# FINAL

# EXECUTIVE SUMMARY FOR THE WATER INFRASTRUCTURE DEVELOPMENT PLANS FOR THE ISLANDS OF SAIPAN, TINIAN, AND ROTA COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

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# 1. EXECUTIVE SUMMARY

The purpose of the Water Infrastructure Development Plan for the Islands of Saipan, Tinian and Rota, Commonwealth of the Northern Mariana Islands (CNMI), is to create a prioritized list of water infrastructure projects that will provide potable water[1], island-wide, 24-hours per day, 7-days per week. The CNMI is a self-governing Commonwealth of the United States. The people of the CNMI chose to join the United States (U.S.) in a 1975 act of self-determination and were granted U.S. citizenship in 1986. The islands' status is based on the "Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States". Section 702 of the Covenant provides for financial assistance from the U.S. Federal Government to the Commonwealth. The purpose of this was to develop the economic resources of the CNMI to attain a goal of self-reliance.

The Island of Saipan does not have potable water that it can provide to its customers on a continuous basis. Currently, the domestic water supply has significant water quality and quantity problems, due to high sodium and chloride (salt) concentrations (poor quality), and lack of a 24-hour water supply in many parts of the system (insufficient quantity)

Some areas of the Island of Saipan receive water for as little as 2 hours per day. The rest of the day there is no water in the distribution system pipes. Lack of water has many serious potential human health and safety impacts. Low or no water pressure in the distribution system can and does result in potentially disease causing, bacteriological contamination entering the water lines (i.e., contaminants, including microorganisms, are drawn back into the pipes through microscopic openings in the pipeline when the line does not have water or is not fully pressurized, as is the case when there is no water in the pipes). Lack of a 24-hour water supply can result in serious sanitary and hygienic problems (lack of sufficient water for bathing, washing hands, flushing toilets, etc.). These conditions can pose particularly high threats for infants, elderly, and populations with immunodeficiency. Lack of 24-hour water also means that fire protection is compromised.

While the existing water system to the Island of Saipan is far below acceptable standards, the Commonwealth Utilities Corporation (CUC) and the United States Geological Service (USGS) have both expended considerable efforts to improve the quality and quantities of water provided. CUC has attacked the problem on several fronts. These include the replacement of leaking water lines, a leak

[1] Potable water is defined as water that meets all of the U.S. Environmental Protection Agency (EPA) primary and secondary standards (aesthetic, taste, appearance, and odor related), including the standards for total dissolved solids (TDS) and chloride, and is not only safe from a health standpoint, but is also sufficiently palatable for drinking water.

detection program, and a public education and conservation program. USGS has been involved in the drilling of 49 wells over the last 6 years with a goal of increasing production, while improving water quality. Currently, the CUC system includes 130 wells, three springs, and one rainwater catchment. As a part of the well drilling program, the wells with the worst quality were abandoned as new production wells became available. The current system produces about 10 million gallons per day (mgd) of which only 1.5 mgd (15%) meets EPA drinking water standards for chloride.

The 1996 Water Master Plan for the Island of Saipan (Winzler & Kelly Consulting Engineers) identified 21 recommended projects to the water system to achieve the goal of continuously supplied potable water. While a couple of those projects have been completed, a lack of financial resources has limited what CUC can complete. Since 1996 CUC has been able to expend about $3.3 Million on improvements to the water system. **At this rate of spending, the CNMI and CUC will never be able to complete the needed improvements to achieve the objective of delivery of continuous potable water, twenty four hours a day, seven days a week.**

The existing water systems on the Islands of Tinian and Rota are currently capable of delivering continuous potable water to all residents connected to the public water system. However, there are residents that live in areas on those islands that rely on water catchments that do not have water treatment, and these residents do not receive potable water according to EPA Primary and Secondary Drinking Water Standards. Thus, one important goal is to also expand the water system to deliver potable water to all residents of Tinian and Rota.

The prioritization procedure utilized in this study involves ranking of projects based on certain criteria, such as requirement to meet Federal and CNMI water quality regulations (related to the primary scope of this study which is to provide all CNMI inhabitants with drinking water that meets the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations, 24-hours per day, 7-days per week), need for meeting water distribution standards and guidelines (meeting flow and pressure requirements), capital and O&M costs, and system reliability. Each of the criteria was assigned a weight based on the relative importance of the criteria. Also, a score was assigned to each project for each criteria, with a range from 1 to 10, with 1 representing a lowest score possible, and 10 representing the highest score possible. The project with the highest weighted score received the highest ranking and the highest priority ranking.

The greatest weight was assigned to the primary scope item, which is the meeting the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations. The remaining criteria were otherwise assigned equal weights.

Table 1.1-1 contains a list of all projects in prioritized order. The total projected cost of all projects is $252,680,000. A proposed schedule follows the prioritization table.

**Table 1.1-1 Overall Project Prioritization**

| Project Name | **Meet Water Quality Regulations (weight=40 %)** | **Meet Water Distribution Standards (weight = 20%)** | **Costs (weight = 20%)** | **System Reliability (weight = 20%)** | **Total Weighted Score** |
|---|---|---|---|---|---|
| Tinian - Sewer Master Plan - $300,000 | 10 | 10 | 10 | 10 | 10 |
| Rota – Sewer Master Plan - $300,000 | 10 | 10 | 10 | 10 | 10 |
| Saipan – Critical distribution system improvements - $1,150,000 | 10 | 10 | 9 | 10 | 9.8 |
| Saipan – Improvements at Springs (assumes treatment is required) - $690,000 | 10 | 10 | 9 | 10 | 9.8 |
| Saipan – Additional pipeline projects - $805,000 | 10 | 10 | 9 | 10 | 9.8 |
| Saipan – Water conservation/leak detection and elimination - $2,875,000 | 10 | 10 | 7 | 10 | 9.4 |
| Saipan – Develop surface water catchment at Sadog Tasi - $5,750,000 | 10 | 10 | 5 | 10 | 9 |
| Saipan – Technical Assistance to CUC - $575,000 | 10 | 10 | 9 | 5 | 8.8 |
| Saipan – Optimize existing wells - $3,450,000 | 10 | 10 | 7 | 5 | 8.4 |
| Saipan – Continue test drilling program - $3,450,000 | 10 | 10 | 7 | 5 | 8.4 |
| Saipan – Develop surface water catchment at CMS/BMC Quarry - $9,200,000 | 10 | 10 | 2 | 10 | 8.4 |
| Saipan – Repair/replace leaking mainline pipes - $10,350,000 | 10 | 10 | 1 | 10 | 8.2 |
| Tinian – Renovation of Existing Reservoirs - $400,000 | 5 | 10 | 10 | 10 | 8 |
| Tinian – Water Master Plan - $300,000 | 5 | 10 | 10 | 10 | 8 |

| Project Name | **Meet Water Quality Regulations (weight=40 %)** | **Meet Water Distribution Standards (weight = 20%)** | **Costs (weight = 20%)** | **System Reliability (weight = 20%)** | **Total Weighted Score** |
|---|---|---|---|---|---|
| Rota – Renovation of Existing Ka'an Reservoir - $200,000 | 5 | 10 | 10 | 10 | 8 |
| Rota – Water Master Plan = $300,000 | 5 | 10 | 10 | 10 | 8 |
| Saipan – Well field isolation project - $5,750,000 | 10 | 10 | 5 | 5 | 8 |
| Saipan – Develop Talafofo Stream Basin - $14,490,000 | 10 | 10 | 0 | 10 | 8 |
| Saipan – Reservoir construction – immediate needs (10.5 MG) - $25,300,000 | 10 | 10 | 0 | 10 | 8 |
| Saipan – Encourage private rainwater catchments - $1,150,000 | 10 | 5 | 9 | 5 | 7.8 |
| Saipan – Implement Operation and Maintenance improvements not covered elsewhere - $575,000 | 5 | 10 | 9 | 10 | 7.8 |
| Rota – Lupok to Gagani Service Waterline - $3,220,000 | 10 | 5 | 7 | 5 | 7.4 |
| Saipan – Booster pump station improvements - $3,105,000 | 5 | 10 | 7 | 10 | 7.4 |
| Tinian – Carolinas Agricultural Homestead Water System (South Point System) - $9,160,000 | 10 | 10 | 1 | 5 | 7.2 |
| Saipan – Implement and enforce groundwater protection standards - $0 | 10 | 5 | 10 | 1 | 7.2 |
| Saipan – Develop wastewater reclamation regulations - $57,500 | 10 | 5 | 10 | 1 | 7.2 |
| Saipan – Enforce underground fuel storage tank regulations - $0 | 10 | 5 | 10 | 1 | 7.2 |
| Tinian – Computerized Maintenance System – $50,000 | 5 | 5 | 10 | 10 | 7 |
| Rota – Computerized Maintenance System - $50,000 | 5 | 5 | 10 | 10 | 7 |
| Saipan – Install 3 MGD RO facility - $27,600,000 | 10 | 5 | 0 | 10 | 7 |

| Project Name | **Meet Water Quality Regulations (weight=40 %)** | **Meet Water Distribution Standards (weight = 20%)** | **Costs (weight = 20%)** | **System Reliability (weight = 20%)** | **Total Weighted Score** |
|---|---|---|---|---|---|
| Tinian – Renovation of Maui Well No. 1 - $6,470,000 | 5 | 10 | 4 | 10 | 6.8 |
| Tinian – Dedicated Transmission Line from Maui Well No. 2 to the Carolinas (HMT) Reservoir - $900,000 | 1 | 10 | 10 | 10 | 6.4 |
| Tinian – Replacement of Old Valves - $300,000 | 1 | 10 | 10 | 10 | 6.4 |
| Rota – Replacement of Old Valves - $200,000 | 1 | 10 | 10 | 10 | 6.4 |
| Saipan – Improve data collection (per year) - $23,000 | 1 | 10 | 10 | 10 | 6.4 |
| Tinian – Dedicated Transmission Line from Maui Well No. 1 to the Marpo (QMT) Reservoir - $1,430,000 | 1 | 10 | 9 | 10 | 6.2 |
| Tinian – Installation of SCADA System - $750,000 | 1 | 10 | 9 | 10 | 6.2 |
| Tinian – Develop Wellhead Protection Program - $500,000 | 10 | 1 | 9 | 1 | 6.2 |
| Rota – Installation of SCADA System - $750,000 | 1 | 10 | 9 | 10 | 6.2 |
| Rota – Develop Wellhead Protection Program - $500,000 | 10 | 1 | 9 | 1 | 6.2 |
| Rota – Talo/As-Funta Waterline Connection - $390,000 | 1 | 10 | 10 | 8 | 6 |
| Rota – As Niebes, Chenchon, and Gampapa/Duge Homestead Water System - $17,290,000 | 10 | 5 | 0 | 5 | 6 |
| Saipan – Reservoir construction - future needs (8.5 MG) - $20,700,000 | 5 | 10 | 0 | 10 | 6 |
| Saipan – SCADA system - $2,300,000 | 1 | 10 | 8 | 10 | 6 |
| Rota – Lupok to Puntan Pona Loop and Fire Flow Relief Waterline - $1,000,000 | 1 | 10 | 9 | 8 | 5.8 |

| Project Name | **Meet Water Quality Regulations (weight=40 %)** | **Meet Water Distribution Standards (weight = 20%)** | **Costs (weight = 20%)** | **System Reliability (weight = 20%)** | **Total Weighted Score** |
|---|---|---|---|---|---|
| Tinian – Leak Detection Study - $300,000 | 1 | 5 | 10 | 10 | 5.4 |
| Rota – Leak Detection Study - $300,000 | 1 | 5 | 10 | 10 | 5.4 |
| Saipan – New sewer construction in Dan Dan and Kagman - $Unknown | 10 | 5 | 0 | 1 | 5.2 |
| Tinian – Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterlines - $1,270,000 | 1 | 10 | 9 | 5 | 5.2 |
| Tinian – Buildings for Chlorination Systems and Deep Wells - $520,000 | 1 | 5 | 9 | 10 | 5.2 |
| Rota – Buildings for Deep Wells - $410,000 | 1 | 5 | 9 | 10 | 5.2 |
| Saipan – Rate Study - $230,000 | 5 | 5 | 10 | 1 | 5.2 |
| Rota – Talo/As-Funta Fireflow Relief Waterline - $1,950,000 | 1 | 10 | 8 | 5 | 5 |
| Rota – New Ginalangan Reservoir - $5,290,000 | 1 | 10 | 5 | 8 | 5 |
| Tinian - Marpo Heights and Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterline - $2,440,000 | 1 | 10 | 7 | 5 | 4.8 |
| Rota – Songsong Peak and Fire Flow Relief Waterline - $3,210,000 | 1 | 10 | 7 | 5 | 4.8 |
| Rota – As-Funta to Songsong Loop Waterline - $3,340,000 | 1 | 5 | 7 | 10 | 4.8 |
| Tinian – Marpo Valley Water Distribution System Replacement Waterlines - $3,810,000 | 1 | 5 | 6 | 10 | 4.6 |
| Rota – Sinapalo Peak and Fire Flow Relief Waterline – $3,870,000 | 1 | 10 | 6 | 5 | 4.6 |
| Rota – Puntan Pona to Taiapu Loop Waterline and New Taiapu Reservoir - $4,110,000 | 1 | 5 | 6 | 10 | 4.6 |

| Project Name | **Meet Water Quality Regulations (weight=40 %)** | **Meet Water Distribution Standards (weight = 20%)** | **Costs (weight = 20%)** | **System Reliability (weight = 20%)** | **Total Weighted Score** |
|---|---|---|---|---|---|
| Tinian – San Jose Village Loop and Fire Flow Relief Waterlines - $7,660,000 | 1 | 10 | 2 | 8 | 4.4 |
| Tinian – New 0.75 MG Tank (Adjacent to the QMT Reservoir) - $1,300,000 | 1 | 5 | 9 | 5 | 4.2 |
| Tinian – New 0.5 MG Tank (Adjacent to the HMT Reservoir) - $950,000 | 1 | 5 | 9 | 5 | 4.2 |
| Tinian – New 1.0 MG Tank (Adjacent to the HMT Reservoir) - $1,500,000 | 1 | 5 | 8 | 5 | 4 |
| Tinian – New 1.25 MG Tank (Adjacent to the HMT Reservoir) - $1,800,000 | 1 | 5 | 8 | 5 | 4 |
| Tinian – Hydro-Geological Study - $1,500,000 | 1 | 5 | 8 | 5 | 4 |
| Rota – As Niebes, Chenchon, and Gampapa/Duge Fire Flow Relief Waterlines – 6,440,000 | 1 | 10 | 3 | 5 | 4 |
| Tinian – Filtration Plant for Existing Maui Well No. 2 - $3,410,000 | 5 | 1 | 7 | 1 | 3.8 |
| Rota – Filtration Plants for Spring Sources – $8,440,000 | 5 | 1 | 2 | 1 | 3.8 |
| Rota – Hydro-Geological Study - $4,500,000 | 1 | 5 | 5 | 5 | 3.4 |

{Projects Schedule}

{Projects Schedule}

{Projects Schedule}

# 2. ISLAND OF SAIPAN - RECOMMENDATIONS AND IMPROVEMENT PROJECTS

## 2.1 Conclusions and Recommendations

### 2.1.1 Water Production

The public water system's major failing is that it does not provide sufficient potable water to meet existing demands on a continuous 24-hour basis. In an attempt to increase the water supply, many wells are over-pumping their design limits and subsequently the aquifer. Over-pumping the wells causes upconing of brackish and saltwater that reduces the water quality, which in many locations is very poor. This poor quality water not only has an effect on the taste, but also makes it very corrosive to the distribution system and customers' fixtures. This results in additional leakage, which further compounds the water shortages.

For the past six years, CUC has been drilling new wells while abandoning wells producing poor quality water. While this has made some improvements to the system, water quantity and quality has not improved significantly. In fact, the quantity of water currently being delivered is approximately the same as reported in 1996. A significant amount of wells producing poor quality water have been abandoned and a greater number of new wells have been installed. From the data presented in section 3, it is evident that the quantity of water available with chloride values meeting the EPA standards of less than 250 mg/L is very minimal, and that there is insufficient potable water readily available to support the island. Currently, the amount of water being produced is approximately 9.8 MGD and the average day demand is 11.21 MGD. Therefore, CUC does not supply enough water to meet the population's demand.

In 1996, the weighted average chloride content for the entire island was 924 mg/L. In 1998, a report prepared by the USGS titled "Summary of Hydrologic Data for 1998, Saipan" reported that the weighted average chloride content for the entire island was 953 mg/L. Currently, the weighted average chloride content is 1,294 mg/L. This indicates that the quality of water being produced is steadily decreasing, and is mainly caused by over-pumping the aquifers and causing upcoming of brackish and saltwater, thus increasing the chloride content. The amount of water currently being produced with chloride contents meeting the WHO standards of less than 500 mg/L is 2.1 MGD, and meeting the EPA standards of less than 250 mg/L is 1.5 MGD. This is a clear indication that there is insufficient potable water readily available to support the island.

During the course of this study, it was observed that some of the production wells did not pump water directly into a reservoir, but instead pumped directly into the distribution system. This is not considered good practice. By pumping directly

from the wells to the services, the fluctuation of pressure common in Saipan's water lines will strain the motors and reduce their lives. The reasons why CUC has some wells pumping directly to consumers is that the wells are numerous, widely scattered with respect to a reservoir, and are considered small production wells (30 gpm). These types of conditions make the construction of an appropriate transmission line costly.

It is important to recognize that the natural geological and hydrogeologic features limit the groundwater resources on Saipan. As the island's population grows, we foresee a potential conflict developing (if it hasn't already developed) between the water source needs of the public purveyor, and those of private interests that have their own wells.

As the maximum safe yield of the groundwater resource is reached, and the effectiveness of water conservation has been achieved, the Island will still need additional sources of potable water. It is clear that the groundwater resource is a finite one. Current estimates of its safe yield of potable water are about 10 MGD. Current maximum daily demand for the island, which is a criterion upon which the water supply facilities are based, is estimated to be about 17 MGD. By the year 2022, that demand is estimated to increase to almost 25 MGD.

### 2.1.2 Water Storage

During this study it was determined that the island of Saipan does not have adequate reservoir storage capacity to supply water to the population on a 24 hours a day basis. The existing total storage capacity is 9.85 MG and the required is 16.82 MG. An additional 9.62 MG of water needs to be stored in order to have enough supply for the current populations demand. As the population increases, the need for additional reservoirs will increase as well.

### 2.1.3 Water Treatment

The primary, initial focus should be on reducing demands through the following actions:

1. Establishing policies and regulations, including water rates, which would mandate conservation, and penalize those who waste water.

2. Aggressively hunt out all leaks and eliminate them.

3. Limit demand and consumption by limiting growth or population.

Once these actions have been implemented a determination could be made on whether the construction of an RO water treatment plant is needed. While we believe that an RO plant will ultimately be needed, that need (and the plant's size)

will be based on how successful the initial actions are and validation of the assumption that CUC desires to supply water to all of its potential customers and not force them to develop their own supply.

A critical question that CUC needs to answer is whether they want to supply water to the whole island or just to their current customers. The answer to this question will help determine if RO water treatment (by CUC) is necessary. Since CUC has all of the other infrastructure (i.e., pipelines, reservoirs and pumping stations) necessary to serve the whole island, we believe it makes sense for them to also develop sufficient sources of supply to serve the whole island. If CUC only wishes to serve their current customers, then RO treatment may not be needed. However, if CUC wishes to ultimately serve the whole island, then RO treatment will likely be needed at some point in the future. In making this decision, CUC would need to consider the advantages and disadvantages of supplying water to the whole island. Issues that would need to be considered include:

- Advantages:
  - It would likely be more cost effective island wide to have one supplier.
  - Provides one manager of the limited groundwater supply.
  - Provides one single O&M authority, which would benefit monitoring of the water quality.
  - Eliminating the many PWS's requiring excessive government monitoring.
- Disadvantages:
  - High capital costs.
  - Lack of system control.
  - Numerous sources of contamination potential.

### 2.1.4 Water Distribution

As the maximum safe yield of the groundwater resource is reached, and the effectiveness of water conservation has been achieved, the Island will still need additional sources of potable water. It is clear that the groundwater resource is a finite one. Current estimates of its safe yield of potable water are about 10 MGD. Current maximum daily demand for the island, which is a criterion upon which the water supply facilities are based, is estimated to be about 17 MGD. By the year 2022, that demand is estimated to increase to almost 25 MGD. There are two general approaches that will be needed to bridge this ever-increasing gap between demand and supply. These include 1) reducing consumption and 2) increasing supply. This report includes numerous recommendations for accomplishing both of these. The primary, initial focus should be on reducing demands through the following actions:

1. Establishing policies and regulations, including water rates, which would mandate conservation, and penalize those who waste water.

2. Aggressively hunt out all leaks and eliminate them.

3. Limit demand and consumption by limiting growth or population.

## 2.2 Improvements Projects List

The goal of this study was to develop an approach that would provide the Island of Saipan water on a 24-hour per day basis. With sufficient U.S. Congressional appropriation the goal could be achieved within a two-year time period, but without that funding it is unlikely that the goal will ever be achieved, as costs so greatly exceed the funds available. Additionally, by evaluating the existing facilities and, based upon estimated growth that is likely to occur, we have developed a list of recommended improvements that would enable the water system to meet the island's needs through the year 2022.

The scope of the study included describing, evaluating, and developing recommended improvements to the system used for extracting, storing, treating, and distributing potable water throughout the island. Because numerous studies have characterized the geology, hydrogeology, and fresh water supply for Saipan, this study did not prepare its own evaluation of the safe yield from the island's aquifer. Rather, we relied upon information developed, and currently being developed, by the U.S. Geological Survey (USGS) and others. Also, this study developed population projections for future growth by using information provided in the 1996 water master plan and the 2000 census, and linearly extrapolating to the year 2022.

Our recommendations can be broken down into four main areas. These can be described as follows:

- Construction projects that will improve the quality and quantity of water available.
- Policy decisions and regulatory actions that will protect the Commonwealth's water resources to insure that it is optimally managed and utilized in the best interests of the people.
- Public education which will encourage and compel the public to engage in water conservation measures that will eliminate wasting of water and maximize utilization of all water resources (e.g. including rainwater).
- Carefully optimized management of resources and continued operations and maintenance of the water infrastructure.

A list of recommended improvements is presented, as follows:

(1) Provide Technical Assistance to CUC:

Project Objectives: This would provide CUC with the technical assistance to implement the recommended improvements.

General Project Description: The project would fund a program manager with knowledge of water systems and construction practices for a minimum of five years to CUC to manage the water projects necessary to achieve the objective of potable water being available to all users on a continuous basis. This could be done through either a consultant or as a contract employee. The program manager would provide technical assistance to CUC, providing oversight and management of the projects. This project would also fund additional positions that might include several trained project managers, a hydrogeologist, a water resources engineer, additional O&M specialists, and an additional procurement and contracting specialist. This recommendation should be the CUC's first step towards improving Saipan's water system.

Estimated Cost: $575,000

(2) Perform and implement a well field isolation project:

Project Objectives: In order to move closer to achieving the goal of 24 hours water, the major well fields on Saipan will need to be isolated. All the wells in a well field would need to be tied into a transmission line that would deliver water directly into one or several reservoirs, capable of storing the maximum day water demand for the areas served. The water would then be treated at the reservoir and delivered to the consumers through distribution lines. This will improve treatment by utilizing the reservoirs for disinfection contact and will reduce O&M costs by reducing the number of chlorination sites.

General Project Description: Since Saipan's water distribution system is interconnected, a well field isolation study would have to be performed in order to determine how to effectively isolate the well fields and provide a steady supply of water to the different areas. One item that would

need to be taken into consideration is the changes that should be made to the pumps and motors on the individual wells in order to be able to deliver the water from the wells to the tanks. Once the study has been completed, the project would include construction of the new transmission pipelines and connections to the wells. Well fields that have been successfully isolated are the Kagman and As Matuis well fields. These areas currently are receiving 24 hours water supply.

Estimated Cost: $5,750,000

(3) Upgrade the quality of water being produced from existing wells by implementing a "Well Optimization Program":

Project Objectives: The goal of this project is to improve the water quality being pumped. Currently, out of 130 wells, only 37 wells produce water with chloride content below the World Health Organization (WHO) standard for potable water of 500 mg/L and 23 of those 37 wells have a chloride content below the EPA standard of 250 mg/L. Specific recommendations are provided in Appendix B and in Chapter V of the 1996 Water Master Plan that will improve the quality of the water being produced. It is important to realize that the flow rates of all existing wells must be adjusted so that TDS levels are below at least 500 mg/L.

General Project Description: This improvement will take time, and will likely result in a reduced quantity of water being produced. Additionally, a few wells may need to be abandoned if water quality cannot be improved. Groundwater supplies currently produce about 9.6 MGD, although only about 2.1 MGD currently meet the WHO drinking water standards and 1.5 MGD meet the EPA drinking water standards. The firm yield of water meeting potable standards is unclear, but is likely estimated to be between 3 to 10 MGD. Optimizing the quality from the existing wells will enable CUC to supply water that is vastly improved in quality. This project would analyze all of the wells in order to determine the characteristics of the good

water quality producing wells and compare them to the poor quality producing wells. This analysis would then provide enough information that would help determine whether a well would need to be rehabilitated or modified.

Estimated Cost: $3,450,000

(4) Continue USGS program for test drilling and installing additional wells to increase the water supply:

Project Objectives: Continue USGS program.

General Project Description: Since the 1996 Water Master Plan, 49 new wells have been successfully installed around the island and 24 poor producing wells have been abandoned. However, we are unable to provide an estimate of how much water would be found in this program.

Estimated Cost: $3,450,000

(5) Encourage or mandate the use of rainwater catchments by the public, businesses, and all government funded projects through establishment of tax incentives and low interest loans, demonstration projects, government policies, regulations and standards:

Project Objectives: Installation and operational standards for rainwater catchment systems should be developed to ensure that the systems do not adversely impact the overall water quality of the CUC's distribution system.

General Project Description: The CUC should also provide technical assistance for the installation and operation of the systems. Several large-scale demonstration projects should be completed to increase water supply and to serve as models. The government should amend their water regulations to require the installation of rainwater catchments systems on residential and commercial customers. Since most of the existing residences already have water storage tanks and booster pumps that they use to provide water under current system operations, it would likely be relatively easy to encourage the development of rainwater catchments at private residences. Water filters will be needed to treat the water prior to being used.

Estimated Cost: $1,150,000

(6) Implement water conservation measures; find and correct leaks:

Project Objectives: By implementing a water conservation program, the projected water demand could be reduced by about 17 percent over the long term.

General Project Description: The water conservation program should consider mandating conservation measures and provide educational information and water saving devices to reduce consumption, such as low flow showerheads for retrofitting, flow restrictive washers, low flow consumption water closets, water bags for insertion into water closets, and provide higher penalties for unfixed leaks. The current water conservation program that CUC has been implementing is an excellent start. Provisions would also be needed to update ordinances to require water conservation for new and existing construction, provide some technical assistance to the public and to perform water audits for the larger users. Additionally, water rates must be set that encourage water conservation and Best Management Practices established, as discussed in Chapter V, beginning on page V-10 of the 1996 Water Master Plan. The results of water conservation take time to realize.

Estimated Cost: $2,875,000

(7) Repair and/or replace leaking pipes in the main distribution system:

Project Objectives: While the surveys performed by CUC's leak detection team show that the majority of the leaks are on the customer's side, we recommend that CUC continue to evaluate leaks in the main distribution system and repair those leaks.

General Project Description: If the section of pipe leaking is old or made of steel, we recommend that it be replaced with new plastic (PVC) pipe. Since 1996, CUC has reportedly spent approximately $3.3 million improving the water system with the majority of the money being spent on waterline projects. The best way to achieve the goal of providing 24 hours water service to the island would be to implement

a systematic, block-by-block, assessment of the leaks and conditions of the facilities that are connected to the system. This approach would include the installation of meters at the property lines that would be able to accept electronic readouts. This would allow CUC to increase their revenues and control consumption. It will require a large effort to stabilize each block, but once one block is stabilized, the focus will then move onto the next block. By implementing this style approach, the critical valves needed to operate the system in a normal manner would be incorporated into the project.

Estimated Cost: $10,350,000

(8) Increase production by diverting water from the Talufofo Stream Basin (TSB):

Project Objectives: This diversion will provide water from the TSB, which is a large, relatively remote drainage shed located on the northeastern side of the island. It is essential that each of the three main tributaries to the TSB, the South Fork, Middle Fork and North Fork, maintain a minimum flow rate of 0.1 cfs in order to maintain a consistent flow in the streams. However, any additional flow may be captured and used as potable water.

General Project Description: Install at least one diversion structure on each stream to collect bypass stormwater flows in excess of 0.1 cfs and/or as needed. Water storage and treatment facility for water collected from the three forks. Pump station to convey water from storage and treatment facility to main distribution points, which may be the water tanks, reservoir, etc.

Estimated Cost: $14,490,000

(9) Implement a stormwater diversion/treatment system in the Sadog Tasi area:

Project Objectives: This recommendation would make use of existing 9 million gallon tanks at the site and could connect into existing pipelines, pump stations, and utilize the pretreatment portion of the RO water treatment plant. A side benefit would be a reduction in potential flooding caused by runoff from the drainages that would be developed.

General Project Description: This project would dam two or more existing streams in the Sadog Tasi area. Their flows could either be pumped or sent by gravity to existing storage tanks at the Sadog Tasi treatment plant. This project takes advantage of the existing storage already in place, but not being used, and would require less pipeline construction to reach the service area. Our calculations show that approximately 750 million gallons fall within two drainage areas that could be connected to the Sadog Tasi catchment.

Estimated Cost: $5,750,000

(10) Implement a surface water catchment at the CMS/BMC Quarry:

Project Objectives: Development of this site would require its own water treatment facility. Prior to development, a study similar to that outlined above would need to be performed.

General Project Description: Evaluate alternative routings and their associated cost for pipelines from stream monitoring gauges to the CMS/BMC Quarries to develop preliminary routing and costs. Evaluate the costs for converting the abandoned CMS/BMC Quarries into a rainwater catchment and the construction of water treatment facilities.

Estimated Cost: $9,200,000

(11) Install, through a design, build and operate process, a 3 MGD reverse osmosis water treatment plant to serve major population areas on the west side of the island:

Project Objectives: Install, through a design, build and operate process, a 3 MGD reverse osmosis water treatment plant to serve major population areas on the west side of the island.

General Project Description: As the maximum safe yield of the groundwater resource is reached, and the effectiveness of water conservation has been achieved, the Island will still need additional sources of potable water. It is clear that the groundwater resource is a finite one. The initial size of 3 MGD, coupled with the other recommendations could be sufficient to bridge the gap in water supply. We

recommend the use of design, build and operate for this facility because we believe it will result in a successful project in the shortest amount of time. We would recommend that CUC own the facility and that the contract for operation be for a period of between 5 and 10 years. During that time, the operator would be training CUC's personnel. After the initial contract for operations is over, CUC can then decide whether they feel comfortable operating the facility, or they want to extend the contract with the original operator. Three sites were preliminarily selected. They are: 1) the Sadog Tasi site to take advantage of the existing ocean outfall and to serve the coastal plains area from Marpi to San Jose; 2) the Kagman area to serve future growth in that area; 3) the Agingan treatment plant to take advantage of the available site and the existing ocean outfall.

Estimated Cost: $27,600,000

(12) Distribution and Storage System Improvements:

Project Objectives: Optimization of Distribution and Storage Improvements, Implement the critical changes to the distribution system that will allow the water system to operate properly with the service zones as outlined in Chapter V of the 1996 Water Master Plan, and Construction of additional reservoirs to meet future, peak hourly demands.

General Project Description: This project would include updating the computer model of the entire water system with a goal of optimizing the location and size of additional reservoirs and pipelines. In addition, the model would be used to evaluate the existing facilities and operating strategies, determine where deficiencies exist in the distribution system under present and future demand conditions, and determine long-range capital improvements. Results in the modeling efforts will assist in the development of a more efficient and reliable operation of the existing facilities, and effectively guide the planning of future

facilities. As the block-by-block projects perform improvements in areas where critical changes to the distribution system are needed, those changes would have to be incorporated into recommendation #7 in order to stabilize that block and move on to the next. Based upon the results of our analysis of the future demands on the system, we recommend that several new reservoirs be constructed to meet the existing and future demands. These reservoirs should be constructed to operate within the same range as the existing reservoirs.

Estimated Cost: $47,955,000

(13) Upgrade booster pump stations to solve existing and projected pressure problems:

Project Objectives: Upgrade booster pump stations to solve existing and projected pressure problems.

General Project Description: A summary of the recommended improvements is listed in the 1996 Water Master Plan. These improvements should be reviewed and updated as needed, by implementing recommendation 12 and updating the hydraulic model developed in the 1996 Water Master Plan. Nevertheless, these improvements need to be made to move water between the various zones..

Estimated Cost: $3,105,000

(14) Government establish ownership of the groundwater resources on Saipan and that it regulate and charge fees for the private use of that resource:

Project Objectives: Government establishes ownership of the groundwater resources on Saipan and that it regulates and charge fees for the private use of that resource.

General Project Description: Private permitted wells located within areas that may affect potable groundwater or that pump high quality groundwater (below a designated chloride content) should be treated as a service connection and billed monthly. This will allow the government to protect the resource and assure that all users pay their share for the groundwater. We recommend that the Department of

Environmental Quality (DEQ) administer the regulations and enforcement of the groundwater protection. Essentially, DEQ would serve as a regulatory body to make sure not only CUC, but all of the water producers, conforms to the regulations necessary to protect the public and the resource..

Estimated Cost: $0

(15) Perform a Rate Study:

Project Objectives: Perform a Rate Study.

General Project Description: This project would include the development of water rates by an independent consultant. They would document that rates have been set for full cost recovery. The goal would be to have the water system on Saipan be funded almost entirely from the sale of water, which would provide more than 90 percent of the revenue. Billing could be bimonthly and would include both a service charge and a per-unit charge, reflecting both fixed costs and costs based on the amount of water the consumer used.

Estimated Cost: $230,000

(16) Adopt regulations that will encourage wastewater reclamation at golf courses and reduce the demand on groundwater supplies:

Project Objectives: Adopt regulations that will encourage wastewater reclamation at golf courses and reduce the demand on groundwater supplies.

General Project Description: Appendix C of the 1996 Water Master Plan includes some sample regulations that cover this activity.

Estimated Cost: $57,500

(17) Implement the operation and maintenance recommendations:

Project Objectives: Implement the operation and maintenance recommendations.

General Project Description: These will improve the performance of CUC and its ability to meet the goals of an efficient and effective service provider. Some, but not all of these are also included within the other recommendations.

Estimated Cost: $575,000

(18) Improve the capture of water at existing springs currently being used:

Project Objectives: Improve the capture of water at existing springs currently being used.

General Project Description: While the flow from the springs varies with the season, and therefore can only be counted as providing a minimal amount towards meeting the maximum daily demand, improvements in the capture rate of water at the existing springs becomes cost effective after the previous recommendations have been implemented. Assumes treatment is required.

Estimated Cost: $690,000

(19) Improve the monitoring of water flow and water quality data from each source:

Project Objectives: Improve the monitoring of water flow and water quality data from each source.

General Project Description: We recommend that CUC continue to monitor all of its water sources for flow and water quality on a routine basis. We further recommend that CUC implement a preventative maintenance program for all of the wells and production facilities in order to prevent problems from occurring.

Estimated Cost: $23,000

(20) Regulate underground fuel storage tanks, insecticides, pesticides and other chemicals to protect the groundwater resource:

Project Objectives: Regulate underground fuel storage tanks, insecticides, pesticides and other chemicals to protect the groundwater resource.

General Project Description: While current regulations are codified, we believe attention to enforcement needs to be improved. It is vitally important that any existing contamination of groundwater be remediated as quickly as possible in existing underground storage tanks, and be controlled or eliminated to prevent further contamination. Regulations need to be codified and enforced that govern the use of insecticides, pesticides and other chemicals, such as fertilizers that can affect groundwater.

Estimated Cost: $0

(21) Minimize and eventually eliminate the use of septic tanks through new sewer construction:

Project Objectives: Minimize and eventually eliminate the use of septic tanks through new sewer construction.

General Project Description: This will reduce the impact of septic tanks on the groundwater supply. Future areas where we recommend sewer construction are in the Dandan and Kagman areas. Development of each of these locations is sufficient to warrant a centralized sewage collection treatment and disposal system. In Kagman, effluent from the treatment plant could be utilized for water reclamation at the golf course.

Estimated Cost: $Unknown

(22) Develop an automated supervisory control and data acquisition (SCADA) system to control the operation of its tanks, booster pump station, and to monitor and control all of the water sources:

Project Objectives: Develop an automated supervisory control and data acquisition (SCADA) system to control the operation of its tanks, booster pump station, and to monitor and control all of the water sources.

General Project Description: For example, with this system, CUC could have on line conductivity meters at all of its well heads and be able to shut down any well that started to produce poor quality water. This would also allow for the transmission of water from one pressure zone to another so that the supply of water can be sufficient to meet the demand in each service district.

Estimated Cost: $2,300,000

## 2.3 Project Prioritization

The prioritization procedure utilized in this study involves ranking of projects based on certain criteria, such as requirement to meet Federal and CNMI water quality regulations (related to the primary scope of this study which is to provide all Saipan inhabitants with drinking water that meets the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations, 24-hours per day, 7-days per week), need for meeting water distribution standards and guidelines (meeting flow and pressure requirements), capital and O&M costs, and system reliability. Each of the criteria was assigned a weight based on the relative importance of the criteria. Also, a score was assigned to each project for each criteria, with a range from 1 to 10, with 1 representing a lowest score possible, and 10 representing the highest score possible. The project with the highest weighted score received the highest ranking and the highest priority ranking.

The greatest weight was assigned to the primary scope item, which is the meeting the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations. The remaining criteria were otherwise assigned equal weights.

**Table 2.3-1 Project Prioritization**

| Project Name | Meet Water Quality Regulations (weight=40%) | Meet Water Distribution Standards (weight = 20%) | Costs (weight = 20%) | System Reliability (weight = 20%) | Total Weighted Score |
|---|---|---|---|---|---|
| Saipan – Technical Assistance to CUC | 10 | 10 | 9 | 5 | 8.8 |
| Saipan – Well field isolation project | 10 | 10 | 5 | 5 | 8 |
| Saipan – Optimize existing wells | 10 | 10 | 7 | 5 | 8.4 |
| Saipan – Continue test drilling program | 10 | 10 | 7 | 5 | 8.4 |
| Saipan – Encourage private rainwater catchments | 10 | 5 | 9 | 5 | 7.8 |
| Saipan – Water conservation/leak detection and elimination | 10 | 10 | 7 | 10 | 9.4 |
| Saipan – Repair/replace leaking mainline pipes | 10 | 10 | 1 | 10 | 8.2 |
| Saipan – Develop Talafofo Stream Basin | 10 | 10 | 0 | 10 | 8 |
| Saipan – Develop surface water catchment at Sadog Tasi | 10 | 10 | 5 | 10 | 9 |

| Project Name | Meet Water Quality Regulations (weight=40%) | Meet Water Distribution Standards (weight = 20%) | Costs (weight = 20%) | System Reliability (weight = 20%) | Total Weighted Score |
|---|---|---|---|---|---|
| Saipan – Develop surface water catchment at CMS/BMC Quarry | 10 | 10 | 2 | 10 | 8.4 |
| Saipan – Install 3 MGD RO facility | 10 | 5 | 0 | 10 | 7 |
| Saipan – Additional pipeline projects | 10 | 10 | 9 | 10 | .8 |
| Saipan – Critical distribution system improvements | 10 | 10 | 9 | 10 | 9.8 |
| Saipan – Reservoir construction - immediate needs (10.5 MG) | 10 | 10 | 0 | 10 | 8 |
| Saipan – Reservoir construction - future needs (8.5 MG) | 5 | 10 | 0 | 10 | 6 |
| Saipan – Booster pump station improvements | 5 | 10 | 7 | 10 | 7.4 |
| Saipan – Implement and enforce groundwater protection standards | 10 | 5 | 10 | 1 | 7.2 |
| Saipan – Rate Study | 5 | 5 | 10 | 1 | 5.2 |
| Saipan – Develop wastewater reclamation regulations | 10 | 5 | 10 | 1 | 7.2 |
| Saipan – Implement Operation and Maintenance improvements not covered elsewhere | 5 | 10 | 9 | 10 | 7.8 |
| Saipan – Improvements at Springs (assumes treatment is required) | 10 | 10 | 9 | 10 | 9.8 |
| Saipan – Improve data collection (per year) | 1 | 10 | 10 | 10 | 6.4 |
| Saipan – Enforce underground fuel storage tank regulations | 10 | 5 | 10 | 1 | 7.2 |
| Saipan – New sewer construction in Dan Dan and Kagman | 10 | 5 | 0 | 1 | 5.2 |
| Saipan – SCADA system | 1 | 10 | 8 | 10 | 6 |

# 3. ISLAND OF TINIAN - RECOMMENDATIONS AND IMPROVEMENT PROJECTS

## 3.1 Conclusions and Recommendations

### 3.1.1 Water Production

Renovation of Maui Well No. 1 should be a high priority. Only one of the three pumps is operational at this well site, and there are other indications of deterioration due to age and corrosion. The renovation of Maui Well No. 1 can also include some capacity increase to make it similar to Maui Well No 2 (with four 350 gpm pumps and an improved infiltration gallery), as well as providing a backup of equal capacity to Maui Well No. 2; however, as stated earlier in Section 4.3.1.1, the groundwater supply capacity of Marpo Marsh could be exceeded with the expansion of the infiltration gallery at Maui Well No. 1;on the other hand, because it is suspected that Maui Well No. 2 could actually be a surface water source, more water could be drawn out of Marpo Marsh. Further hydro-geological studies will be needed to determine if more groundwater can be withdrawn from Marpo Marsh

Development of future water sources should begin in the near future. There are a number of issues related to location of the future water sources, property ownership, and impact on the groundwater aquifer. To begin progress toward additional water supply development to meet future water production needs, a hydro-geological study is needed to investigate new water sources.

A water catchment at the Tinian Airport could collect a sizeable amount of water during the wet season, and could collect about 80% of average daily flow during the dry season. Also, without sizable storage, excess rainfall would be lost, even in the dry season; rainfall is not predictable, and the storage has to be large enough to capture all of a dry month rain event, assuming there are very few rain events per month in the dry months. The cost of a catchment at the Airport without such storage would be about $3,800,000, and the cost of significant storage to collect enough water between storms in a dry month (say a 10 MGD reservoir) would be about $8,000,000. This total cost appears to be prohibitive when compared to other future water sources, but it warrants further study in a future comprehensive master plan.

### 3.1.2 Water Storage

It was proposed that additional storage of 0.5 MG near the HMT Reservoir is needed for the existing system, and 0.75 MG near the QMT Reservoir and 2.75 MG near the HMT Reservoir would be needed in the future (considering the additional 1.0 MG that would be constructed for the South Point System).

Since it is recommended that the reservoir for the South Point System be constructed at the same overflow elevation as the HMT Reservoir, construction of a reservoir near the HMT Reservoir for existing conditions could be deferred if the reservoir for the South Point System is constructed in the immediate future. This would imply that if a 1.0 MG reservoir were constructed for the South Point System, then 0.5 MG of that reservoir would benefit existing conditions in the Maui Well No. 2 Subsystem, and 0.5 MG of that reservoir would benefit the South Point System (it is assumed here that the maximum daily demand of the South Point System would not exceed 0.5 MG in the immediate future).

### 3.1.3 Water Treatment

If the Sisonyan Marpo Marsh (Maui) sources are determined at a later date to be "groundwater under the influence of surface water" (GWUI), full treatment will be required under the Federal and CNMI Surface Water Treatment Rules. A typical treatment project meeting the regulations could consist of:

- Deep bed upflow sand filters
- New filter feed clearwell to separate infiltration gallery water from distribution system pumps clearwell
- Filter feed pumps
- A distribution system pumps clearwell level sensor to control the operation of the filter feed pumps

There are agricultural activities in Marpo Valley that could introduce chemicals, such as fertilizers, herbicides and pesticides, into the groundwater aquifer. "Organic" alternatives to these chemicals could be encouraged and implemented, and a Wellhead Protection Program could be developed to further protect the aquifer. However, the individual economics of agriculture may not make it easy for the farmers to change their current practices. Thus, if it is later determined through future sampling and investigations that there is contamination of the wells and aquifer of Marpo Valley, then additional treatment of the water from the wells will be required to remove complex organic contaminants, using such processes as granulated activated carbon filters, air strippers, etc.

While not water treatment, the addition of an island-wide wastewater treatment system will reduce sewage impact on the groundwater aquifer. It is recommended that the wastewater facilities plan be updated again, the last version being published in 1990 and is over 10 years old.

### 3.1.4 Water Distribution

All of the water line improvements will improve the ability of the water system to deliver water meeting the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations 24-hours per day, 7-days per week, to all residents of Tinian living south of the Military Retention

Boundary. The improvements for the South Point System are especially important if all residents of Tinian are to have water meeting the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations; residents in the south point area currently use water catchments that may not meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations. Other improvements are required by the existing system to meet an existing deficiency, improve existing system reliability, and reduce water loss.

## 3.2 Improvements Projects List

Because of the existing system delivery deficiencies and storage deficits, the projects that improve existing delivery and eliminate storage deficits are of the highest priority. These projects are (not listed in any particular order of priority):

- Marpo Heights and Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterline
- Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterlines
- Marpo Valley Water Distribution System Replacement Waterlines
- San Jose Village Loop and Fire Flow Relief Waterlines
- Dedicated Transmission Line from Maui Well No. 1 to the Marpo (QMT) Reservoir
- Dedicated Transmission Line from Maui Well No. 2 to the Carolinas (HMT) Reservoir
- Carolinas Agricultural Homestead Water System (South Point System)
- New 0.75 MG Tank (Adjacent to the QMT Reservoir)
- New 0.5 MG Tank (Adjacent to the HMT Reservoir)
- New 1.0 MG Tank (Adjacent to the HMT Reservoir)
- New 1.25 MG Tank (Adjacent to the HMT Reservoir)
- Renovation of Existing Reservoirs
- Renovation of Maui Well No. 1
- Filtration Plant for Existing Maui Well No. 2
- Replacement of Old Valves
- Installation of SCADA System
- Buildings for Chlorination Systems and Deep Wells
- Computerized Maintenance System

Also, due to a predicted shortage in future water production, a hydro-geological study should be performed to determine additional groundwater sources and how they should be developed.

A comprehensive master plan should be prepared, using a detailed water model, and including information on future groundwater availability via hydro-geological

exploration mentioned above. The master plan can also provide more detailed for improvement projects, as well as be able to locate needed facilities, such as PRVs.

Similarly, an updated sewer master plan should be developed, since the last sewer master plan was produced over 10 years ago.

Finally, to reduce system water loss, a thorough leak detection study should be performed. Also, those customers that are not metered should have meters installed. A computerized maintenance system is also recommended.

The projects involving new construction will require, at a minimum, construction permits and zoning clearances, and an Environmental Assessment. Should the environmental impact be severe for a specific project, based on the response to the Environmental Assessment, then and Environmental Impact Statement will be required. The need for an Environmental Impact Statement by project cannot be predicted at this time.

However, projects involving maintenance, such as replacement of valves, leak detection, or non-construction items, such as a computerized maintenance system, will not require construction permits or an Environmental Assessment. Typically, maintenance of a system is not required to create an Environmental Assessment for that activity.

Easements may be required for new waterlines and reservoirs that are located in private property. The project designer should consider the location of easements, and specific waterline routing and reservoir location in their design.

The development and implementation of a Wellhead Protection Program will determine potential aquifer pollution sources and protect the drinking water aquifer from these contamination sources.

Project descriptions are provided as follows. Budget estimates of construction costs (including administration and design) are provided for funding purposes. An allowance of 15% was included for contingency, and another 25% was included for administration and design.

(1) Marpo Heights and Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterline:

Project Objectives: To provide improved peak flow pressure and fire flow delivery rates to the Marpo Valley Heights Subdivision and upper Marpo Valley area that is served by the QMT Reservoir.

General Project Description: Provide 4,800 linear feet of new 16" PVC relief waterline from the QMT Reservoir to

the Marpo Valley Heights Subdivision. Leave existing 6" PVC water line in place.

Estimated Cost: $2,440,000

(2) Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterlines:

Project Objectives: To provide improved peak flow pressure and fire flow delivery rates to the Upper Marpo Valley area that is served by the QMT Reservoir.

General Project Description: Provide 7,100 linear feet of new 8" PVC replacement waterline from the Maui Well No. 1 driveway entrance to the end of the existing water line in Marpo Valley. Abandon existing 3" and 2" water line in place.

Estimated Cost: $1,270,000

(3) Marpo Valley Water Distribution System Replacement Waterlines:

Project Objectives: To replace suspected high water loss pipes in the Marpo Valley area that is served by the QMT Reservoir. No overlap of Figure 4.3-2 project.

General Project Description: Provide 25,700 linear feet of new 6" PVC replacement waterline to replace existing pipes in the Marpo Valley are (Upper Valley and Kanadan). Abandon existing 4", 3" and 2" water lines in place.

Estimated Cost: $3,810,000

(4) San Jose Village Loop and Fire Flow Relief Waterlines:

Project Objectives: To provide improved peak flow pressure and fire flow delivery rates to San Jose Village that is served by the HMT Reservoir.

General Project Description: Provide 5,100 linear feet of new 14" PVC and 17,200 linear feet of new 12" PVC relief waterline from the HMT Reservoir to the center of San Jose Village, providing two paths for water service. Leave existing water line in place in parallel service, except that line to Casino must also be served by one of the new PRVs. Add two new PRVs.

Estimated Cost: $7,660,000

(5) Dedicated Transmission Line from Maui Well No. 1 to the Marpo (QMT) Reservoir:

Project Objectives: To provide dedicated transmission line between Maui Well No. 1 and the QMT Reservoir

General Project Description: Provide 9,300 linear feet of new 6" PVC transmission waterline from the QMT Reservoir to Maui Well No. 1. Leave existing 6" PVC water line in place.

Estimated Cost: $1,430,000

(6) Dedicated Transmission Line from Maui Well No. 2 to the Carolinas (HMT) Reservoir:

Project Objectives: To provide dedicated transmission line between Maui Well No. 2 and the HMT Reservoir

General Project Description: Provide 5,500 linear feet of new 6" PVC transmission waterline from the HMT Reservoir to Maui Well No. 2. Leave existing 8" PVC water line in place.

Estimated Cost: $900,000

(7) Carolinas Agricultural Homestead Water System (South Point System):

Project Objectives: To provide water to residents in the south point area to meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations; residents in the south point area currently use water catchments that may not meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations.

General Project Description: Provide 14,500 linear feet of new 8" PVC and 22,100 linear feet of new 6" PVC waterline from the south end of the Maui Well No. 2 Subsystem to the south point area. Install new 1.0 MG reservoir at same overflow elevation as the HMT Reservoir – 0.5 MG of this reservoir benefits the Maui Well No. 2 Subsystem immediately.

Estimated Cost: $9,160,000

(8) New 0.75 MG Tank (Adjacent to the QMT Reservoir):

Project Objectives: To provide storage to meet future maximum daily demands for Maui Well No. 1 Subsystem.

General Project Description: Provide new 0.75 MG reservoir constructed adjacent to QMT Reservoir, at same overflow elevation as QMT Reservoir.

Estimated Cost: $1,300,000

(9) New 0.5 MG Tank (Adjacent to the HMT Reservoir):

Project Objectives: To provide storage to meet future maximum daily demands for Maui Well No. 2 Subsystem.

General Project Description: Provide new 0.5 MG reservoir constructed adjacent to HMT Reservoir, at same overflow elevation as HMT Reservoir.

Estimated Cost: $950,000

(10) New 1.0 MG Tank (Adjacent to the HMT Reservoir):

Project Objectives: To provide storage to meet future maximum daily demands for Maui Well No. 2 Subsystem.

General Project Description: Provide new 1.0 MG reservoir constructed adjacent to HMT Reservoir, at same overflow elevation as HMT Reservoir.

Estimated Cost: $1,500,000

(11) New 1.25 MG Tank (Adjacent to the HMT Reservoir):

Project Objectives: To provide storage to meet future maximum daily demands for Maui Well No. 2 Subsystem.

General Project Description: Provide new 1.25 MG reservoir constructed adjacent to HMT Reservoir, at same overflow elevation as HMT Reservoir.

Estimated Cost: $1,800,000

(12) Renovation of Existing Reservoirs:

Project Objectives: To provide future life for the existing reservoirs for both Maui Well Subsystems.

General Project Description: Rehabilitate and recoat inside and outside surfaces of QMT and HMT Reservoirs, with repairs to tank walls. Also repair broken valves (such as altitude valves, etc.).

Estimated Cost: $400,000

(13) Renovation of Maui Well No. 1:

Project Objectives: To provide renovation and improved flow (to 1400 gpm) for Maui Well No. 1.

General Project Description: Provide four new pumps and new pipe gallery, plus filtration plant to meet GWUI requirements.

Estimated Cost: $6,470,000

(14) Filtration Plant for Existing Maui Well No. 2:

Project Objectives: To provide a filtration plant (to 1400 gpm) for Maui Well No. 2.

General Project Description: Provide filtration plant to meet GWUI requirements.
Estimated Cost: $3,410,000

(15) Replacement of Old Valves:
Project Objectives: Replace all gate and PRV valves in the entire system.
General Project Description: Provide new gate and PRV valves for entire system, and install new PRV valves in areas of the system where the pressure it too high.
Estimated Cost: $300,000

(16) Installation of SCADA System:
Project Objectives: To provide a SCADA and telemetry system for control of pumps and reservoir levels, recording of water system data, and alarms provision.
General Project Description: Provide SCADA and telemetry system, with sensors.
Estimated Cost: $750,000

(17) Buildings for Chlorination Systems and Deep Wells:
Project Objectives: To provide deep wells with vandalism and weather protection.
General Project Description: Provide four 200 square foot buildings, one for each deep well.
Estimated Cost: $520,000

(18) Computerized Maintenance System:
Project Objectives: To provide a computerized maintenance system for the CUC water system.
General Project Description: Provide one computer, associated computer programs and training.
Estimated Cost: $50,000

(19) Hydro-Geological Study:
Project Objectives: To provide study of aquifer potential, including capacity of Marpo Marsh, Kanadan Marsh, and deep well aquifer capacity.
General Project Description: Provide test wells and groundwater study.
Estimated Cost: $1,500,000

(20) Leak Detection Study:
Project Objectives: To provide reduction in water losses to achieve 25% target water loss rate.
General Project Description: Provide leak detection services.
Estimated Cost: $300,000

(21) Water Master Plan:

Project Objectives: To provide a comprehensive water master plan.

General Project Description: Provide water master plan to cover groundwater production, storage, treatment and distribution.

Estimated Cost: $300,000

(22) Sewer Master Plan:

Project Objectives: To provide a comprehensive sewer master plan.

General Project Description: Provide sewer master plan to cover groundwater protection, collection and treatment.

Estimated Cost: $300,000

(23) Develop Wellhead Protection Program:

Project Objectives: To create and implement a Wellhead Protection Program.

General Project Description: Provide development, initial staff funding and training for a Wellhead Protection Program.

Estimated Cost: $500,000

## 3.3 Project Prioritization

The prioritization procedure utilized in this study involves ranking of projects based on certain criteria, such as requirement to meet Federal and CNMI water quality regulations (related to the primary scope of this study which is to provide all Tinian inhabitants with drinking water that meets the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations, 24-hours per day, 7-days per week), need for meeting water distribution standards and guidelines (meeting flow and pressure requirements), capital and O&M costs, and system reliability. Each of the criteria was assigned a weight based on the relative importance of the criteria. Also, a score was assigned to each project for each criteria, with a range from 1 to 10, with 1 representing a lowest score possible, and 10 representing the highest score possible. The project with the highest weighted score received the highest ranking and the highest priority ranking.

The greatest weight was assigned to the primary scope item, which is the meeting the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations. The remaining criteria were otherwise assigned equal weights.

**Table 3.3-1 Project Prioritization**

| Project Name | Meet Water Quality Regulations (weight=40%) | Meet Water Distribution Standards (weight = 20%) | Costs (weight = 20%) | System Reliability (weight = 20%) | Total Weighted Score |
|---|---|---|---|---|---|
| Marpo Heights and Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterline | 1 | 10 | 7 | 5 | 4.8 |
| Marpo Valley Water Distribution System Upgrade and Fire Flow Relief Waterlines | 1 | 10 | 9 | 5 | 5.2 |
| Marpo Valley Water Distribution System Replacement Waterlines | 1 | 5 | 6 | 10 | 4.6 |
| San Jose Village Loop and Fire Flow Relief Waterlines | 1 | 10 | 2 | 8 | 4.4 |
| Dedicated Transmission Line from Maui Well No. 1 to the Marpo (QMT) Reservoir | 1 | 10 | 9 | 10 | 6.2 |
| Dedicated Transmission Line from Maui Well No. 2 to the Carolinas (HMT) Reservoir | 1 | 10 | 10 | 10 | 6.4 |

| Project Name | Meet Water Quality Regulations (weight=40%) | Meet Water Distribution Standards (weight = 20%) | Costs (weight = 20%) | System Reliability (weight = 20%) | Total Weighted Score |
|---|---|---|---|---|---|
| Carolinas Agricultural Homestead Water System (South Point System) | 10 | 10 | 1 | 5 | 7.2 |
| New 0.75 MG Tank (Adjacent to the QMT Reservoir) | 1 | 5 | 9 | 5 | 4.2 |
| New 0.5 MG Tank (Adjacent to the HMT Reservoir) | 1 | 5 | 9 | 5 | 4.2 |
| New 1.0 MG Tank (Adjacent to the HMT Reservoir) | 1 | 5 | 8 | 5 | 4 |
| New 1.25 MG Tank (Adjacent to the HMT Reservoir) | 1 | 5 | 8 | 5 | 4 |
| Renovation of Existing Reservoirs | 5 | 10 | 10 | 10 | 8 |
| Renovation of Maui Well No. 1 | 5 | 10 | 4 | 10 | 6.8 |
| Filtration Plant for Existing Maui Well No. 2 | 5 | 1 | 7 | 1 | 3.8 |
| Replacement of Old Valves | 1 | 10 | 10 | 10 | 6.4 |
| Installation of SCADA System | 1 | 10 | 9 | 10 | 6.2 |
| Buildings for Chlorination Systems and Deep Wells | 1 | 5 | 9 | 10 | 5.2 |
| Computerized Maintenance System | 5 | 5 | 10 | 10 | 7 |
| Hydro-Geological Study | 1 | 5 | 8 | 5 | 4 |
| Leak Detection Study | 1 | 5 | 10 | 10 | 5.4 |
| Water Master Plan | 5 | 10 | 10 | 10 | 8 |
| Sewer Master Plan | 10 | 10 | 10 | 10 | 10 |
| Develop Wellhead Protection Program | 10 | 1 | 9 | 1 | 6.2 |

# 4. ISLAND OF ROTA - RECOMMENDATIONS AND IMPROVEMENT PROJECTS

## 4.1 Conclusions and Recommendations

### 4.1.1 Water Production

Development of future water sources should begin in the near future. There are a number of issues related to location of the future water sources, property ownership, and impact on the groundwater aquifer. To begin progress toward additional water supply development to meet future water production needs, a hydro-geological study is needed to investigate new water sources.

A water catchment at the Rota Airport could collect a sizeable amount of water during the wet season, and could collect about 100% of average daily flow during the dry season. Also, without sizable storage, excess rainfall would be lost, even in the dry season; rainfall is not predictable, and the storage has to be large enough to capture all of a dry month rain event, assuming there are very few rain events per month in the dry months. The cost of a catchment at the Airport without such storage would be about $3,800,000, and the cost of significant storage to collect enough water between storms in a dry month (say a 10 MGD reservoir) would be about $8,000,000. This total cost appears to be prohibitive when compared to other future water sources, but it warrants further study in a future comprehensive master plan.

### 4.1.2 Water Storage

It was proposed that the Ginalangan system could benefit from an increase in service pressure by the installation of a new reservoir at the 800' elevation level. This was based on low theoretical service pressures in portions of the Sinapalo I and II Subdivisions. A new reservoir has many advantages over feeding the higher pressure directly from the spring source line (that is pressurized to about 1100'), in the sense that the reservoir provides storage that is closer to the user than the springs, and requires less mechanical devices (such as PRVs).

Therefore, with a new reservoir above Ginalangan being desirable, then additional storage of 1.25 MG should be constructed above Ginalangan for the existing system; although 0.75 MG of the 1.25 MG is based on theoretical future demand, that demand will come fairly quickly in that the best available flat land area on Rota is located on the eastern plateau. It is also assumed, based on the need to provide potable water to the inhabitants of the Gagani area, a 0.8 MG reservoir will also be constructed in Gagani. Further into the future, assuming the new 1.25 MG Ginalangan tank and the 0.8 MG Gagani tank have been constructed, then additional future storage of 0.75 MG could be constructed near the Ka'an

Reservoir. Alternately, the future 0.75 MG reservoir could be constructed in Taiapu instead of at Ka'an with the loop line from Puntan Pona to Taiapu.

### 4.1.3 Water Treatment

If the Matanhanom Water Cave and As Onan Spring sources are determined at a later date to be "groundwater under the influence of surface water" (GWUI), full treatment will be required under the Federal and CNMI Surface Water Treatment Rules. A typical treatment project meeting the regulations could consist of:

- Deep bed upflow sand filters
- Filter feed wetwell
- Filter feed pumps

The location of such treatment facilities for the spring water would best be located adjacent to the first point of entry into the distribution system, rather than up on the Sabana south escarpment. For the western portion of the island, the would be at the Ka'an Reservoir and at the future Gagani Reservoir. For the eastern portion of the island, this would be at the new Ginalangan Reservoir and at the future Taiapu Reservoir. Water from the spring sources would first pass into the filter feed wetwell; after filtering, the filter feed pumps would pump the treated water into their respective reservoirs.

There are agricultural activities on Mount Sabana and the eastern plateau (Sinapalo to Gampapa/Duge) that could introduce chemicals, such as fertilizers, herbicides and pesticides, into the groundwater aquifer. "Organic" alternatives to these chemicals could be encouraged and implemented, and a Wellhead Protection Program could be developed to further protect the aquifer. However, the individual economics of agriculture may not make it easy for the farmers to change their current practices. Thus, if it is later determined through future sampling and investigations that there is contamination of the springs and aquifer of Mount Sabana, then additional treatment of the water from the springs will be required to remove complex organic contaminants, using such processes as granulated activated carbon filters, air strippers, etc.

While not water treatment, the addition of an island-wide wastewater treatment system will reduce sewage impact on the groundwater aquifer. It is recommended that the wastewater facilities plan be produced, since the only other plan that has addressed wastewater in limited detail was the Rota Physical and Economic Master Plan (J.C. Tenorio & Associates, 1996).

### 4.1.4 Water Distribution

All of the water line improvements will improve the ability of the water system to deliver water meeting the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations 24-hours per day, 7-days per week, to all residents of Rota. The improvements for the Gagani System and

Eastern Plateau are especially important if all residents of Rota are to have water meeting the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations; residents in the these areas currently use water catchments that may not meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations. Other improvements are required to meet an existing deficiency and improve existing system reliability.

## 4.2 Improvements Projects List

Because of the existing system delivery deficiencies and storage deficits, the projects that improve existing delivery and eliminate storage deficits are of the highest priority. These projects are (not listed in any particular order of priority):

- Sinapalo Peak and Fire Flow Relief Waterline
- As Niebes, Chenchon, and Gampapa/Duge Fire Flow Relief Waterlines
- Talo/As-Funta Fireflow Relief Waterline
- Lupok to Puntan Pona Loop and Fire Flow Relief Waterline
- Songsong Peak and Fire Flow Relief Waterline
- Puntan Pona to Taiapu Loop Waterline and New Taiapu Reservoir
- As-Funta to Songsong Loop Waterline
- Lupok to Gagani Service Waterline
- New Ginalangan Reservoir
- Talo/As-Funta Waterline Connection
- As Niebes, Chenchon, and Gampapa/Duge Homestead Water System
- Renovation of Existing Ka'an Reservoir
- Filtration Plants for Spring Sources
- Replacement of Old Valves
- Installation of SCADA System
- Buildings for Deep Wells
- Computerized Maintenance System

Also, due to a predicted shortage in future water production, a hydro-geological study should be performed to determine additional groundwater sources and how they should be developed.

A comprehensive master plan should be prepared, using a detailed water model, and including information on future groundwater availability via hydro-geological exploration mentioned above. The master plan can also provide more detailed for improvement projects, as well as be able to locate needed facilities, such as PRVs.

Similarly, a comprehensive sewer master plan should be developed.

Finally, to reduce system water loss, a thorough leak detection study should be performed. Also, those customers that are not metered should have meters installed. A computerized maintenance system is also recommended.

The projects involving new construction will require, at a minimum, construction permits and zoning clearances, and an Environmental Assessment. Should the environmental impact be severe for a specific project, based on the response to the Environmental Assessment, then and Environmental Impact Statement will be required. The need for an Environmental Impact Statement by project cannot be predicted at this time.

However, projects involving maintenance, such as replacement of valves, leak detection, or non-construction items, such as a computerized maintenance system, will not require construction permits or an Environmental Assessment. Typically, maintenance of a system is not required to create an Environmental Assessment for that activity.

Easements may be required for new waterlines and reservoirs that are located in private property. The project designer should consider the location of easements, and specific waterline routing and reservoir location in their design.

The development and implementation of a Wellhead Protection Program will determine potential aquifer pollution sources and protect the drinking water aquifer from these contamination sources.

Project descriptions are provided as follows. Budget estimates of construction costs (including administration and design) are provided for funding purposes. An allowance of 15% was included for contingency, and another 25% was included for administration and design.

(1) Sinapalo Peak and Fire Flow Relief Waterline:

Project Objectives: To provide improved peak flow pressure and fire flow delivery rates to the Sinapalo I and II Subdivisions and eastern plateau area that are to be served by the new Ginalangan Reservoir.

General Project Description: Provide 6,600 linear feet of new 18" PVC replacement waterline from the new Ginalangan Reservoir to the entrance of the Sinapalo I Subdivision. Install new PRV station along the new line near the entrance to the Sinapalo I Subdivision. Abandon existing 8" water line in place.

Estimated Cost: $3,870,000

(2) As Niebes, Chenchon, and Gampapa/Duge Fire Flow Relief Waterlines:

Project Objectives: To provide improved peak flow pressure and fire flow delivery rates to the eastern plateau area that is to be served by the new Ginalangan Reservoir

General Project Description: Provide 33,000 linear feet of new 8" PVC replacement waterline for the eastern plateau area. Abandon existing 6" water lines in place.

Estimated Cost: $6,440,000

(3) Talo/As-Funta Fireflow Relief Waterline:

Project Objectives: To provide improved fire flow delivery rates to the Talo/As-Funta area that is to be served by the springs source high-pressure line.

General Project Description: Provide 7,300 linear feet of new 10" PVC replacement waterline for the Talo/As-Funta area. Abandon existing 6" water line in place.

Estimated Cost: $1,950,000

(4) Lupok to Puntan Pona Loop and Fire Flow Relief Waterline:

Project Objectives: To provide improved peak flow pressure and fire flow delivery rates to the Puntan Pona area and Songsong Village.

General Project Description: Provide 3,600 linear feet of new 8" PVC waterline from the springs source line in Lupok down through Gagani to the end of the existing 8" water line in Puntan Pona. Add one new PRV. New 0.8 MG reservoir to be constructed as part of the Gagani water line project (Figure 4.3-9).

Estimated Cost: $1,000,000

(5) Songsong Peak and Fire Flow Relief Waterline:

Project Objectives: To provide improved peak flow pressure and fire flow delivery rates to Songsong Village that is served by the Ka'an Reservoir.

General Project Description: Provide 5,200 linear feet of new 18" PVC replacement waterline from the existing Ka'an Reservoir to the center of Songsong Village. Install new PRV station at location of existing PRV station, but on new 18" line. Abandon existing 10", 8" and 6" water lines in place.

Estimated Cost: $3,210,000

(6) Puntan Pona to Taiapu Loop Waterline and New Taiapu Reservoir:

Project Objectives: To provide improved reliability and connection along the south coast between the Ka'an system and the Ginalangan system. A new 0.75 MG reservoir will be constructed in Taiapu.

General Project Description: Provide 11,000 linear feet of new 8" PVC waterline from the end of the existing 8" water line in Puntan Pona to the location where the springs service line meets the south coast road. Add new 0.75 MG reservoir in Taiapu.

Estimated Cost: $4,110,000

(7) As-Funta to Songsong Loop Waterline:

Project Objectives: To provide improved reliability and connection along the north coast between Songsong Village and the Ginalangan system.

General Project Description: Provide 17,000 linear feet of new 8" PVC waterline from the end of the water line As-Funta to Songsong Village along the upper road along the north base of Mount Sabana. Add one new PRV.

Estimated Cost: $3,340,000

(8) Lupok to Gagani Service Waterline:

Project Objectives: To provide water to residents in the Gagani area to meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations; residents in the Gagani area currently use water catchments that may not meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations. A new 0.8 MG reservoir will be constructed in Gagani

General Project Description: Provide 4,600 linear feet of new 8" PVC waterline in the Gagani area. Add one new PRV. Add new 0.8 MG reservoir in Gagani.

Estimated Cost: $3,220,000

(9) New Ginalangan Reservoir:

Project Objectives: To provide storage to improve average daily flow pressures in the Sinapalo I and II Subdivisions, as well as meet future maximum daily demands for the Ginalangan system.

General Project Description: Provide new 1.25 MG reservoir with overflow elevation of 800' above msl, constructed on Mount Sabana overlooking Ginalangan. Abandon existing Ginalangan reservoir.

Estimated Cost: $5,290,000

(10) Talo/As-Funta Waterline Connection:

Project Objectives: To improve average daily flow pressures in the Talo/As-Funta area.

General Project Description: Provide 800 linear feet of new 10" PVC waterline. Add one new PRV. Demolish Talo Booster Pump Station.

Estimated Cost: $390,000

(11) As Niebes, Chenchon, and Gampapa/Duge Homestead Water System:

Project Objectives: To provide water to residents in the eastern plateau area to meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations; residents in the eastern plateau area currently use water catchments that may not meet the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations.

General Project Description: Provide 92,000 linear feet of new 8" PVC waterline in the eastern plateau area.

Estimated Cost: $17,290,000

(12) Renovation of Existing Ka'an Reservoir:

Project Objectives: To provide future life for the existing reservoirs for the Ka'an system.

General Project Description: Rehabilitate and recoat inside and outside surfaces of Ka'an Reservoirs with repairs to tank walls. Also repair broken valves (such as altitude valves, etc.).

Estimated Cost: $200,000

(13) Filtration Plants for Spring Sources:

Project Objectives: To provide a filtration plant (to 800 gpm) associated with each reservoir that stores water from a spring source.

General Project Description: Provide filtration plant to meet GWUI requirements. Four potential plants (Ka'an, Gagani, Taiapu and Ginalangan).

Estimated Cost: $8,440,000

(14) Replacement of Old Valves:

Project Objectives: Replace all gate and PRV valves in the entire system.
General Project Description: Provide new gate and PRV valves for entire system, and install new PRV valves in areas of the system where the pressure it too high.
Estimated Cost: $200,000

(15) Installation of SCADA System:

Project Objectives: To provide a SCADA and telemetry system for control of pumps and reservoir levels, recording of water system data, and alarms provision.
General Project Description: Provide SCADA and telemetry system, with sensors.
Estimated Cost: $750,000

(16) Buildings for Deep Wells:

Project Objectives: To provide deep wells with vandalism and weather protection.
General Project Description: Provide three 200 square foot buildings, one for each deep well.
Estimated Cost: $410,000

(17) Computerized Maintenance System:

Project Objectives: To provide a computerized maintenance system for the CUC water system.
General Project Description: Provide one computer, associated computer programs and training.
Estimated Cost: $50,000

(18) Hydro-Geological Study:

Project Objectives: To provide study of deep well aquifer potential.
General Project Description: Provide test wells and groundwater study.
Estimated Cost: $4,500,000

(19) Leak Detection Study:

Project Objectives: To provide reduction in water losses to achieve 25% target water loss rate.
General Project Description: Provide leak detection services.
Estimated Cost: $300,000

(20) Water Master Plan:

Project Objectives: To provide a comprehensive water master plan.

General Project Description: Provide water master plan to cover groundwater production, storage, treatment and distribution.

Estimated Cost: $300,000

(21) Sewer Master Plan:

Project Objectives: To provide a comprehensive sewer master plan.

General Project Description: Provide sewer master plan to cover groundwater protection, collection and treatment.

Estimated Cost: $300,000

(22) Develop Wellhead Protection Program:

Project Objectives: To create and implement a Wellhead Protection Program.

General Project Description: Provide development, initial staff funding and training for a Wellhead Protection Program.

Estimated Cost: $500,000

## 4.3 Project Prioritization

The prioritization procedure utilized in this study involves ranking of projects based on certain criteria, such as requirement to meet Federal and CNMI water quality regulations (related to the primary scope of this study which is to provide all Rota inhabitants with drinking water that meets the requirements of the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations, 24-hours per day, 7-days per week), need for meeting water distribution standards and guidelines (meeting flow and pressure requirements), capital and O&M costs, and system reliability. Each of the criteria was assigned a weight based on the relative importance of the criteria. Also, a score was assigned to each project for each criteria, with a range from 1 to 10, with 1 representing a lowest score possible, and 10 representing the highest score possible. The project with the highest weighted score received the highest ranking and the highest priority ranking.

The greatest weight was assigned to the primary scope item, which is the meeting the EPA Primary Drinking Water Regulations and Secondary Drinking Water Regulations. The remaining criteria were otherwise assigned equal weights.

**Table 4.3-1 Project Prioritization**

| Project Name | Meet Water Quality Regulations (weight=40%) | Meet Water Distribution Standards (weight = 20%) | Costs (weight = 20%) | System Reliability (weight = 20%) | Total Weighted Score |
|---|---|---|---|---|---|
| Sinapalo Peak and Fire Flow Relief Waterline | 1 | 10 | 6 | 5 | 4.6 |
| As Niebes, Chenchon, and Gampapa/Duge Fire Flow Relief Waterlines | 1 | 10 | 3 | 5 | 4 |
| Talo/As-Funta Fireflow Relief Waterline | 1 | 10 | 8 | 5 | 5 |
| Lupok to Puntan Pona Loop and Fire Flow Relief Waterline | 1 | 10 | 9 | 8 | 5.8 |
| Songsong Peak and Fire Flow Relief Waterline | 1 | 10 | 7 | 5 | 4.8 |
| Puntan Pona to Taiapu Loop Waterline and New Taiapu Reservoir | 1 | 5 | 6 | 10 | 4.6 |
| As-Funta to Songsong Loop Waterline | 1 | 5 | 7 | 10 | 4.8 |
| Lupok to Gagani Service Waterline | 10 | 5 | 7 | 5 | 7.4 |
| New Ginalangan Reservoir | 1 | 10 | 5 | 8 | 5 |
| Talo/As-Funta Waterline Connection | 1 | 10 | 10 | 8 | 6 |

| Project Name | Meet Water Quality Regulations (weight=40%) | Meet Water Distribution Standards (weight = 20%) | Costs (weight = 20%) | System Reliability (weight = 20%) | Total Weighted Score |
|---|---|---|---|---|---|
| As Niebes, Chenchon, and Gampapa/Duge Homestead Water System | 10 | 5 | 0 | 5 | 6 |
| Renovation of Existing Ka'an Reservoir | 5 | 10 | 10 | 10 | 8 |
| Filtration Plants for Spring Sources | 5 | 1 | 2 | 1 | 3.8 |
| Replacement of Old Valves | 1 | 10 | 10 | 10 | 6.4 |
| Installation of SCADA System | 1 | 10 | 9 | 10 | 6.2 |
| Buildings for Deep Wells | 1 | 5 | 9 | 10 | 5.2 |
| Computerized Maintenance System | 5 | 5 | 10 | 10 | 7 |
| Hydro-Geological Study | 1 | 5 | 5 | 5 | 3.4 |
| Leak Detection Study | 1 | 5 | 10 | 10 | 5.4 |
| Water Master Plan | 5 | 10 | 10 | 10 | 8 |
| Sewer Master Plan | 10 | 10 | 10 | 10 | 10 |
| Develop Wellhead Protection Program | 10 | 1 | 9 | 1 | 6.2 |