the findings of 303 manholes inspected for lines ≥ 10" diameter.

		Summary of Highest Concentration of:				
Inspection Area	**No. of Manholes**	**Collection System Surcharge**	**Medium - Heavy Grease**	**Silt**	**Mahole Barrel Infiltration**	**Mahole Frame to Ring Seal**
Agana	21	17		4		4
Agat	61	27		12	4	53
Barrigada	27	13				
Chalan Pago/Ordot	21				2	
Dededo	48	23				
Mangilao	12					
Merizo	11		2	3		
Piti	10	7				
Santa Rita	2					
Talofofo	1					
Tamuning	37	19	15			
Yigo	22		3		1	5
Yona	14		3			
Other	16					
Low concentration inspected areas[1]		23	13	4	0	10
TOTAL INSPECTIONS	**303**	**129**	**36**	**23**	**7**	**72**
% of Total Inspected		43%	12%	8%	2%	24%

[1]Areas not specifically identified based on Brown & Caldwell Master Plan Draft

4.1.3. Additional Discrepancies

The following are issues were identified during interviews of GWA personnel conducted by Brown & Caldwell. These issues were not previously documented or could not be determined during completed assessments/inspections. These issues should be evaluated and inspections conducted for confirmation and development of corrective actions.

Agana

- 8-inch line on Mendiola Lane east of Tutujan Drive is suspected of having sags.
- 8-inch line on Paasan Drive west of Tutujan Drive is suspected of having sags.
- Lateral connections to the 24"/27" line on Marine Drive between 6th Street and 10th Street are made at the pipe invert. Laterals back up and as the mainline pipe can flow ¾ full at high peak.
- Suspected storm drain cross connections to wastewater collection system in this area.

Agat

- The residential development bounded by San Francisco Street to the south and Erskin Drive to the north is suspected of having high I/I. Clay pipes are believed to be damaged and stub outs plugged with tar may be failing.
- Finile Drive housing development is suspected of having high I/I. PVC piping believed to have poor bedding leading to possible sags.
- Inverted siphon on Route 2 across the Togcha River causes grease build-up.
- Agat WWTP influent pump station seems undersized and backs flow up in upstream lines.
- 8-inch line on South Perino Street connects to the invert of the 16"/18" main line which causes flow to back up in wet weather.

Yona

- 14-inch line on Route 4 between the two entrances to Sister Mary Encarita Drive (loop) has grease issues.

Piti

- The Tepungan pump station seems undersized.
- 8-inch line on J. M. Tuncap Street has grease issues.
- The manhole at the junction of Route 1 and J. M. Tuncap Street has a pipe running through it making maintenance difficult.

Asan

- 8-inch line adjacent to Nino Perdido Church that connects to 16"/18" main line on Marine Drive has grease issues.
- 6-inch line on North San Carlos has grease issues.

Barrigada

- 8-inch line on Jalaguac Way is prone to spills due to layout.

Tamuning

- Influent lines to pump station along Pale San Vitores Road (10" line from south and 24" line from north) surcharge due to possible undersized pumps.
- Ypao Beach Pump Station has bar screen blockage issues (manual bar screen cleaning).
- 6-inch line south of Route 3 (from Numero Uno?) has grease issues.
- 10-inch line along the coast that feeds the Tamuning Bayside Pump Station is always surcharged because the minimum water level for the pump must be kept high to keep the pump cool.
- Manhole at the Marine Drive and Sereno Avenue intersection has a 90-degree connection that restricts flow in the main line.
- The Marine Drive inverted siphon near the Route 30 junction may be undersized as it backs flow up.

Dededo

- 8-inch line west of the elementary school on Y-Sengsong Road between East San Antonio Avenue and East Santa Monica Avenue is believed to have sags that cause grease issues.
- 10-inch line on Delores Street is believed to have broken sections of AC pipe.
- 10-inch line at the Marine Drive and Harmon Loop Road intersection is prone to wet and dry weather spills due to heavy grease.

- Collector line west of residential area (just west of Marine Drive and south of school) that connects to 14" line on Harmon Loop Road is prone to blockage and back-ups due to grease.
- 8-inch collector line south of South Lemai Court/South Mariposa Court/South Melindes Court is prone to grease blockage.
- 18-inch line on Adrian Sanchez Street that flows west from the Route 16 intersection is prone to overflow when the Route 16 pump station is down and flow bypasses to this line.
- Manhole on Route 16 near the Mendiola intersection (northwest of Harmon Coral Pit) is believed to surcharge due to downstream pipe alignment. The area near the school is prone to wet and dry weather spills.
- 8-inch line on the east side of the Santa Ana subdivision at the Route 3 and Route 9 junction that carries flow to 30" line has heavy grease issues.
- 36-inch line through the golf course on Route 3 surcharges, possibly due to connection from the adjacent housing development.

4.2. Pumping Stations

The following is a listing of GWA pump stations which identify current pump operational status, station operating capacity and emergency generator capacity.

No.	District	Location	Design Capacity (GPM)	No of Pumps	No. of Operating Pumps as of 2/17/06	Generator Equipped	Comments
1	Central	AGANA MAIN PUMP STATION - 4 Pumps	22,000	4	4	Yes	
2	Central	ALUPANG COVE PUMP STATION, TAMUNING - 2 Pumps	400	2	2	Yes	
3	Central	ASAN PUMP STATION - 2 Pumps	1,650	2	2	Yes	
4	Central	MANGILAO PUMP STATION (Asmuyao)- 2 Pumps	1100	2	2	Yes	
5	Central	BARRIGADA PUMP STATION (Aspengao) 2 Pumps	3,500	2	2	Yes	
6	Central	BAYSIDE PUMP STATION, TAMUNING - 1 Pump	350	1	1	Yes	
7	Central	CABRAS ISLAND PUMP STATION - 2 Pumps	600	2	2	No	
8	Central	CASIMERO PUMP STATION, MONGMONG - 2 Pump	300	2	2	No	

9	Central	CHALAN PAGO PUMP STATION #3, CRUZ DR. - 2 Pumps	1,206	2	2	Yes	
10	Central	CHALAN PAGO PUMP STATION #5, CHALAN HUEGON - 2 Pump	2,360	2	2	Yes	
11	Central	CHAOT PUMP STATION (NEW) AFAME, SINAJANA - 3 Pumps	9,000	3	3	Yes	
12	Central	CHAOT PUMP STATION (OLD) AFAME, SINAJANA - 3 Pumps	2,100	3	2	Yes	
13	Central	COMMERCIAL PORT PUMP STATION - 2 Pumps	600	3	2	Yes	
14	Central	DAIRY ROAD PUMP STATION (DOC) -2 Pumps	240	2	2	Yes	
15	Central	FLORA PAGO GARDENS PUMP STATION, CHALAN PAGO - 2 Pumps	800	2	2	Yes	
16	Northern	HARMON PUMP STATION - 2 Pumps	1,000	2	2	Yes	
17	Central	MAITE EJECTOR - 2 Pumps	60	2	2	Yes	
18	Central	MAMAJANAO PUMP STATION, UPPER TUMON - 3 Pumps	6,330	3	3	Yes	
19	Central	MONGMONG TOTO PUMP STATION - 2 Pumps	1,400	2	2	Yes	
20	Central	NAMO PUMP STATION, YONA - 2 Pumps	100	2	2	No	
21	Central	ORDOT CHALAN PAGO ELEM. SCHOOL PUMP STATION - 2 Pumps	300	2	2	Yes	
22	Central	PAGO DOUBLE SHAFT, RT - 3 Pumps	1,200	3	1	Yes	
23	Northern	PASEO DE ORO PUMP STATION, YPAO RD. - 2 Pumps	300	2	2	Yes	
24	Central	PITI PUMP STATION - 2 Pumps	880	2	2	Yes	
25	Central	SINAJANA PUMP STATION - 2 Pumps	500	2	2	Yes	
26	Central	TAI MANGILAO PUMP STATION - 3 Pumps	9,450	3	3	Yes	

27	Central	TOTO GARDENS PUMP STATION (MAYOR'S HSE.) - 2 Pumps	240	2	2	Yes	
28	Northern	YPAO PUMP STA., TUMON - 2 Pumps	1,000	2	2	Yes	
29	Northern	ASTUMBO 1 PUMP STATION - 2 Pumps	400	2	2	Yes	
30	Northern	ASTUMBO 2 PUMP STATION - 2 Pumps	400	2	2	Yes	
31	Northern	FEMA 96 PUMP STATION, ASTUMBO SUBDIVISION - 2 Pumps	150	2	2	Yes	
32	Northern	FUJITA PUMP STATION, TUMON - 4 Pumps	7,120	4	3	Yes	
33	Northern	HAFA ADAI PUMP STATION, DEDEDO - 2 Pumps	400	2	2	Yes	
34	Northern	LATTE HEIGHTS DOUBLE TROUBLE - 2 Pumps	1,400	2	2	Yes	
35	Northern	LATTE HEIGHTS SUBMARINE PUMP - 2 Pumps	250	2	2	Yes	
36	Northern	LATTE HEIGHTS SUNRISE VILLA - 2 Pumps	130	2	2	Yes	
37	Northern	LATTE HEIGHTS VILLAGE (PLANTATION) - 2 Pumps	170	2	2	Yes	
38	Northern	LIGUAN TERRACE PUMP STATION, RT. 16, DEDEDO - 4 Pumps	21,200	4	2	Yes	
39	Northern	MACHANAO PUMP STATION, MAGOF DRIVE, DEDEDO (COCK PIT) - 2 Pumps	1,154	2	2	Yes	
40	Northern	MACHECHE SUBDIVISION PUMP STATION - 2 Pumps	300	2	2	Yes	
41	Northern	PACIFIC LATTE, YIGO (SHS) - 2 Pumps	160	2	2	Yes	
42	Northern	PGD PUMP STATION, DEDEDO - 2 Pumps	760	2	2	Yes	
43	Northern	SOUTHERN LINK PUMP STATION, HARMON - 4 Pumps	32,000	4	2	Yes	
44	Northern	YIGO PUMP STATION - 3 Pumps	5375	3	2	Yes	

45	Northern	YPAOPAO ESTATE PUMP STATION, AGA BLVD - 3 Pumps	1200	3	1	Yes	
46	Southern	AGAT PUMP STATION, CHALIGAN (ACROSS MARINA)	2000	2	2	Yes	
47	Southern	AGAT PUMP STATION, GAAN (AGAT TREATMENT PLANT)	6000	3	2	Yes	
48	Southern	AGAT PUMP STATION, TIPALEO (BUS SATELLITE STA)	6000	3	2	Yes	
49	Southern	AGAT. PAGACHO PUMP STATION	200	2	2	Yes	GPA Portable Unit
50	Southern	INARAJAN LIFT PUMP STATION	600	2	2	Yes	
51	Southern	INARAJAN MAIN LIFT PUMP STATION	1200	2	2	Yes	
52	Southern	REYES PUMP STATION, MERIZO	800	2	2	Yes	
53	Southern	TALOFOFO PUMP STATION	1000	2	2	Yes	
54	Southern	UMATAC-MERIZO PUMP STATION 11	600	2	2	Yes	
55	Southern	UMATAC-MERIZO PUMP STATION 12	650	2	2	Yes	
56	Southern	UMATAC-MERIZO PUMP STATION 13	2200	2	2	Yes	
57	Southern	UMATAC-MERIZO PUMP STATION 14	1400	2	2	Yes	
58	Southern	UMATAC-MERIZO PUMP STATION 15	1300	2	2	Yes	
59	Southern	UMATAC-MERIZO PUMP STATION 16	800	2	2	Yes	
60	Southern	UMATAC-MERIZO PUMP STATION 17	700	2	2	Yes	
61	Southern	UMATAC-MERIZO PUMP STATION 18	600	2	2	Yes	
62	Southern	UMATAC-MERIZO PUMP STATION 19	700	2	2	Yes	
63	Southern	UMATAC-MERIZO PUMP STATION 20	400	1	1	Yes	
64	Southern	EJECTOR #2	100	2	2	No	
65	Southern	EJECTOR #3	30	2	2	No	
66	Southern	EJECTOR #4	30	2	2	No	
67	Southern	EJECTOR #5	30	2	2	No	
68	Southern	EJECTOR #6	30	2	2	No	
69	Southern	EJECTOR #7	30	2	2	No	

70	Northern	SANTA ANA PUMP STATION	60	2	2	Yes	
71	Central	LEYANG BARRIGADA	75	2	2	Yes	Operational, Acceptance from Contractor pending.
72	Southern	AGAT STP (Inside Plant)	0.75	3	3	No	May be connected with Gaan #1 Generator

4.2.1. Operations Summary

The pumping stations are not manned. Personnel are tasked to rove stations to verify operational status, take readings, perform routine maintenance and conduct site inspections. There is presently no SCADA system to remotely monitor station operating status. The rovers work in shift schedules varying for reach district's needs. Northern district has 3 shifts including grave yard; Central & Southern districts have two shifts, day & swing. All crews are on 24 hour call for emergencies. Crews are dispatch via I-Connect hand held radios or personal cell phones in the event of an overflow or spill.

4.2.2. Condition Assessment

Pump Station	Equipment Name	Condition and Functionality Rating									
		Physical Condition Rating					Functionality Rating				
		0	1	2	3	4	0	1	2	3	4
Agana Main	Pump 1		x					x			
	Pump 2		x					x			
	Pump 3		x				x				
	Pump 4		x					x			
	sump pump		x				x				
Agat #1 (Gaan)	Pump 1				x		x				
	Pump 2		x				x				
	Pump 3				x				x		
Agat #2 (Tipaleo)	Pump 1				x					x	
	Pump 2			x			x				
Alupang Cove	Pump 1			x					x		
	Pump 2			x					x		
	Pump 3			x			x				
Asan	Pump 1			x					x		
	Pump 2			x					x		
	Sump Pump			x					x		
Asnamo Yona	offline - pump in litigation - new but never operated										

Astumbo #1	Raw Sewage Pump (Submersible)			x						x	
Astumbo #2	Raw Sewage Pump (Submersible)			x					x		
	Bubbler		x				x				
	Check Valve				x					x	
Barrigada	Pump 1		x						x		
	Pump 2		x					x			
	Sump Pump				x					x	
Bayside	Submersible Pump		x						x		
Cabaras	Pump 1				x				x		
	Pump 2				x				x		
	Sump Pump			x					x		
	Cathodic Protection				x					x	
Casimero	Submersible Pump 1				x					x	
	Submersible Pump 2				x					x	
Chalan Pago #3	Submersible Pump 1			x						x	
	Submersible Pump 2			x						x	
	Bubbler			x						x	
Chalan Pago #5	Submersible Pump 1			x						x	
	Submersible Pump 2			x						x	
	Bubbler			x						x	
	Hoists (2)										
Chaligan (Agat #3)	Pump 1			x					x		
	Pump 2			x					x		
	Pump 3	x					x				
Commercial Port	Hoist				x						x
Commercial Port (cont.)	Genset (175kW)			x						x	
	Pump 1		x					x			
	Pump 2					x		x			
	Pump 3					x		x			
	Dewatering Pump			x				x			
	Sump Pump 1			x						x	
	Sump Pump 2			x						x	
	Air Compressor										
	Cl2 injector			x					x		
	Cl2 leak detector		x					x			
	Scale		x					x			
Dairy Road	Submersible Pump 1		x			x				x	
	Submersible Pump 2	x				x	x			x	
Double Trouble	Pump 1				x					x	
	Pump 2				x					x	
	Bubbler				x					x	
Ejector Station #2	Air Compressor 1				x					x	
	Air Compressor 2				x					x	

	3-way valve				x					x	
Ejector Station #3	Air Compressor 1				x					x	
	Air Compressor 2				x					x	
Ejector Station #4	Air Compressor 1				x					x	
	Air Compressor 2				x					x	
	3-way valve				x					x	
Ejector Station #5	Air Compressor 1				x					x	
	Air Compressor 2				x					x	
	3-way valve				x					x	
Ejector Station #6	Compressor 1				x					x	
	Compressor 2				x					x	
	3-way valve			x					x		
Ejector Station #7	Compressor 1					x				x	
	Compressor 2					x				x	
	3-way valve			x					x		
FEMA 96	Submersible Pump 1			x					x		
	Submersible Pump 2	x					x				
	Bubbler			x					x		
Flora Pago	Submersible Pump 1				x					x	
	Submersible Pump 2				x					x	
Fujita	Pump 1					x					x
	Pump 2					x					x
	Pump 3			x				x			
	Pump 4					x					x
	Sump Pump 1			x			x				
	Sump Pump 2				x				x		
	Surge Arrestor tank				x				x		
Hafa Adai	Submersible Pump 1				x					x	
	Submersible Pump 2				x					x	
Harmon (Pepsi)	Submersible Pump 1			x					x		
	Submersible Pump 2			x			x				
	Bubbler					x				x	
Inarajan Lift	Pump 1				x					x	
	Pump 2				x					x	
	Bubbler			x					x		
Inarajan Main	Submersible Pump 1			x						x	
	Submersible Pump 2			x						x	
Ipao	Pump 1				x					x	
	Pump 2				x					x	
Latte Plantation	Submersible Pump 1				x					x	
	Submersible Pump 2	x					x				
Machananao	Pump 1			x					x		
	Pump 2			x					x		
	Comminutor			x				x			

	Chlorinator		x					x			
	Sump Pump			x					x		
	Bubbler			x					x		
	HVAC		x				x				
	Rotameter		x				x				
	CL2 scale		x				x				
	CL2 leak detector		x				x				
Macheche	Submersible 1			x						x	
	Submersible 2	x					x				
Maite	Air Compressor 1			x					x		
	Air Compressor 2			x					x		
	3 way valve			x					x		
	check valves		x					x			
Mamajanao	Pump 1			x						x	
	Pump 2			x						x	
	Pump 3			x			x				
	Sump Pump 1			x					x		
	Sump Pump 2			x					x		
	Comminutor		x				x				
Mangilao	Pump 1				x					x	
	Pump 2				x					x	
	Sump Pump				x					x	
Namo Yona	Air Compressor 1				x					x	
	Air Compressor 2			x					x		
	Suction Valve		x						x		
	Discharge Valve		x						x		
	2 Tanks			x						x	
New Chaot[1]											
Old Chaot	Pump 1			x					x		
	Pump 2		x				x				
	Pump 3		x					x			
	Sump Pump		x					x			
	Check valve			x			x				
Ordot	Submersible Pump 1			x					x		
	Submersible Pump 2			x					x		
	Hoists										
Pacific Latte	Submersible Pump 1			x						x	
	Submersible Pump 2				x					x	
	Bubbler					x					x
Pagachao	Pump 1		x						x		
Pago Double Shaft	Pump 1				x					x	
	Pump 2			x						x	
	Pump 3				x					x	
	Sump Pump				x					x	

Pago Socio (Package WWTP for nearby housing)	Blower 1			x					x		
	Blower 2			x					x		
	Diffuser 1		x						x		
	Diffuser 2		x						x		
	Pere Field (collapsed)		x						x		
Paseo de Oro	Submersible Pump 1				x					x	
	Submersible Pump 2				x					x	
	Bubbler										
PGD	Submersible Pump 1			x						x	
	Submersible Pump 2 – pulled out										
Piti	Pump 2		x						x		
	Pump 1		x						x		
	Sump Pump 1			x					x		
Reyes	Submersible Pump 1			x						x	
	Submersible Pump 2			x						x	
Route 16	Pump 1				x					x	
	Pump 2				x					x	
	Pump 3					x	x				
	Pump 4				x					x	
	Sump Pump 1			x						x	
	Sump Pump 2			x						x	
Santa Ana	Submersible Pump 1					x				x	
	Submersible Pump 2					x				x	
Sinijana	Pump 1			x					x		
	Pump 2			x					x		
	Sump Pump			x					x		
Southern Link	Pump 1			x					x		
	Pump 2	x						x			
	Pump 3	x						x			
	Pump 4			x					x		
	Sump Pump 1			x					x		
	Sump Pump 2	x					x				
	Comminutor		x				x				
Station #11	Pump 1				x					x	
	Pump 2				x					x	
Station #12	Pump 1				x					x	
	Pump 2				x		x				
Station #13 (at Umatac WWTP)	Pump 2				x				x		
	ABS Pump – temporary										
Station #14	Pump 1			x					x		
	Pump 2				x			x			
Station #15	Pump 1			x				x			

	Pump 2			x					x		
	Pump 3			x					x		
Station #16	Pump 1			x						x	
	Pump 2			x						x	
Station #17	Pump 1			x				x			
	Pump 2				x					x	
	Compressor 1					x					x
	Compressor 2				x					x	
Station #18	Pump 1			x					x		
	Pump 2			x					x		
	Bubbler Compressor			x					x		
Station #19	Pump 1				x					x	
	Pump 2				x			x			
Station #20	Submersible Pump				x					x	
Submarine	Pump 1				x					x	
	Pump 2				x					x	
	Sump Pump		x				x				
Sunrise Villa	Submersible Pump 1			x					x		
	submersible Pump 2	x					x				
Talofofo	Pump 1				x				x		
	Pump 2				x				x		
	Sump Pump										
	Chlorine system						x				
	Chlorine Scale								x		
Tai Mangilao	Pump 1			x						x	
	Pump 2			x						x	
	Pump 3			x						x	
	Sump Pump 1			x					x		
	Sump Pump 2			x					x		
Tiyan #1	not GWA										
Tiyan #2	not GWA										
Tiyan #25	not GWA										
Tiyan #26	not GWA										
Toto (Mongmong Toto)	Pump 1				x				x		
	Pump 2				x				x		
	Sump Pump			x					x		
Toto Garden	Pump 1				x				x		
	Pump 2				x				x		
Yigo	Pump 1			x						x	
	Pump 2			x						x	
	Pump 3	x					x				
	Sump Pump				x					x	
	Comminutor		x				x				
Ypaopao	Pump 1			x					x		

	Pump 2			x					x		
	Pump 3		x				x				
	Sump Pump			x					x		
	Bubbler			x					x		
	Chlorinator		x					x			

1New station; not on-line at time of assessment.

GWA Wastewater Pump Station Generator Physical Condition Assessment

Total Number of Pump Stations	72
GWA Generators	30
GPA Generators	23
Pump Stations without Generators	18
Number of GWA Generators with Physical Condition Rating Below	
0 – Not Applicable	0
1 – Equipment integrity severely compromised by corrosion and/wear.	11
2 -Moderate to high risk of failure	8
3 – Visible degradation of equipment, but acceptable	11
4 – Well-maintained, like new condition of equipment	0
Other1	1

1 Asnamo-Yona not included; never operated

5. Operations and Maintenance

5.1. Operational Characteristics

Based on the findings from Brown & Caldwell as well as previous evaluation reports, it is evident that personnel lack understanding of equipment functions and operation process. A training program instituting theory training and process understanding should be implemented to ensure that treatment processes are not compromised and necessary repairs are reported.

5.2. Operations/Maintenance Practices

The condition assessments indicate that lack of maintenance along with Guam's corrosive environment have impacted the condition of equipment. The implementation of a computerized maintenance management system with skilled training and planning will aid in maintaining equipment throughout its useful life cycle. Inadequate number of positions and other skilled positions plus funding issues may have also contributed to current maintenance issues.

5.3. Support Services

5.3.1. GWA Water Production Capabilities

Description of department & capabilities of personnel: The Water Production and Distribution sections of GWA comprise of certified water production operators as well as maintenance personnel (mechanics, instrument technicians, electricians). It is anticipated

that water and wastewater personnel will be cross-trained to provide both divisions with necessary manpower during critical/emergency periods.

5.3.2. GWA Engineering Capabilities

Description of department & capabilities of personnel: Presently, GWA engineering personnel have been tasked with planning projects to address Stipulated Order issues. It is not anticipated that they will be available to support GWA PMC due to current work loads.

5.3.4. Guam Power Authority Capabilities

Description of department & capabilities of personnel: Guam Power Authority (GPA) and Guam WaterWorks Authority (GWA) have a Memorandum of Understanding which identifies a process for reimbursement of all labor and materials costs used for GWA support. GPA skilled labor includes electricians, mechanics, instrument technicians, welders and machinists which are mainly for power plant maintenance support. A Central Maintenance facility located in the Cabras Power Plant compound is equipped with lathes, drill press, welding machines, machining tools and other various hand and special tools

In addition to Power Plant and Transmission & Distribution (T&D) support, GPA has available engineers in Electrical, Mechanical and Environment areas, as well as facility maintenance personnel, computer technicians, and safety officers.

5.4. Computerized Maintenance Management System (CMMS)

GWA does not have a Computerized Maintenance Management System in place. Work orders are manually created and tracked. This is a functional requirement for the PMC to implement.

5.5. System Organization

5.5.1. Existing Organization Chart

The existing organization chart is located in Appendix H.

5.6. Operations Department

5.6.1. Waste Treatment Plant Operators

Description of Department Structure & Capabilities: Waste treatment plant operators, supervisors and leaders are required to initiate processing, take samples, and complete daily records.

Formal Training summary: GWA does not have a formal training program in place. Certification listing of existing staff is provided in Appendix H on Organizational Charts

5.6.2. Pump Station Operators

Description of Department Structure & Capabilities **:** Pumping station operators, supervisors and leaders are required to monitor and assess pumps at all pump stations.

Formal Training summary: GWA does not have a formal training program in place. Certification listing of existing staff is provided in Appendix H on Organizational Charts

5.7. Maintenance Department

5.7.1. Mechanical Maintenance Employees

Description of Department Structure & Capabilities: Maintenance mechanics are staffed for all treatment plants and pumping station districts. GWA mechanics perform preventive maintenance on most equipment including lubrication, repacking, exercising valves, etc. Contractual services are generally required for heavy equipment rental, machining services, ground maintenance and major overhauls on generators.

Formal Training summary: GWA does not have a formal training program in place. Certification listing of existing staff is provided in Appendix H on Organizational Charts

5.7.2. Electrical Maintenance Employees

Description of Department Structure & Capabilities: There are no electricians in the exisiting organizational chart for the Wastewater Division, however GWA has proposed an organizational chart for electricians for the Pumping Stations. GWA electricians perform preventive maintenance for most electrical equipment and motor replacements. Motor rewinds are typically contracted for repair at local companies.

5.8. Training

GWA has submitted a grant application through the U.S. Department of Interior for training. A training program was developed in October 2005 which can be found as a supporting document to this Volume along with the submitted grant application. Although GWA has initiated the process to develop a training program there is no program presently implemented. In order to immediately address training and skill issues, GWA will require the PMC to develop a training program for the operations and maintenance personnel of the Wastewater Division. The training should be structured for theoretical and "hands-on" (field) training. This is discussed in more detail in Volume II.

5.8.1. Apprenticeship Program

GWA does not have an apprenticeship program currently in place. It is the intention of the PMC contract that a training program will be developed and incorporated into an approved U.S. Department of Labor Apprenticeship Program for the Wastewater Division.

The positions that have been previously reviewed for the Apprenticeship program are:

- Electrician
- Instrument Technician
- Wastewater Treatment Plant Operator

- Pump Mechanic
- Diesel Engine Mechanic
- Collection System Operator and Repairer

The development of an apprenticeship program is discussed in more detail in Volume II.

5.9 Capital and O&M Performance Improvement Projects

The following is a listing of some of the Wastewater Division Capital Improvement Projects and Performance Improvement Projects. A complete listing of recommended CIP for 5-years and their description is available on the draft Master Plan and is provided as a supporting document to this volume. This can also be found on the GWA website (http://www.guamwaterworks.org/) (WRMP Volume III – Chapter 9 Recommended WW CIP).

FY 2006 Revenue Bond Projects:

No.	Project Title	Project Description	Estimated Amount	Status
Wastewater Treatment Facilities				
1	Agana Wastewater Treatment Plant Rehabilitation-	Repair/replacement of facility and equipment within the parshall flume/inlet chamber, ozone system, pump gallery, aerobic digestion, primary clarification, mechanical dewatering, effluent divertor box, as well as the operator facility.	$ 10,475,000	Ongoing
2	Agana WTP Ocean Outfall	Extension of outfall into significantly deeper water for more sufficient missing and dilution of effluent	$ 5,030,000	
3	Northern District WTP Ocean Outfall	Extension of outfall into significantly deeper water for more sufficient missing and dilution of effluent	$ 4,700,000	
4	Baza Gardens Wastewater Treatment Plant Upgrade		$ 5,000,000	
5	Umatac-Merizo Facility Improvements (CPE)		$ 2,000,000	
6	Agat Facilities Plan/ Improvements (CPE)		$ 1,000,000	
		Subtotal:	**$ 28,205,000**	
Wastewater Collection Facilities				
5	Old Agat Wastewater Collection (I&I Reduction)		$ 4,180,000	
6	Chaot WW Pump Station/Collection System		$ 710,000	
7	Lift Station Upgrades		$ 1,730,000	
8	Collection Line Upgrades		$ 1,700,000	
	Revolving Fund for Sewer Hookups		$ 150,000	
		Subtotal:	**$ 8,470,000**	

Other (Efficiency Upgrades & Miscellaneous Projects for Water & Wastewater)				
	SCADA System (Water & Wastewater)		$ 1,000,000	
	Water/Wastewater Master Plan		$ 5,900,000	
	Laboratory Modernization (Water & Wastewater)		$ 900,000	
	Emergency Generators (Water & Wastewater)		$ 900,000	
	Facilities Improvements		$ 1,750,000	
	Vehicles/Equipment		$ 1,885,000	
	WW Mobile Pumping Equipment		$ 400,000	
Subtotal:			**$ 12,735,000**	
GRAND TOTAL:			**$ 49,410,000**	

Additional proposed projects for Sewer Treatments pumps are provided in the Volume III Supporting documents. An evaluation of these projects must be done to determine if they are CIP or O&M projects.

The following is a listing of approved FY 2006 CIP projects for the Wastewater Treatment Facilities which are smaller scale projects and vehicle/equipment purchases.

FY 2006 Wastewater Treatment Plant CIP Listing:

Treatment Plant	No.	CIP Project	Budgeted Amount
Agana	1	Add Secondary Treatment	$ 10,000,000
	2	Repair/replace outside street lighting	$ 1,000,000
	3	Replace gate at entrance of island	$ 10,000
	4	Replace headworks at pump station (barscreen, communitor, grit chamber)	$ 2,000,000
	5	Bushcutting riding mower	$ 20,000
	6	Half-ton pickup for plant	$ 20,000
		Subtotal:	**$ 13,050,000**
Northern	7	Add Secondary Treatment	$ 10,000,000
	8	Repair/replace otside street lighting	$ 1,000,000
	9	Repair primary and secondary digesters	$ 2,500,000
	10	Repair sludge building	$ 30,000
	11	Replace centrifuges in sludge building	$ 700,000
	12	Bushcutting riding mower	$ 20,000
	13	Remodel plant lab	$ 30,000
	14	Repair/replace fence	$ 30,000
	15	Replace gate	$ 20,000
	16	Replace headworks at pump station (barscreen, communitor, grit chamber)	$ 2,000,000
	17	Half-ton pickup for plant	$ 20,000
		Subtotal:	**$ 16,350,000**
Agat	18	Repair/replace fence	$ 20,000
	19	Replace gate	$ 10,000
	20	Build office, shop, storage building	$ 500,000
	21	Bushcutting riding mower	$ 20,000
	22	Half-ton pickup for plant	$ 20,000
		Subtotal:	**$ 570,000**
Baza Gardens	23	Repair/replace fence	$ 20,000
	24	Replace gate	$ 10,000
	25	Remodel plant lab	$ 20,000
	26	Half-ton pickup for plant	$ 20,000
	27	Fix/repair sludge pumps for hauling	$ 20,000
		Subtotal:	**$ 90,000**
Umatac-Merizo	28	Repair/replace fence	$ 20,000
	29	Replace gate	$ 10,000
	31	Bushcutting riding mower	$ 20,000
	32	Redo/digout leach field	$ 100,000
		Subtotal:	**$ 150,000**
		GRAND TOTAL	**$ 30,210,000**

In addition to these projects, the Sewer Collection system requires CCTV inspection of all lines. This would be considered a Performance Improvement Project to be done over a course of 3-4 years. GWA

would work with PMC to determine priority lines and initiate project to complete 50miles of sewer line per year.

6. Historic Spending Patterns

The following is the historical spending data from FY 1999 thru FY 2005 for the Wastewater Division. The data includes expenses for wastewater collection maintenance, treatment plants, and pump stations.

		Fiscal Year							
Obj Code	Object Code	1999	2000	2001	2002	2003	2004	2005	7Yr. Avg.
204	Training Offisland							81,470	81,470
206	POV Mileage Reimbursement							68	68
301	Advertising Expense							17,171	17,171
311	HvyEqpmnt/MotorRep	93,262	143,958						118,610
313	Heavy Equipment Rental	428,760	1,059,796	580,781	200,655	726,452	925,965	1,065,180	712,513
327	Janitorial Services							842	842
331	Renovatn of Facility		-6,745	-13,840				-300	-6,962
332	Bldg Repair & Maint	3,975		24,339					14,157
334	Trash Pickup							1,806	1,806
365	Various Repair Services	90,343	567,571	66,078	194,874	-144,994	470,443	39,291	183,372
391	Aircon Maintenance							800	800
402	Fuel/Lubricant	10,014	6,972	-16,909	5,695	32,414	51,556	115,449	29,313
405	Office Supplies	991	463	93		7,156	3,318	12,893	4,153
408	Operational Sup/Mat	45,055	89,868	55,028	43,528	592,819	265,833	480,740	224,696
412	Pumps&Gen Part	1,430	32,968						17,199
417	Asphalt Material							6,685	6,685
419	Safety Equipment	4,360	17,308	18,551	30,145	23,386	21,032	54,660	24,206
420	Vehicle Parts	2,844	160					45,409	16,138
430	Chemicals	229,592	-103,395	95,777	162,651	56,276	-187,473	56,908	44,334
501	Office Equipment	1,024	1,785	10,815	699	-5,000	6,150	12,916	4,056
502	Equip/Hand Tools	1,710	13,281	-2,047	10,107	4,147	14,327	24,347	9,410
503	Gas Operated Equip	479	1,830				1,274	41,278	11,215
506	Pumps/Motor Inv	400	8,232			39,758	91,623	-17,416	24,519
600	Miscellaneous		160					30	95
703	Telephone		329	2,247	5,128	472	6,045	6,326	3,425
704	Cellular	595	602	383					527
705	Radio/Pager				1,535		3,681	2,343	2,520
715	Fuel/Power Product					3,011			3,011
SUBTOTAL		**914,833**	**1,835,142**	**821,296**	**655,018**	**1,335,898**	**1,673,774**	**2,048,895**	**1,326,408**
701	Purchase Power	648,912	6,224,280	6,302,680	5,758,484	4,155,551	556,071	879,811	3,503,684
GRAND TOTAL		**1,563,745**	**8,059,423**	**7,123,976**	**6,413,502**	**5,491,449**	**2,229,845**	**2,928,706**	**4,830,092**

The historical expense data was retrieved from GWA's J.D. Edwards' Financial System. Additional information on FY 2005 power consumption and monthly billings per meter from the GPA billing system is provided as a supporting document for this Volume. The O&M budget for the PMC will exclude power consumption costs, however power consumption reduction is an incentive for the PMC and the bonus will be the savings shared between GWA and the PMC.

The PMC will be required to track all costs using the Object Code account structure and the National Association of Regulatory Utility Commissioners (NARUC) chart of accounts. This will ensure that historical data can be tracked consistently for future evaluation.

7. System Documentation Summary

The following is a list of supporting documents and drawings for this technical review.

No.	Document/Drawing Description	
Comprehensive Performance Evaluations (Consultant)		**Report Date**
1	Agana Sewage Treatment Plant (Duenas & Associates)	March 2002
2	Agat Sewage Treatment Plant (Winzler & Kelly)	September 2004
3	Baza Gardens Sewage Treatment Plant (Winzler & Kelly)	August 2004
4	Northern Sewage Treatment Plant (Duenas & Associates)	March 2002
5	Umatac-Merizo Sewage Treatment Plant (Winzler & Kelly)	August 2004
National Pollution Discharge Elimination System Permits		**Expir. Date**
6	Agana STP (Permit No. GU0020087)	June 30, 1991
7	Agat STP (Permit No. GU0020222)	Apr. 15, 2006
8	Baza Gardens STP (Permit No. GU0020095)	Sept. 6, 2005
9	Northern District STP (Permit No. GU0020141)	June 30, 1991
10	Umatac-Merizo STP (Permit No. GU00250273)	Sept. 6, 2005
Preventive Maintenance Programs		
11	Preventive Maintenance Schedule (WWTP)	
12	Monthly Maintenance Work Schedule – Pump Stations	
Proposed Training Program (Dept. of Interior Grant)		
13	GWA Training Grant Application	
14	Certification Letter20051028Training ReportSO46-47	
GWA Wastewater Power Billing & Consumption Data		
15	FY05 GWA Wastewater Power Consumption	
16	FY05 GWA Wastewater Power Billing Summary	
Drawings		
17	GWA Manhole Inspection Mapping (9/8/05)	
Recommended WW CIP & Other Projects		
18	GWA Master Plan (Draft) Volume III, Chapter 9 – Recommended CIP	
19	Sewer Pump Stations Proposed Projects	
GWA Stipulated Order		
20	GWA Stipulated Order	
GWA Emergency Response Plan		
21	Emergency Response Plan	