

# Water for Honey Hill: Supplying Water to the Community of Cerro Miel

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## Community Background

Cerro Miel is located within the Comarca Ngöbe-Bugle, an indigenous reservation in western Panama (See Figure 1). The community of Cerro Miel relies on subsistence farming as a way of life. Up until recently, the people of Cerro Miel have lived in family clusters. Many people are just now getting accustomed to living in a larger community. There is, however, a community-driven water committee established in Cerro Miel.

## Project Background

There are currently two water distribution systems in Cerro Miel. The first system was built in 1998 and is fed from a small spring source. The system is in good working condition, but lacks the supply to meet the community's water needs. The second system was built by the Panamanian Government in 2008. The water comes from a large stream source. Although the system has the capabilities to meet the water needs of the community, it rarely does because poor construction and flaws in the original design often cause the pipeline to break.

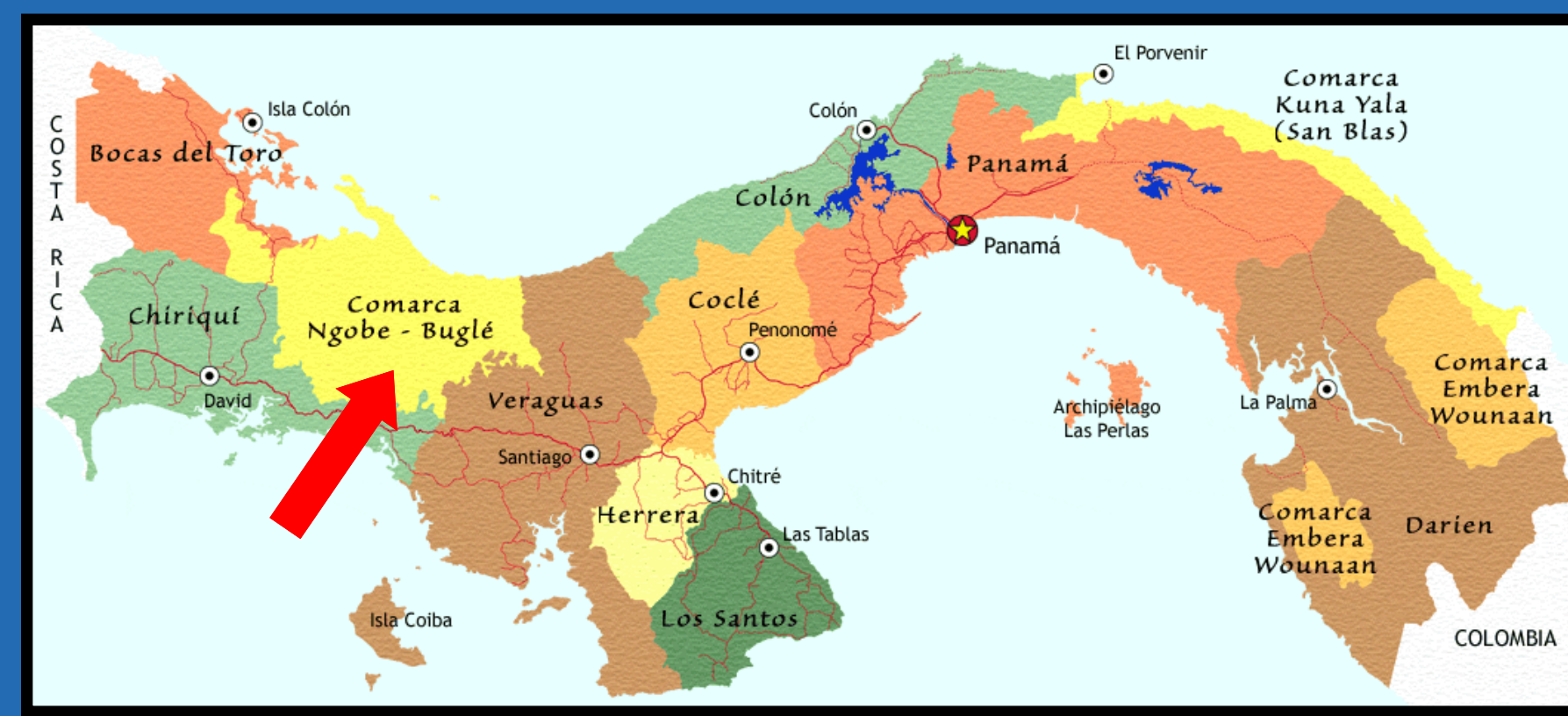


Figure 1: Map of Panama [worldheadquarters.com]



## Design Recommendations

### 1. System Expansion

- It is recommended that the old system be used to supply water to eight homes that are near the spring source for the system.
- The remaining homes should be serviced by the new system. There are a total of 62 homes that will be connected to the new system (Map to the left)

### 2. Addition of Pressure Release Tanks

- Addition of the tanks will alleviate pressure within the pipes, preventing pipe breaks from occurring. There are three recommended locations within the community of Cerro Miel where pressure release tanks should be located. The mason-break pressure tank is recommended at these three locations (Figure 4).

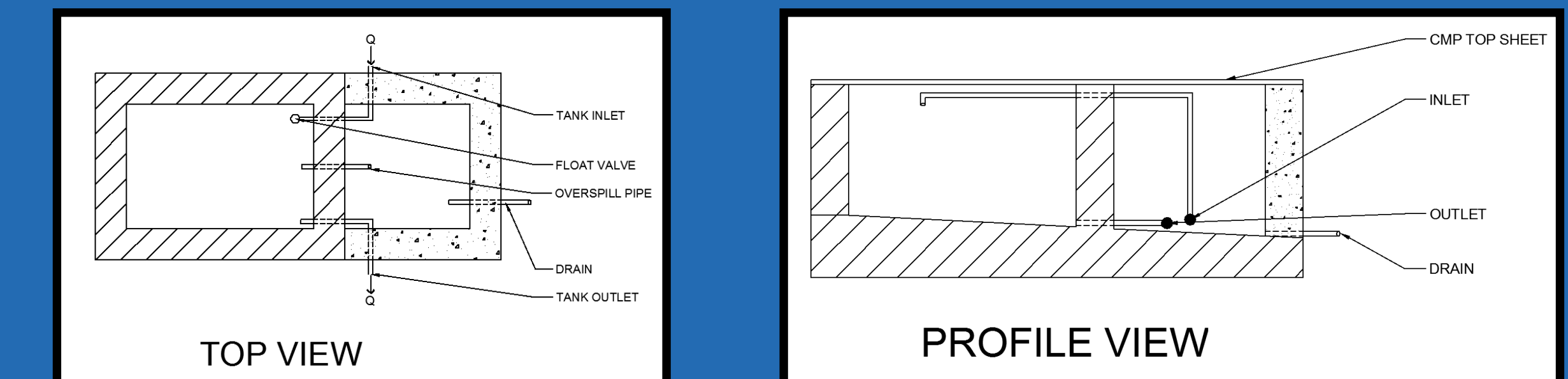


Figure 4: Mason-Break Pressure Tank Design

- An additional tank will be located near a storage tank in the community of Tugri. This tank is located on the supply line that feeds the new tank in Cerro Miel. High pressures have made maintenance of a slow sand filter and chlorination system dangerous. The pressure release tank would provide safer conditions for maintenance of the water treatment devices.

### 3. Addition of Air Release Valves

- When there is a high point in the pipe, air may build up, creating blockages that prevent flow. Manual air release valves will alleviate these air blockages.
- Padlocks incorporated into the air release valves help keep the system secure.

### 4. Gully Crossing Supports

- Weak points exist in the system when unsupported PVC pipe crosses a gully. To create a more reliable distribution system, suspension supports will be installed (Figure 5).

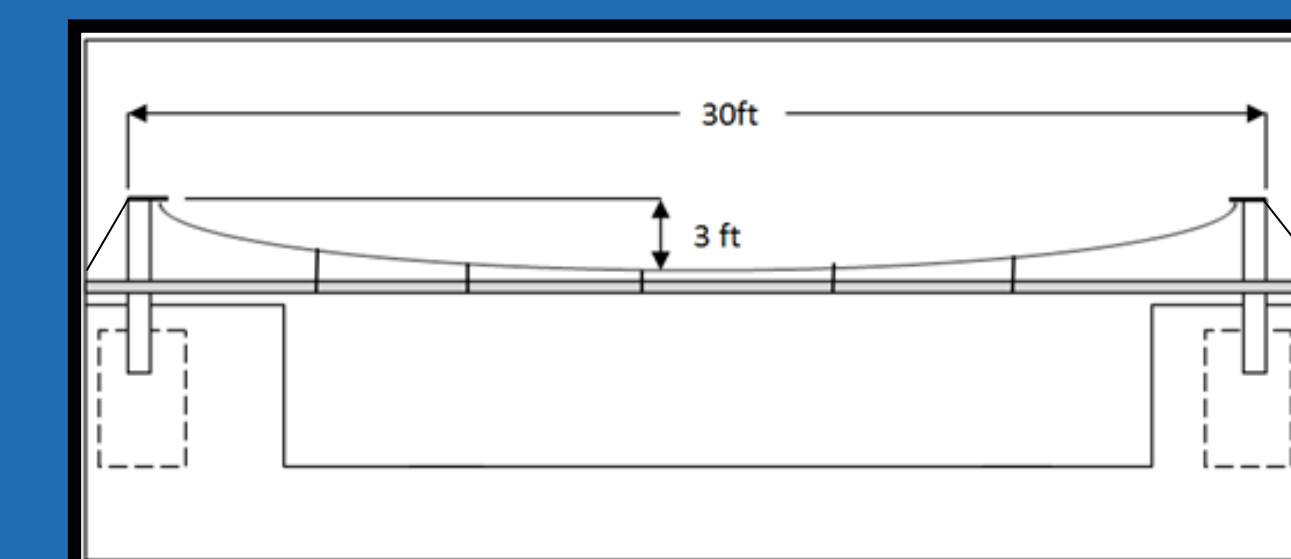


Figure 5: Gully Crossing Support Diagram

### 5. Solar UV Protection

- UV radiation makes PVC pipe brittle, decreasing its lifespan. The best way to counter this is to bury the pipe 2 feet. Doing this will protect the pipe from vandalism and foot traffic. However, when burying the pipe is not feasible, painting the pipe with a light colored, water based latex paint is recommended.

## Cost Estimate and Construction Schedule

- The cost to implement the final design is summarized in the table to the right. The final cost is \$7,850. This includes a 10 percent overhead to account for unforeseen costs.

- A construction schedule was also prepared to assist the community in implementing the system. The total time to construct the aqueduct is estimated to be 105 days. This includes extra days for inclement weather.

Project Costs	
Item	Cost
Pipeline, Fittings, Valves	4350
Pressure Release	535
Air Release	215
Gully Crossing Supports	1380
UV Protection	440
Transportation of Materials	930
<b>Total:</b>	<b>\$7,850</b>

## Existing Issues

During a pre-assessment trip to Cerro Miel in August, the team observed several issues that prevented the current system from functioning reliably. These issues include:

- High Pressure** – Because the pipeline travels over a large elevation difference, large pressures are experienced within the pipes, causing the pipes to burst. This was not addressed in the original design.
- Exposed Pipes** – Much of the PVC pipe was not buried, exposing the pipe to UV rays, foot traffic by people and animals, curious children, burning of farmland, and mudslides.
- Unsupported Pipes** – Currently the pipe is not supported in most of the places it crosses a stream or gully. These places are currently the locations of the most frequent breaks in the supply line.
- No Maintenance Plan** – When the system was installed, little instruction was given about care and maintenance for the system.

## Project Objectives

In order to create a design for Cerro Miel that would overcome the issues of the last system, the team decided on some key project objectives.

- Serviceability** – Once the system is installed, the community members will be able to operate and maintain it without any outside help.
- Ease of Construction** – Most of the construction will be done by hand with limited tools. Also, materials may have to be carried a long way so lightweight, smaller units were favored.
- Economy** – No matter how good the design is, it will not be built if the community cannot afford it. Therefore, the team tried to limit project cost to a \$5000 grant that the community currently has.
- Environmental Impact** – The system will have no adverse effects on the environment.

**Mission Statement:** *Uno Más Engineering seeks to provide clean drinking water to developing communities in a sustainable, reliable, economical, and environmentally friendly way. Uno Más is also committed to educating community members on proper sanitation, use regulation, and system maintenance.*

## Basis For Design

The final design was based on information gathered during an assessment trip to Panama. The data collection methods include:

- Abney Level Surveying:** Topographical information was gathered and used to create elevation profiles and to find distances. This was used to evaluate the feasibility of a gravity fed system.
- GPS Surveying:** GPS points were taken at surveyed locations, existing and proposed tap locations, and other important locations such as tanks and water sources. A Google Earth map was created from this information.
- Water Quality Testing:** 3M Petrifilms were used to find the amount of coliform and aerobic bacteria in the two water sources. This was used to evaluate the need for water treatment. (Figures 2 and 3)
- Water Usage:** A water usage survey was conducted to find out how much water was used at various times throughout the day.
- Water Availability:** The flow rates of the two sources were found using the time-volume method. The water available in the system was then calculated.
- Community Interviews:** Interviews were conducted to determine community needs and important social factors.

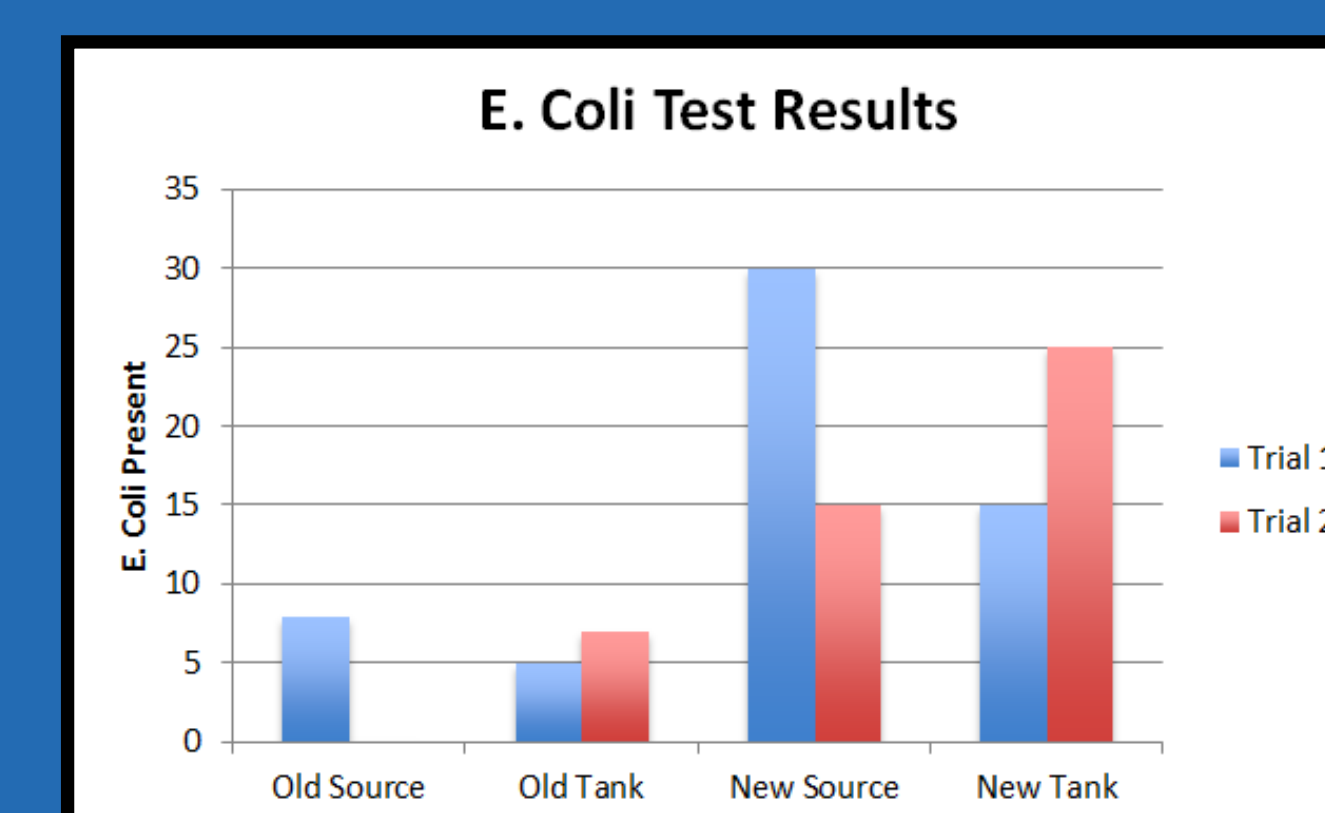


Figure 2: Results from coliform bacteria testing

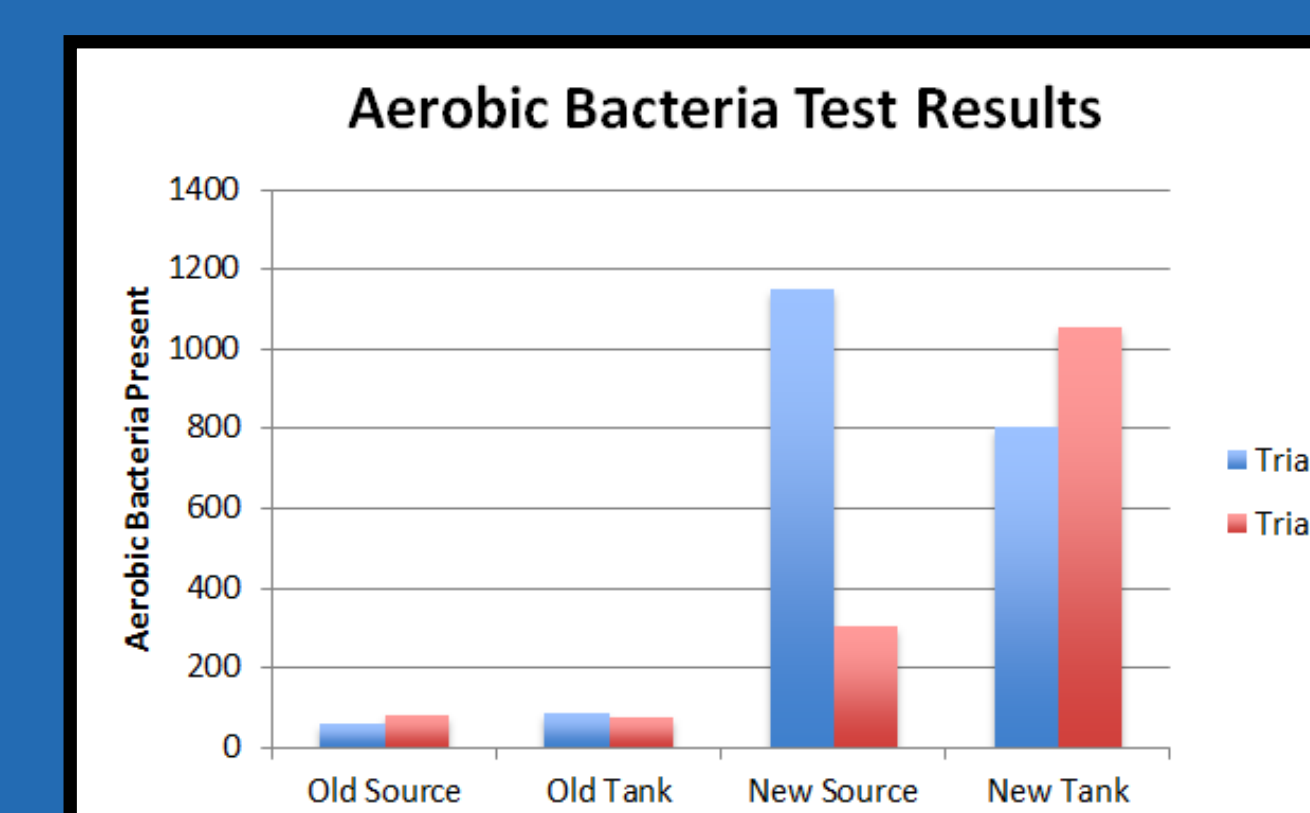


Figure 3: Results from aerobic bacteria testing