BACKGROUND SUMMARY

Introduction

The Water Resources Master Plan (WRMP) integrates asset management best practices and utility optimization with traditional master planning. A strong emphasis has been placed on both short- and long-term success factors to unlock resources that can be reallocated to meet Guam Waterworks Authority's (GWA)'s most critical needs. Recommendations are presented for meeting efficiency goals for both water and wastewater utilities. Application tools such as hydraulic and financial models, a Geographic Information System (GIS), and other management systems have been developed and described in the WRMP. Chapters in Volume 1 describe these and other tasks, which were either completed or recommended to GWA as crucial to continuation toward the goal of becoming a best in class utility.

Chapter 1 – Background

The consultant team led by Brown and Caldwell developed a plan that maximizes interaction with the GWA staff while addressing the Stipulated Order for Preliminary Relief (Stipulated Order) requirements. The plan also integrates asset management best practices with an implementation plan. A combination of related master planning, utility optimization, and asset management experience was important to the development of this plan. A strong emphasis has been placed on both short- and long-term success factors to unlock resources that can be reallocated to meet GWA's most critical needs. This chapter outlines the goals for the plan as well as defining the plan's implementation steps.

Project Goals

Five project goals are presented for accomplishing the objectives in the plan, these are:

- Institute sound asset management and capital planning
- Develop a foundation for sound management operation and maintenance and financial planning
- Engage GWA's customers to achieve the appropriate level of service
- Achieve long-term resource sustainability
- Establish the road map for full regulatory compliance

Project Approach

In order to meet the project goals, the following implementation tasks are defined:

- Project planning
- Identify planning requirements
- Define levels of service
- Assess current status
- Develop assessment toolbox
- Develop and analyze opportunities
- Prepare strategic master plan

- Develop implementation plan

Summary

Chapter 1 presents an overview of five major goals and eight tasks for completion of the GWA WRMP. Emphasis is on the fact that the master plan completion is an important element of the requirements in the Stipulated Order and will set the course for capital water and wastewater improvements for the next 20 years and beyond.

Chapter 2 – Planning Requirements

This chapter addresses a range of planning requirements and constraints which form the basis of many of the WRMP tasks. The major requirements are covered in the following sections.

Stipulated Order

GWA entered into a Stipulated Order with U.S. Environmental Protection Agency (EPA) Region IX providing guidance on addressing a number of needs in both the water and wastewater systems on Guam. The first priority of the Stipulated Order is to address potential threats to public health and safety in Guam. The second priority is to set intermediate, achievable goals, such as coming into compliance with relevant health, environmental, and safety regulations. A major objective of the WRMP is to establish a timetable for future capital improvements.

Resource Constraints

Resource constraints for GWA are divided into three categories: personnel, financial, and material. Specifics relating to these constraints are presented in subsections of this section.

Preliminary Assessment of Affordability

Affordability is an important socioeconomic issue. A major goal of the WRMP is the establishment of a 20-year CIP and the financial impact resulting from this analysis. To address affordability of the program, a preliminary assessment was conducted to provide some measure of the level of investment that could be afforded by users based on current income.

Summary

The Stipulated Order was a major driver for the WRMP planning requirements. As noted in the chapter, developing a program to upgrade the utility as defined in the CIP results in financial needs that are affordable. The chapter addresses these issues.

Chapter 3 – Organization Assessment

This chapter profiles the efforts of a team of experienced environmental professionals assembled to review the existing organization structure and composition. Certain recommendations were made for modifying areas where improvements were warranted and reinforcing areas that were functioning well. The chapter covers this effort.

Current Organization

The chapter notes that GWA is authorized to have 246 full-time equivalent positions for FY 2006, of which 232.5 are currently filled according to the August 27, 2006 organization chart. Various measures have been taken over the past several years to optimize the staffing level of

the organization. The results of this activity reduced the organization full-time equivalent positions by approximately 100 employees while improving service to GWA's customers.

The organization is managed by a general manager who reports to the Consolidated Commission on Utilities (CCU). The following divisions or groups report to the general manager:

- Legal Council
- Internal Services Unit
- Chief Financial Officer
- Chief Engineer
- Production/Treatment Division
- Collection/Distribution Division

In addition to reviews by the master planning consultants, other reports and group surveys contributed to background on the current organization. These are:

- Qualserve Peer Review Report
- Hunter Water Australia Report
- Comprehensive Performance Evaluation Observations
- Stipulated Order Quarterly Report Summaries
- Outside Consultant Training Activities

Organization Improvement Opportunities

This section discusses a process that has been successfully used by other entities to reach intended levels of service. The basic elements are:

- Commitment by GWA's management personnel
- An identified "champion" with management backing
- Access to the necessary resources
- A "coach" with experience in carrying out the process

Internal Communication

Developing internal communication required creating a sense of ownership. To do this, GWA staff input was sought. Two initial group meetings and additional monthly meetings were held as part of this process. Bringing closure to the formal input process is as important as seeking it in the first place. The most visible method of feedback is the WRMP Web site that was created at the time the WRMP project was initiated. Through this site, GWA personnel have been able to access important WRMP progress.

External Communication

The external communication was carried out through public presentations of the WRMP to all 22 villages on Guam. Each of the villages has a mayor, and each receives its water and sewage services from GWA. Another vehicle for keeping the public informed was implementation of

WRMP newsletter to communicate with GWA's customers. This topic is covered extensively in Volume 1, Chapter 5 – Communication.

Other Factors Impacting the Organization

During the course of the analysis of the organization, other topics were considered and discussed in the chapter. These include:

- Barriers to Personnel Success
- Organization Aspects of Levels of Service
- Training and Certification
- Sewage Collection System Organization
- Water Treatment Facilities Organization
- Water Distribution System Organization
- Facility Assessments and O&M Factors

Summary

This chapter addresses pertinent organization factors either influenced by or influencing the WRMP results. The point is made that the "people" side of the process is as important as the technical factors in the success of the program.

Chapter 4 – Levels of Service

The WRMP topic covered in this chapter included the task for the planning team in communication with GWA management to define service levels. The point is made that the implementation of the WRMP will not only require facilities to be constructed over the next 20 years, but it will also require an organization that can run effectively and efficiently for the next 20 years as well. Service levels represent the primary operating goals that the organization must achieve each year.

Objectives presented in this chapter are threefold:

- Provide a starting point and outline the process for establishing service levels
- Provide guidance to GWA in developing appropriate performance measures
- Describe how GWA can monitor performance for reporting results

Service Levels and Performance Measures

A number of performance indicators can be developed for a monopoly utility like GWA, ranging from measures of safety to the average time it takes to handle a bill payment. **Service levels** are performance indicators that are considered particularly important by customers and regulators. Those that GWA has already established are to meet drinking water quality standards and sewage effluent quality requirements. Service levels are few, externally focused, and very important.

Performance measures cover important aspects of organizational performance relating to efficiency, productivity, safety, and other areas that are not as exposed to close public or regulatory review.

Current Service Levels

Four current GWA service level categories required to satisfy regulatory needs and meet legal code requirements are:

- Drinking water quality
- Continuity of water supply
- Wastewater system spills
- Wastewater effluent discharges

Process for Going Forward

This section emphasizes that development of successful service levels and performance measures must be a team effort led by management and involving all levels of GWA staff. The staff is the foundation of the utility, and their involvement is essential if the organization is to instill the service level concept and achieve long-term success in identifying and implementing early gains.

Summary

Service levels are the regulatory and customer service measures that drive the organization. GWA already has service levels for regulatory purposes that cover water quality, wastewater effluent discharges, and system spills.

This chapter provides a guide to GWA in developing performance measures that will allow the organization to meet these service levels and monitor other important facets of its operations.

Chapter 5 – Strategic Communications

This chapter describes research that was completed in July 2005 to develop background for a plan and also presents the elements of the strategic communication plan. The immediate action plan included fundamental strategies and tactics that would begin communication between GWA and its customers and employees about the master plan.

Plan Components

The components of the communication plan require trained, empowered, dedicated staff knowledgeable about the community and the public outreach process. Adequate resources, both human and fiscal, are necessary to ensure the communication efforts will accomplish the goals and objectives of the communication program.

Research

Research was conducted in three phases. These were:

- One-on-one interviews
- Focus groups
- Telephone survey

Other Pertinent Topics for Plan Development

Following are topics that are expanded in the chapter:

- Setting communication goals
- Setting short and long term objectives
- Establishing public outreach strategies
- Establishing communication methods

Implementation

The communication program has been implemented in a variety of ways throughout the WRMP development, including:

- Prepared two fact sheets for GWA staff
- Held "all hands" meetings with GWA staff
- Held village meetings
- Prepared issues of the newsletter

Summary

A multifaceted communications plan was developed to inform both the citizens served by GWA and GWA's internal staff. Ongoing activities were identified to keep the public informed during and after the WRMP project and into the implementation phase resulting from master plan recommendations.

Chapter 6 – Population and Land Use

An in depth population and land use forecast for the island of Guam was performed to provide relevant input to other portions of the WRMP, including data for developing the water, wastewater, and costing models. The focus of this chapter is on several major elements:

- Task approach
- Existing land use plans
- Future considerations
- Key assumptions.

Task Approach

The approach to attaining population and land use projections for Guam requires systematic study and analysis of existing conditions, probable future conditions, and potential scenarios of future population distribution.

Existing Land Use Plans

Existing population and land use conditions on Guam are discussed in this section. The following topics are considered:

- Population
- Land use

Future Considerations

Using information gained from historical sources, the next area is to consider future impacts and related factors. Some of these are:

- Future population
- Future land use
- Future population distribution

Summary

This chapter concentrates on planning factors necessary to meet short-term and long-term water demand and wastewater disposal requirements in support of GWA's WRMP and is not intended to serve as a land use planning document. Other pertinent conclusions include:

- Future development in rural northern Guam will likely be limited to single-family residential units because the groundwater source is considered the principal water supply.
- Firm population projections are difficult to make due to potential military personnel placement and movement.

Chapter 7 – Asset Inventory

This chapter discusses the process used for identifying and recording GWA assets in both the water and wastewater systems. This effort entailed developing a program that catalogs existing assets and also provides a system going forward for incorporating new and modified assets. Volume 1, Chapter 8 – Asset Management, presents details on the ultimate use of the asset inventory. InfoCollect, a computerized data collection tool, was developed using Microsoft Access as the database software. A summary of the tools used in formulating the asset management program are presented below.

Data Collection Activity

Three teams were assembled to collect asset information, each dedicated to a different area of data compilation:

- Wastewater treatment plants and the Ugum Water Treatment Plant
- Wastewater pumping stations
- Wells, water booster pumping stations, and reservoirs

Equipment and Maintenance Submittal Procedure

A procedure is presented describing a means by which information for new equipment pertinent to GWA's asset inventory can be acquired. Five steps are described in detail in the section.

Verification Process

Three steps are defined for the verification process by different GWA groups:

- Operations and maintenance personnel
- Financial personnel
- Data entry personnel

Summary

InfoCollect, a computerized data collection tool, was developed using Microsoft Access as the database software. Tablet computers were used to facilitate field data collection. Three teams were tasked with collecting asset information, each dedicated to a different area of data compilation:

- Wastewater treatment plants and the Ugum Water Treatment Plant
- Wastewater pumping stations

- Wells, water booster pumping stations, and reservoirs

Unique asset identification numbers were developed using acronyms and numbers for individual assets.

1.9 Chapter 8 – Asset Management

This chapter provides an overview of orientation and training provided for GWA personnel in the concepts of asset management. Three specific areas of asset management were addressed:

- Several training workshops were held to provide an overall understanding of asset management
- A facilitated Business Case Evaluation (BCE) process was demonstrated
- Asset Management Program Evaluation (AMPE) methodology was demonstrated

Asset Management Training Workshops

Five asset management workshops were held to orient key GWA staff members covering the following topics:

- Basic asset management concepts
- Service levels
- Business Case Evaluation
- Risk management
- Customer service

Business Case Evaluation (BCE)

A sample project was used to demonstrate the BCE process. It was noted that this process is very useful in establishing priorities and potential costs of projects in the CIP. The example project addressed the potential for using collector wells as opposed to constructing a series of transmission mains.

Asset Management Program Evaluation (AMPE)

The framework used for the assessment of GWA's business process review was based on a methodology called AMPE. Details for the process are presented in this section.

Summary

Three areas for application of principles discussed in the training sessions were presented for consideration:

- Establish a computerized maintenance management system
- Continue the asset management program
- Complete the AMPE visioning process

Chapter 9 – GIS Program

This chapter documents the methodology used to develop the geodatabases for GWA. The initial step was to assess the current status of GWA's geographical information system (GIS), which was

developed for GWA in the early 1990s. Because it is unclear how that system was developed and whether the data format would be compatible with new software systems, creating a new GIS system was determined to be the best course of action.

An assessment was performed to determine the potential uses of GWA's GIS system. The most immediate uses for the data collected in the GIS are:

- Location of assets in the field
- Inventory of assets
- Development of hydraulic models

GIS Program Elements

The chapter is technical and specific in the development and implementation of the GIS program. Key topics discussed include:

- GIS Datum and Projection
- Geodatabase Structure
- Base Map Geodatabase
- Population Projection Data Table
- Wastewater Geodatabase
- Water Geodatabase
- Digitizing and Data Entry into Geodatabases

Summary

A comprehensive approach for upgrading and maintaining GWA's GIS program is presented in this chapter. This involved several steps that are detailed above:

- Initial review of the existing program
- Decision to build new water and wastewater geodatabases
- Define the elements of each of the geodatabases
- Define the process of data entry
- Define quality control procedures
- Train GWA staff in input processes and maintaining the geodatabases

Chapter 10 – Capacity Assurance Planning Environment (CAPE) Program

This chapter presents the basics of CAPE, noting that it is a suite of integrated software applications and decision support tools designed specifically to support the master planning process. Its primary use is in integrating information technology to reduce data handling complexity and provide the decision-making tools that are essential in the master planning process. CAPE has several modules available, however only three modules are being implemented:

- Time series data manager
- Infiltration/Inflow work bench

- CIP manager

The three major modules and functions are summarized below:

Time Series Data Manager

The Time-Series Data Manager is a storage and retrieval system for managing large sets of time-series data (e.g. flow meter and rain gauge data). It uses powerful compression algorithms, which result in files that are less than 5% of the size required by an Access database.

Infiltration/Inflow (I/I) Work Bench

The I/I Workbench is a modeler's workbench for performing area-wide I/I studies for wastewater collection system modeling. It includes two different kinds of continuous simulation I/I models - one based on a mathematical regression and the other on an urban watershed model.

CIP Manager

The Capital Improvement Project Planner provides a simple Gantt chart interface for managing capital improvement information. Project schedules can be changed by dragging boxes in the chart.

Chapter 11 – Corrosion Assessment

The chapter describes a corrosion and durability assessment of key water and wastewater facilities operated by GWA to assess the general integrity of the utility assets from a corrosion perspective.

The assessment was carried out through a site visit. Subsequent laboratory examinations and analysis in Australia were carried out on a number of soils, bedding material, and steel samples. Consequently, the assessment provides a general overview of major asset classes rather than a detailed examination of component assets. The methodology used in this assessment was to examine 'typical' examples of each class of GWA asset and extrapolate these to provide a snapshot of the asset type as a whole. The results are summarized below:

Deep Well Pump Stations

While only a single example of these was examined in any detail, a cursory review concluded that as an asset class these are unlikely to cause significant future problems and given adequate maintenance will continue to provide good service.

Water Pump Stations

The pump station concrete construction coupled with ongoing maintenance should provide extended life for this asset class.

Water Treatment Works and Ancillary Assets

A single asset evaluated in its own right (the Ugum WTP) showed excellent concrete structures and generally very good equipment condition. Leaking chlorine gas was a minor blemish, but the only item of major concern was the storm-damaged steel finished water tank.

Water Reservoirs

Reservoirs are generally in either unknown or poor shape. Based on the 7 reservoirs examined, all have external paint problems and clear lack of inspection of the internal surfaces, typified by the lack of ladders for roof access.

If one of the reservoirs represents typical internal corrosion, then potentially very serious issues apply to the remaining tanks. Further, there is a risk of catastrophic failure with consequences for public safety.

Sewage Pump Stations

It was observed that pump stations had good concrete and only minor corrosion and durability issues. It can be concluded that this asset class has extensive future life provided maintenance is continued.

Sewage Treatment Plants

Based on those examined, this asset class has significant corrosion and durability issues. While the concrete exposed to atmosphere was generally excellent, concrete (and steel) exposed to H_2S in non-ventilated conditions is often in degraded condition and requires extensive remedial work. Further, much equipment and pipe work is corroded and also requires attention.

Pipelines

By their very nature, none of this asset class was able to be directly examined. The limited failure data obtained did not indicate significant corrosion related failures and this is supported by the random soil corrosivity data measured in the laboratory. However, the seismic influence on mechanical failure is likely to be significant and the performance overall of both water and sewer mains, as GWA's largest asset cost, should be carefully monitored.

Chapter 12 – Electrical Assessment

This chapter discusses the assessment approach to assist GWA personnel with identifying, correcting, and developing procedures to safely operate and maintain its electrical system. Standard investigative techniques were used to identify and locate the sources of the electrical challenges plaguing the consistent operation of GWA services.

Existing Electrical System

Five types of utility components were profiled in the electrical assessment:

- Water wells
- Water booster stations
- Wastewater pump stations
- Sewage treatment plants
- Water treatment plant

Assessment Methodology

The first step in preparing this assessment report was to collect electrical data using power-analyzing test equipment. A rating scale described in the section was used to define assessment results. Types of equipment and techniques used included:

- Power quality analyzer
- Infrared imaging
- Digital photography

Electrical Observations and Findings

This section describes collected electrical data, site observations, personal interviews, work practice observations, photographs, and manufacturer inquiries. Identified issues are described in detail and are incorporated into WRMP CIP projects. Photos and charts are included in the discussion (where applicable) for the following topics:

- Electrical System Power and Grounding Discussion
- Voltage and Current Unbalance Issues
- Electrical Meter Failures
- Motor Overload Protection
- Phase Monitors or Motor Protectors
- Reduced Voltage Motor Starting
- Motor Oversizing
- Standby Generators
- Diesel Fuel Line Building Wall Penetration
- Coordination with Guam Power Authority
- Voltage at Motor
- Pump Station Grounding
- Lightning and Surge Arresters
- Power Factor Correction Capacitors
- GWA Personnel Work and Maintenance Practices

Electrical Assessment

Charts are presented for results of electrical assessment findings. A ranking system similar to the one described in the assessment methodology was implemented.

Implementation Approaches Based on Field Observations

Implementation approaches to resolve items found in the field observations are described for the areas listed in the assessment. Eleven items are discussed in this section.

Implementation Activities

A number of specific implementation activities are detailed in this section, followed by concluding observations and recommendations. Major topics discussed are electrical practice and electrical testing procedures.

Summary

The major findings discussed in the chapter can be summarized as follows:

- A majority of the electrical challenges at the water wells deal with voltage imbalance conditions and installation methodology.

- Much of electrical infrastructure suffers from the effects of natural disasters, lack of preventive maintenance, and vandalism.
- Standby generators, that are necessary for operation during a power outage, were non-functional at several stations due to missing parts or batteries.
- Lack of predictive and preventive maintenance and personnel training affects results.
- Wastewater pump high frequency of operation contributes to pump electrical and mechanical wear.

Chapter 13 – SCADA Assessment

This chapter presents an overview of the existing, essentially non-functional SCADA system and recommends a four-phase reconstruction to provide a functioning system. The four phases are:

- Add a base station to the existing Motorola SCADA system
- Install new Remote Terminal Units (RTUs) at priority sites
- Expand the system through the GWA local area network (LAN)
- Incorporate a maintenance management system and integrate operational data and accounting information

Existing SCADA and Control System Description

This section describes the Motorola initial SCADA system installed in the early to mid-1990s at all water and wastewater treatment plants and pump stations, reservoirs, and related facilities. More recent projects in the past five years have incorporated later Motorola designs; however, these installations were never made operational.

SCADA Assessment Methodology

The methodology used to conduct this assessment consisted of site surveys and observations of the existing SCADA and control equipment, review of digital photographs, field voltage checks, and communications testing (where possible). A rating table and explanation of factors is included in the section.

SCADA & Control System Site Observations

Site visits were made to approximately 75% of the water wells and booster pump stations and 55% of the wastewater pump stations. The observations are listed for site visit results.

SCADA & Control Implementation Activities

The process control system is a critical component in achieving GWA goals for operational efficiency. Therefore, the recommendations in this report is to include technologies that comply with the following criteria:

- Adoption of standards for hardware installations
- Open standards for software programming languages
- Leveraging existing communication infrastructures
- Integration of current Information Technology (IT) systems

Summary

The results of the SCADA system survey and recommendations are detailed in this chapter. Major items pertinent to the system are:

- A SCADA monitoring system (which was installed in the 1990s) was never functional.
- Four phases are recommended to make the system fully functional.
- Water pumping and booster station automatic controls are currently operating only in a manual mode.
- Site visits revealed that many complex electrical instrumentation and controls systems were not operational.
- During field visits to facilities, it was evident that there is a lack of skilled personnel to operate and maintain control systems.
- Effective information transfer would be enhanced by providing two-way radio communication between operations, maintenance, and administrative personnel.

Chapter 14 – Financial Program

Chapter 14 documents the GWA financial plan and water and wastewater rates. The evaluation develops appropriate rate-based revenue requirements based on sound fiscal policies, and identifies an improved water and wastewater rate structure resulting in community-oriented customer bills. The following section divides the findings into projected expenditures, cost of service, rate sensitivity to cost analysis, customer affordability. It also provides a summary of the conclusions and financial plan recommendations.

The assumptions, findings and conclusions of this chapter are summarized in this final section. Once the appropriateness and legality of the updated rate structure, system development charges and miscellaneous fee findings are approved by the elected officials of GWA, CCU, and the Guam government and GWA counsel, the conclusions can be implemented.

14.12.1 Projected Expenditures and Revenue Findings

Annual O&M expenses of $43 million in FY 2004-05, plus $4 million in debt service, will climb to $63 million by FY 2011-12 due to inflation and growth in customer service, plus $30 million in debt service for project funding. The WRMP CIP identifies $894 million in total project costs. There are two alternatives to the pace of construction, with the differences due to a delay in certain construction of projects not essential for life and safety. The alternatives are described as the "Base Case" CIP and the "Minimum Pace" CIP.

- **Base Case CIP.** In the first five years through FY 2010-11, the project expenditures total $185 million in 2007 dollars, or $213 million in then-current dollars escalated for inflation. To fund the CIP, rate-based revenues should be almost doubled by FY 2011-12. User rates must be increased by eight percent annually for seven years. A 20-year cashflow analysis through 2026 finds that rates must then increase to 14% per year for two years, and then decline to an annual increase of between three to four percent for the remainder of the 20-year cashflow analysis.

- **Minimum Pace CIP.** The first five years of the CIP totals $132 million, or $148 million in then-current dollars escalated for inflation. User rates must be increased by 6 to 6.4 percent annually for six years, and then 11% per year for two years before dropping to three to four percent per year for the remaining years of the 20-year period.
- **Conclusion.** The "Minimum Pace" CIP should be implemented. In doing so, the project funding requirements will limit the short-term rate-based revenue requirements to increases of six percent per year. While the result of these limited increases to revenues will delay projects required for reliability and capacity, it is likely that higher utility billing increases required for the Base Case CIP will not be acceptable to the Guam community. Under the existing economic conditions, we recommend that multiple rate increases over six percent annually be postponed whenever possible.

Cost of Service Findings

The current rate structure is imbalanced between water and sewer utility services, with wastewater services funded in part by water service revenues. 64% of all costs are for the water utility, with the remainder going to the wastewater system.

Residential customers are underpaying by 17%, overall. These customers are paying approximately four percent too little for water services and 57% too little for sewer services. Hotels are paying 29% too much overall, and other commercial customers are overpaying by an average of 16%.

Nevertheless, our conclusion is that the current rate structure, with an updated lifeline program, should continue to be used for the next ten years. Thereafter, starting in 2016, cost of service-based rates should be phased-in. Typically, it is desirable to enhance billing equity, revenue stability and rate structure simplicity concurrent with other changes to billings. However, with high increases in revenues required over the next ten years, any improvement in equity will cause extreme increases to residential bills. In delaying the implementation of rate equity, billing increases to residential customers can be kept to a level that will minimize rate-shock and maximize affordability.

Sensitivity Analysis Findings

The typical single-family residential bill is currently $55 per month. Due to the replacement of the water meters, these bills will increase to $62 per month by FY 2010-11 without any changes in the rates. A six percent annual increase under the Minimum Pace CIP will result in a $77 per month bill.

Changes to certain modeling assumptions have a significant effect on the FY 2010-11 residential bills, which are projected to be $84 per month under the Base Case CIP:

- O&M inflation is currently projected at six percent per year. If inflation is four percent, then the bill will be $4 less per month, and if it is eight percent then the bill will be $2 more.
- Water sales are projected at 7.8 million Kgal per year. If the water sales are only 6 million Kgal, then the bill will be $9 more per month, and if it is 10 million Kgal then the bill will be $2 less.

- Bond interest rates are projected at six percent per year. If interest rates are only four percent, then the bill will be $8 less per month, and if rates are eighr percent then the bill will be $4 more.

Other variables have less of an impact on projected bills, including level of system development charges and nonpayment of customer bills.

Affordability Findings

Current combined utility bills are 1.6 percent of the median income, with more than 21% of residential customers having charges greater than three percent of their household income, and 65% of households paying less than two percent. The Guam community has a disproportionately large number of low-income households.

By 2010 the median household will pay more than two percent of income on water and sewer utilities, by 2014 the payments will rise to three percent. Over 20 years the cost of utilities never rises over 3.7 percent of the median household income, which represents a high but probably affordable level for the median household.

Second, it may be difficult for elected utility managers to enact continuous rate increases of over five percent annually. While a public outreach information campaign will create some support for rate increases, either the Base Case CIP or the Minimum Pace CIP funding will be challenging to implement if approval by elected officials is required. The needs and benefits of the improvements will need to be clearly communicated to GWA's customers to gain support.

Conclusions

The following is a summary of the financial plan conclusions:

- **Create a New Lifeline Program.** To reduce rate shock to the most financially vulnerable 15% of the residential customers, a new lifeline program should be implemented, to limit future rate increases to changes in the Consumer Price Index. The program would be funded with a surcharge to all other customer bills.
- **Fund the Minimum Pace CIP.** The funding of the Minimum Pace CIP, with multiple annual rate increases of six percent through FY 2011-12, provides the best balance between implementation of the WRMP recommendations and the community affordability concerns.
- **Continue with the Current Rate Structure.** Based on community affordability findings, the current rate structure with an updated lifeline program (Alternative 2) should be used as the basis for rate increases, until 2015. All unit rates, including the current "lifeline" rates for tier 1 water use and the residential sewer services, should be increased equally each year.
- **Phase-in Cost of Service Rates.** To enhance billing equity in 2016 or when the annual rate-based revenue increases decline below five percent annually, the cost of service rate structure (Alternative 3) should be phased in.
- **Update the Financial Plan Every Three Years**. A five year projection of rate-based revenue requirements should be prepared every three years, to verify that the financial plan rate-based revenue changes are appropriate. The GWA should

not attempt to make financial decisions based on single "test" year budgets, as CCU policies, including debt funding with capitalization of debt service, result in material changes to rate-based revenue requirements beyond that single-year evaluation period.

- **Public Information Program.** An increase is needed in public information and outreach activities to inform and persuade customers and utility stakeholders of the critical issues affecting GWA services. The outreach efforts should be based on building a compelling case for the essential need of more funding, by emphasizing the value of service reliability, quality and the environmental and economic benefits of protecting the beaches of Guam.

Chapter 15 – Capital Improvement Program

This chapter defines the recommended CIP projects proposed to be implemented over the next 20 to 30 years. Tools have been developed as part of the WRMP to continually update this initial effort. Also, successful implementation of the proposed CIP requires GWA to communicate and seek buy in of its developed CIP policy by the staff, CCU, PUC and its rate payers.

Elements for a CIP

The major components required to support a sound CIP decision making policy include:

- Asset management program (asset inventory, asset database)
- Hydraulic models
- GIS system
- CMMS program
- Replacement Planning Model (RPM)
- Business Case Evaluation (BCE) protocol
- Rate setting models
- Communication outreach program

Elements of a CIP Policy

The elements for a successful policy include:

- Defined Levels of Service expectations.
- Utility master plans that provide a roadmap to meet future needs.
- A process to evaluate selected projects before they are listed as a CIP item through the use of a BCE.
- Procedures to obtain feedback from the operations group on major OM&R issues that are CIP projects.
- A risk evaluation process to guide decision making.
- A prioritization process for proposed CIP projects.
- An understanding of utility budgetary constraints.
- A communication plan to involve and share with GWA staff and decision makers.

Delivery of CIP Projects

Consideration should be given to a wide variety of delivery mechanisms available for designing, constructing and operating water and wastewater infrastructure. Four types of project delivery mechanisms are suggested:

- Traditional design by a consultant and construction by a contractor
- Design and construct under the one contract
- Contracts to build, own and operate facilities for periods of 10 to 20 years
- Alliances, partnerships and operations support arrangements

WRMP CIP Projects

Specific WRMP projects were ranked and prioritized based on the specific needs they fulfilled including:

- Life and Safety
- Regulatory Compliance
- System Reliability
- System Redundancy
- System Capacity
- Operation Maintenance and Rehabilitation Recommendations

The defined CIP indicates that GWA will be in a catch up mode for the first 5 to 10 years to reestablish the base foundation for the utility. The highest priority projects will focus on meeting the level of service expected by the CCU, GWA staff and GWA's customers. Primary among the expectations are:

- Continuity of water supply
- Safe drinking water quality
- Mitigating wastewater spills
- Appropriate wastewater treatment

Concurrent with rebuilding the foundation of the utility, GWA must complete projects that will ensure that water and wastewater systems can meet Guam's immediate growth requirements.

WRMP CIP Cost Estimating

This section notes that the cost estimating range of accuracy is based on the level of project definition. A Cost Estimate Classification System (Recommended Practice No. 18R-97) created by the AACE International defines 5 classes of cost estimates and was used as a guideline for cost estimation. Using this matrix as a guide, the GWA WRMP cost estimate accuracy range should vary from -50% to +100%. The matrix is an appendix item.

The chapter recommends that project cost estimates be reviewed and revised on an annual basis as part of the budget process to account for the volatile construction marketplace. The

past 5 years have seen material and construction cost skyrocket based on the worldwide competitive market for materials and construction resources.

CAPE Application

Details on the CAPE tool are presented elsewhere in the WRMP. The primary function is how it ties together wastewater forecasting, GIS and CIP planning. Elements of the Time Series Data Manager module and the Wastewater Forecasting System module will be incorporated into CIP planning.

WRMP 20-year CIP

Two CIP schedules (Base Case and Minimum Case) have been identified, with both using the same proposed projects. The schedules differ in the deferral from construction in the first five years of projects not essential for life and safety and in the period needed to complete the construction (Base – 20 years, Minimum – 30 years). The funding for both schedules is shown in Volume 1, Chapter 14 - Financial Program.

Summary

This chapter provides a basis for the development of the CIP and emphasizes the need for and usefulness of several tools to significantly upgrade the present method of CIP development. Key elements discussed include:

- CIP Development
- CIP Policy Development
- CIP Delivery Options
- CIP Tools - Capacity Assurance Planning Environment (CAPE) Application
- CIP Cost Estimating

Chapter 16 – Privatization and Consolidation Opportunities

This chapter notes that GWA's past history has resulted in the government evaluating the transfer of the management and operation of the GWA utility to the private sector. There are possibilities for shifting these responsibilities to the private sector or the U.S. military through consolidation, concession, outsourcing, and/or privatization. The successful implementation of any alternative approach depends on the support of GWA staff, the Government of Guam, the competence of the third party, overall cost, and the wishes of GWA's customers. Two primary options are presented as well as other relevant considerations

Privatization

Privatization is a broad term describing many policy tools for shifting some degree of responsibility for services to the private sector. There are several reasons why privatization is considered for traditional government-owned facilities such as water and wastewater, and there are varying degrees of privatization based on the reasons presented in this section.

Consolidation

Consolidation is a process whereby two entities that provide a similar service can combine efforts in order to increase efficiency, improve service, and save money. The most logical partner in this case is with the military installations. Rationales for consolidation are presented in this section.

Privatization Considerations

The section notes that as a result of GWA's repeated violations of the Clean Water Act (CWA) and Safe Drinking Water Act, and the issuance of the Stipulated Order that proposed expenditures of significantly large amounts of money to rebuild the system and improve operations. GWA began exploring options to meet the federal standards and its customer's expectations. Steps toward privatization and options available to GWA are explored in detail.

Consolidation Considerations

In addition to exploring public-private partnerships, the CCU also began evaluating consolidation opportunities with GPA. One example is that a joint task force of GPA and GWA employees is responsible to repair or replace generators and electrical controls. This section identifies a number of options to be considered by GWA and the CCU for consolidation opportunities.

Summary

Recommendations based on this chapter are summarized below:

- Continue the process for selection of a PMC contractor
- Define a process for improving the relationship between GWA and the military
- Continue the pursuit of both privatization and consolidation initiatives in accordance with the conditions defined in the Stipulated Order

Chapter 17 – Military Expansion on Guam

This chapter identifies challenges facing GWA in the near future due to the potential transfer of significant numbers of Marines and Air Force personnel. It is recognized that in addition to armed services personnel, dependants and support personnel will impose demands on both the water and wastewater systems on the island. Information was supplied to the consultants at a point in the planning process which made it impossible to determine exact numbers for inclusion in the planning and CIP.

A positive factor in this situation is the fact that the WRMP provides tools and processes to modify various models and the CIP to improve forecasting for the future. The chapter identifies areas of concern and makes assumptions, which will need to be modified as more information becomes available from military sources.