

## **Report for 2004GU30B: Hydrology of the Sabana Watershed and Water Cave, Rota, CNM**

There are no reported publications resulting from this project.

Report Follows

## **Project Title: Hydrology of the Sabana Watershed and Water Cave, Rota**

### **Problem and Research Objectives**

Rota, about 40 miles (64 km) north of Guam, supports a population of about 2500. The island obtains nearly all of its potable water from a karst spring estimated to produce from 0.5 to 1.5 mgd (0.02 to 0.06 m<sup>3</sup>/sec). Although the spring has historically produced more than enough during wet years, it can slow to very low flow during dry years, nearly ceasing entirely during the 1998 El Nino event. Reliable management of the water production over the long term requires a better understanding of the hydrology of the Water Cave and the catchment that feeds it. The Sabana area is undergoing active use, including the cultivation of crops in the watershed that feeds the sink points, and hence ultimately the spring. For the island to effectively manage this preeminent water source, it is crucial that engineers and planners understand the properties of the Sabana Watershed and the hydrologic connection between the watershed and spring.

### **Methodology**

The study employed classical methods of geological field investigation. Fieldwork included exploration and mapping of the watershed, particularly the topographic divides, contacts between the limestone and adjacent volcanic outcrops, and the karst features, particularly the sinkholes in the watershed catchment and the discharging springs along the contact above the Talakhaya area. This project supported a graduate student on a full-time research assistantship who was able to visit the site during wet and dry seasons, and following major storms. We located what appear to be the major sink points, geologic boundaries, and hydrologic boundaries. Field information is being input to a GIS from which maps and related analyses can be made.

### **Principal Findings and Significance**

The principal product of this study will be technical report (in preparation) containing a set of maps of the Sabana Watershed showing the boundaries, geologic contacts, vegetation, and land use. The maps will also include field relationships of the important hydrogeological features, particularly the locations of the sink points and the inferred and observed flow paths to them. This work complements parallel work planned by the US Geological Survey Field Office in the CNMI in collaboration with the Army Corps of Engineers (Capital Improvement Program) to reinstall a rain gauge in the Sabana Watershed, and new stage gauging instrument in the spring, both of which were destroyed by the typhoon of July 2002. The maps will support future studies of the water budget, including the relationships between rainfall, watershed characteristics, storm water runoff and ponding at the sink points, transport time to the spring, and stage response of the spring. The results of this work will thus provide a basis for assessing the risk to water quality posed by human activities in the Sabana Watershed, along with appropriate strategies for aquifer protection and remediation.

## **PROJECT SYNOPSIS REPORT**

**Project Title: Groundwater development and utilization for emergency drinking water, Fais Island, Yap State, FSM**

### **Problem and Research Objectives**

The objective of this project is assess of the physical resources and sociocultural factors that must be considered to ensure a reliable source of drinking water to meet emergency needs of the residents of the small (2.6 km<sup>2</sup>), remote island of Fais, Yap State, Federated States of Micronesia. Fais's permanent population of about 320 people currently relies almost exclusively on rainwater catchments to meet its potable water needs. However, on average once a decade a major storm destroys or damages existing catchments, most recently in November 2003. In light of the small size and subsistence economy of Fais and the prevailing traditional social organization and land tenure, technical recommendations for development and protection of water resources must be compatible with the island's social traditions, cultural values, and indigenous authority. The central objectives of this study are therefore inventorying and mapping the key karst features that relate to groundwater availability and making an inventory of patterns of usage, storage, and sharing of water from existing rainwater catchments and other sources. These data will be used to developing recommendations for an appropriately balanced approach to management of rain catchment and groundwater resources to meet emergency needs.

### **Methodology**

The study employed the classical methods of geological field investigation, including exploration and mapping of selected geological features. Because no previous geological study has been made and no maps or orthophotographs of Fais have been published, we are building our own base maps for this projects from a set of aerial photos that Dr. Rubinstein has in his collection from previous work on the island. In addition to mapping caves and searching for coastal seeps and springs, we are also mapping major sinkholes, fractures and features that may influence the capture and transport of water in the aquifer. Sociological methods of investigation build upon Dr. Rubinstein's 35 years of association with residents of Fais, assuring excellent access and trust from island leaders. Specific procedures involve participant-observation and open-ended interviewing following semi-structured question protocols, using an opportunity sample of island adults and social leaders.

### **Principal Findings and Significance**

This project has been continued into a second year. Observations from the first year's fieldwork showed that the residents have a strong preference for rain catchment water sources because of the convenience of using and storing it at the household or village catchment source rather than having to carry it from a well. The primary limitation on emergency supply appears to be lack of sufficient storage capacity for rainwater. We are therefore returning to obtain complete information on storage capacity versus actual household requirements under emergency conditions, to include availability of other alternative sources, including coconuts and well water. The current work will also complete the inventory of karst features, to include mapping caves that were not accessible because of weather and surf conditions during the first year.