

Quebrada Pastor

Current State of Systems - Project Overview



PROJECT MANUAL

August 2026



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1. Executive Summary

A new high school for the community of Quebrada Pastor is under construction and expected to open in the near future. In anticipation of the additional water demand for the new school, community leaders and WEFTA have completed Phase 1 and Phase 2 of the school water supply project. Phase 1 made improvements to the reliability of the existing school water supply system by increasing storage, reducing leaks, and reducing surface water inflow.

Phase 2 proposed improvements to an interconnected community water system. Specific details outlining the proposed work can be found in Section 2 (Project Understanding) below.

2. Project Understanding

In anticipation of the additional demand for the new high school, community leaders and WEFTA began construction on a school water supply project in March 2022. The Phase 1 work consisted of:

- Rebuilding the spring intake structure for the school aqueduct system to secure the source water and eliminate leaks and surface water inflow into the system
- Building a new concrete block water storage tank to replace the old plastic tanks and increase storage capacity of the system
- Replacing the large pipe bridge over the largest stream and replacing the towers of the small pipe bridge

An April 2022 volunteer trip was made to verify progress on the project, assist with filling any information gaps or necessary coordination, listen to feedback from the community, and confirm ongoing construction plans. Construction was completed in the following months, and discussion began for developing Phase 2 of the project to increase the water supply for the system.

Proposed work for Phase 2 consisted of:

- 1) Install a water meter at the school so the water committee can measure the school's water usage, plan for the future, and use the data to promote conservation efforts.
- 2) Repair existing family system spring intake structures (Carrisal system, Abrego system) to secure these water supply sources.
- 3) Existing system tanks
 - a) Build a new concrete block tank for the Mario Lopez system to store enough water overnight to supply the homes during the day. The new tank would be built in exchange for allowing the overflow to be directed to the school. After completion of the new, larger concrete tank for the family system, donate the plastic tank originally installed on that system to the school for additional storage.
 - b) Build a new concrete block tank for the Carrisal system to increase system storage. Donate the original plastic tank to the school system.
- 4) Build a new spring intake structure and supply system at the spring near Alfonso Lopez's home to be used as a dedicated school supply, completely independent of the shared school system.

Volunteer trips in January 2023 and 2025 were made with the following objectives:

- Review Phase 1 work completed
- Assess all existing community water supply systems to identify opportunities for increasing the available supply to the new school
- Summarize proposed improvements
- Explore additional undeveloped spring sources

The most recent volunteer trip in March 2026 served to provide in-depth updates on the status of each water distribution line, collect water quality data, and assess the relationship between the community, school, and water committee.

3. Community Background

Quebrada Pastor is located in the municipality of Valle de Agua in the province of Bocas del Toro. The community of Quebrada Pastor sits between the mangroves where the Pacific Ocean and Caribbean Sea meet. It is situated on the highest ridge, which has a view of the entire archipelago of the Bocas del Toro islands. The center of the community is at kilometer 54 on the Chiriquí Grande-Changuinola highway. The inhabitants of the community – defined in general as those who send their children to primary school in Quebrada Pastor – live from km 52 to km 56 on the highway, downhill from the highway until the sea, and uphill of the highway on various hillsides up to the ridge of these hills, about 2 km from the highway. A small center consisting of the existing middle school, new proposed high school, and some houses is next to the Chiriquí Grande-Changuinola highway, but the majority of the population lives in small groups of houses hidden among the cacao forests covering the hills up to the ridge.

It is estimated that the population of Quebrada Pastor is about 1000 people in about 130 houses, as of March 2026. The population has grown a lot since the development of the highway in 1999. The community is divided into neighborhoods, and each neighborhood, in general, is occupied by a family. Due to the geographical separation of the neighborhoods, the characteristics and needs of each neighborhood are unique.

4. Water Committee

The water committee, or *directiva de agua*, is the governing body of the water distribution systems. This trip prioritized understanding the water committee, how they operate, and determining the level of ownership within the system to design the most effective solution to the problems identified. It is known that if systems are donated to a community, they tend to lack a sense of ownership, and communities are less likely to maintain and operate the system efficiently.

4.1 Water Committee Roles & Status Update

The water committee is composed of four main roles: a president, treasurer, secretary, and fiscal. There is a fifth “vocal” role in charge of informing community members of meetings and providing meeting notes afterwards. The following bullet list provides a status for each water committee role as of the March 2026 trip:

- The president is the main representative of the water committee who plans and schedules work days and makes the final decisions regarding problems with the water distribution system after consulting the rest of the water committee.
- The secretary is the master record keeper for the water distribution system and keeps a record of all missed payments, work day attendance, and fines.
- The treasurer is in charge of collecting monthly water bills and fines from all households and tracking households that do not pay, information which is then passed to the fiscal.
- The fiscal, which translates to public prosecutor in English, is the rule enforcer of the system.
- The vocal role is currently vacant, with the fiscal covering the role.

The residents who are on the water distribution system currently pay \$3 per month. However, there has been discussion of raising the monthly rate. If a resident’s water bill is unpaid, their water supply is disconnected eight days after a warning from the fiscal. Additionally, there are fines in place for those who are overusing or wasting water, or those who have breaks in their system but do not report them to the operator for repair. There is a \$5 -

\$10 penalty for anyone caught manipulating the valve or otherwise messing with the distribution line. The fiscal has issued fines and shut off water for people who have unpaid bills or manipulated the system. The school and the church pay a small fee for water, but the school's fee is disproportionate to its water usage. The committee collectively defines the water bill and fine amounts.

The maintenance of the Mario Lopez System depends on the operator, currently Mario's son, who cleans the intake and *tubo madre* monthly and helps users experiencing issues with the line by request. The monthly payment to the operator is \$30 per month to perform these functions. The Carrisal system does not have a person assigned as the operator, but its maintenance is performed by all users, *entre todos*, at least once a month, or even every 15 days.

After interviewing each member of the water committee, it was concluded that all members realize the importance of doing the jobs that their positions demand of them. However, the committee would benefit from having more members. These individuals were elected to their positions, and many seem to enjoy and take pride in their positions. According to the treasurer, all residents had paid their water bills at the time of the interview. One issue noted was the lack of participation on work days. Some people would rather pay the fine than spend the day hiking up to and cleaning out the tanks.

5. Existing Water Demand

1. Community: 28 households
2. School: Currently, 300 students

6. Future Water Demand

3. High School: Future 500 students

7. Data Collection

The trip consisted of recording GPS coordinates of important positions along the existing distribution systems as well as the newly built Mario Lopez 2 pipeline, rapid E.Coli/coliform petrifilm tests, nitrate/nitrite tests, and interviewing water committee members. The GPS coordinates were used to create maps of the distribution lines in Google Earth as shown later in Section 8.

For the rapid E.coli and coliform Petrifilm tests, water samples were taken from the Mario Lopez 2 tank intake, Mario Lopez 2 tank, Mario Lopez plastic tank, Carrisal intake, a house on the Carrisal line, Alfonso Lopez intake, and the school tank. Water drinking standards help define the maximum allowable contaminant levels in drinking water to help protect public health. In Panama, the water standards allow a sample to have a tolerance of 5.0% of either coliform or E.Coli, as long as it goes through chlorination before drinking. However, unchlorinated water from natural spring sources must be completely free of Coliform and E. Coli. In the Quebrada Pastor community, the water is not chlorinated or filtered. Therefore, no levels of contamination are tolerated according to Panamanian water standards. As per the Panamanian government in the "Reglamento Tecnico DGNTI-COPANIT 23-395-999", an acceptable range of nitrate is below 10 ppm, and an acceptable range of nitrite is below 1 ppm. Results for the rapid E.coli and coliform Petrifilm tests, along with the nitrate/nitrite tests, can be found later in Section 8.

8.1 Mario Lopez

The Mario Lopez system consists of two separate pipelines. The original Mario Lopez line runs from the point labeled “Plastic Intake” to the two plastic tanks shown in Figure 8. The second Mario Lopez line, which was previously referred to as “Mario Lopez 2” but will now be referred to as “Mario Lopez arriba”, runs from the point labeled Concrete Intake to the large concrete tank shown in Figure 10. The length of these two pipelines combined is roughly 965 meters (3166 feet). The main purpose of these two pipelines is to feed into the Centro tanks, which subsequently feed the school and community distribution lines.

8.1.1 Maps

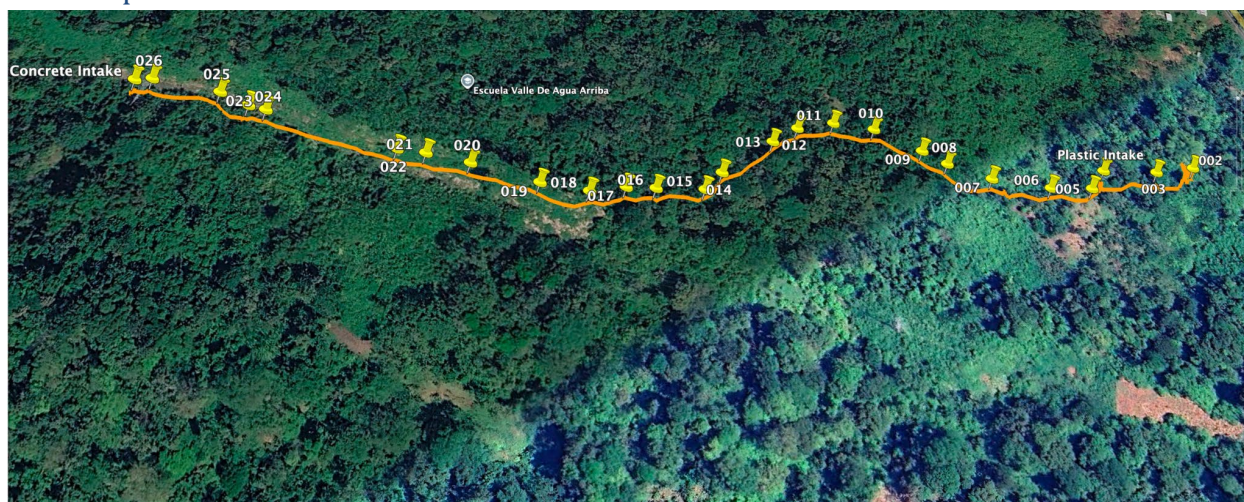


Figure 3: Mario Lopez Pipeline

8.1.2 Water Quality Tests

All samples indicate the presence of coliform, which does not adhere to Panamanian drinking water standards. However, all nitrate/nitrite tests for the Mario Lopez system came back satisfactory.

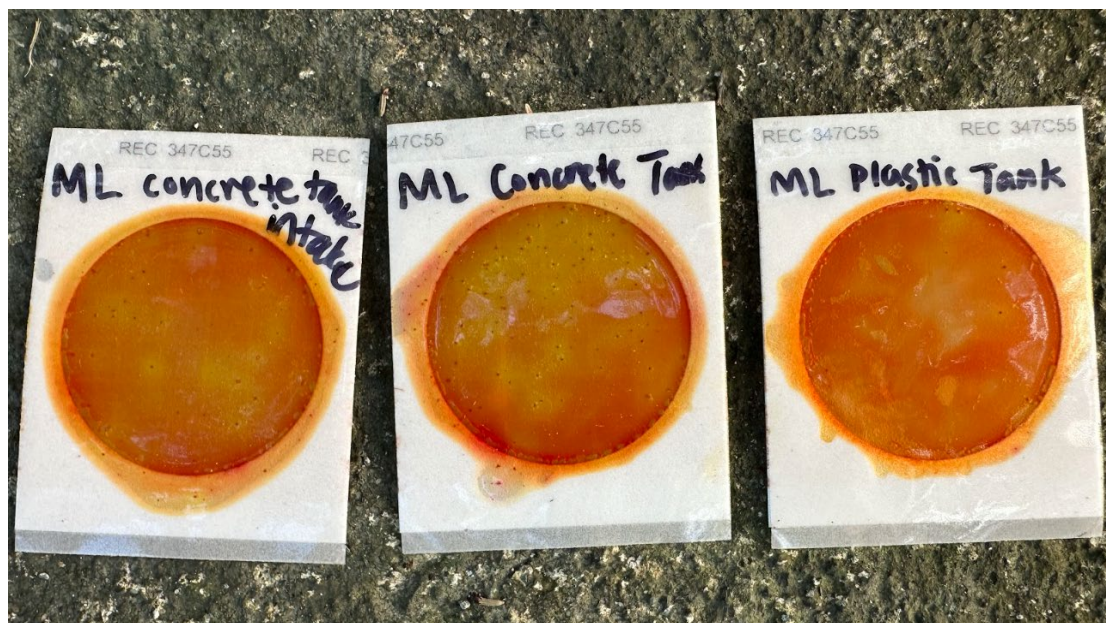


Figure 4: From left to right: Mario Lopez Arriba Intake, Mario Lopez Concrete Tank, Mario Lopez Plastic Tank

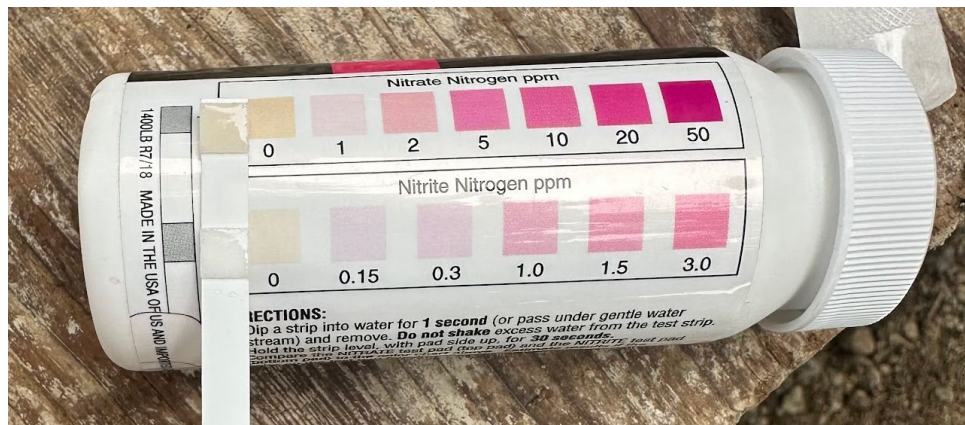


Figure 5: Mario Lopez Plastic Tank Nitrate/Nitrite Test



Figure 6: Mario Lopez Arriba Concrete Tank Nitrate/Nitrite Test

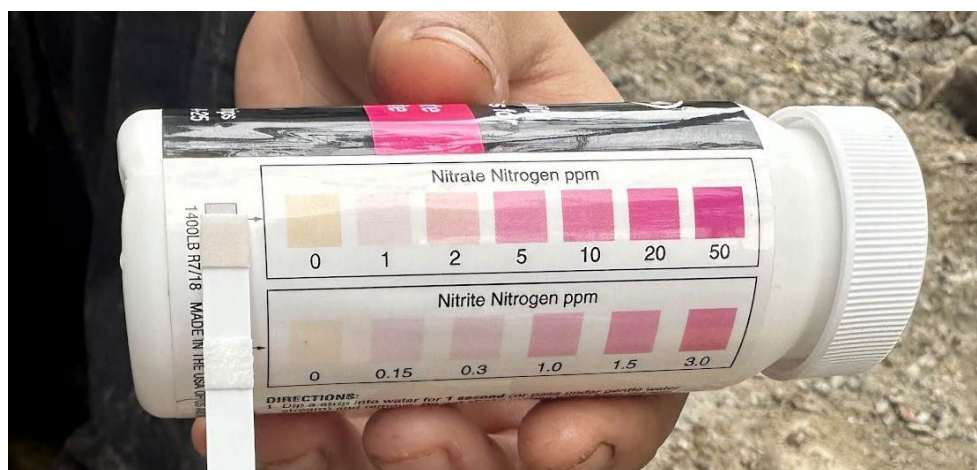


Figure 7: Mario Lopez Arriba Intake Nitrate/Nitrite Test

8.1.3 System Images



Figure 8: Mario Lopez Original Plastic Tanks



Figure 9: Mario Lopez Intake



Figure 10: Mario Lopez Arriba Concrete Tank Cleanout & Overflow



Figure 11: Mario Lopez Arriba Intake



Figure 12: Mario Lopez Arriba Pipeline



Figure 13: Mario Lopez Arriba Pipeline Bridge

8.2 Carrisal

The Carrisal system is purely residential and serves the houses along the line, as shown in Figure 14. It is a smaller system than Mario Lopez, and the community does not anticipate its expansion in the near future. The water

committee and users of the line noted that they run into issues with the system where sometimes houses will go without access to water or have very limited water flowing out of their taps. The community believes that natural wear and tear to the pipe, as well as weather events, greatly affects the integrity of the pipe as it sits right above ground.

8.2.1 Maps



Figure 14: Carrisal System Pipeline

8.2.2 Water Quality Tests

The sample taken at the intake exhibits too many coliform colonies to count. However, the house on the Carrisal line sampled from a family's tap does not show any signs of E.Coli or coliform. Therefore, the intake does not adhere to Panamanian drinking water standards, but the family tap does. Both samples are compliant with the national allowable nitrate and nitrite levels.



Figure 15: Carrisal Intake and Carrisal House REC Tests

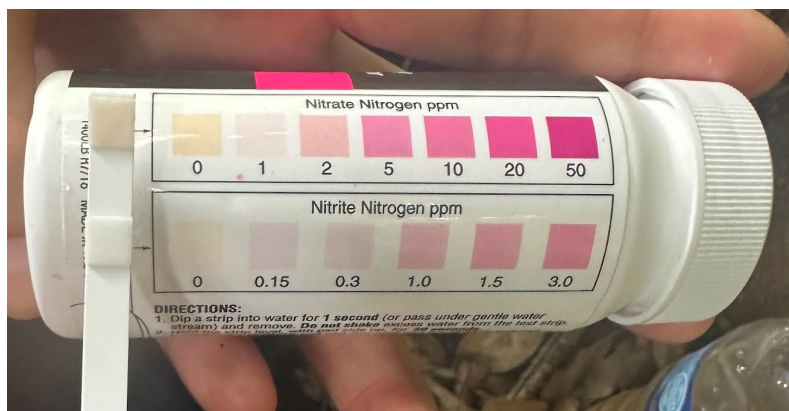


Figure 16: Carrisal Intake Nitrate/Nitrite Test

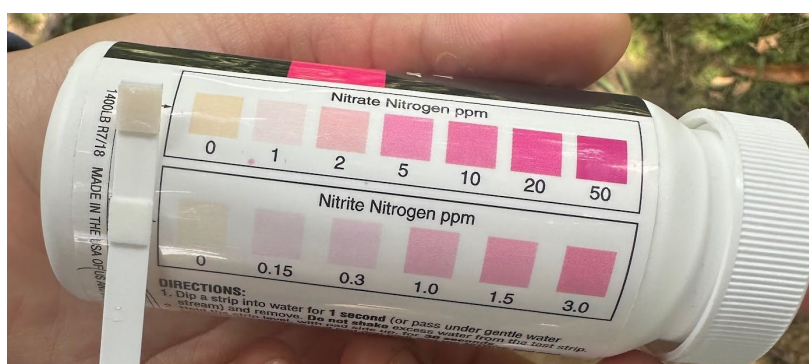


Figure 17: House on Carrisal Line Nitrate/Nitrite Test

8.2.3 System Images



Figure 18: Carrisal Pipeline



Figure 19: Carrisal tank cleanout and overflow



Figure 20: Carrisal tank



Figure 21: Carrisal tank intake, valve half open to control flow



Figure 22: Carrisal Water Sample



Figure 23: Carrisal Intake

8.3 Alfonso Lopez

The Alfonso Lopez system consists of a spring intake structure located near Alfonso Lopez's home. The proposed pipeline will span from the proposed intake to the Centro tanks, where it connects to feed the school distribution lines. The main purpose of this system is to serve as a dedicated school water supply, functioning independently of the other shared community water systems.

8.3.1 Maps



Figure 24: Alfonso Lopez System Pipeline

8.3.2 Water Quality Tests

The sample at the intake indicates the presence of coliform, which makes it noncompliant with the drinking water standards. However, the nitrate/nitrite levels are in compliance with the national standards.

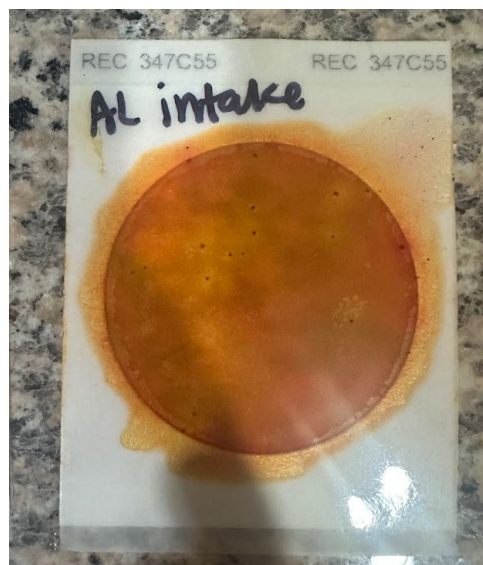


Figure 25: Alfonso Lopez Intake REC Test



Figure 26: Alfonso Lopez Nitrate/Nitrite Test

8.3.3 Proposed System Images



Figure 27: Alfonso Lopez Proposed Intake

8.4 School and Centro Tanks

Currently, the school is utilizing two temporary water tanks while the secondary school remains under construction. The two temporary tanks were supplied by the Ministry of Health (MINSa) to fulfill the water demand at the school. In the future, the tanks shown in Figure 30 will be moved onto the platform shown in the same image.

8.4.1 Water Quality Tests

The sample from the school tank shows the presence of coliform, but no E.Coli. The strip test indicated 0 ppm of both nitrite and nitrate in the water. Currently, these results show that the water does not adhere to the water standards in Panama.

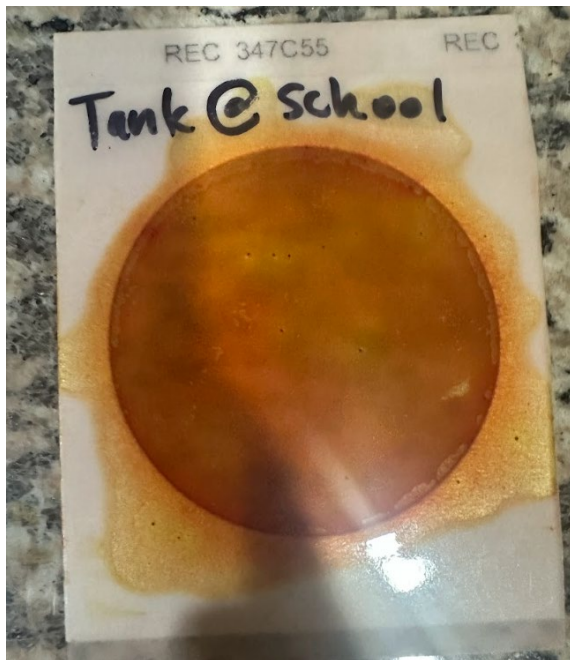


Figure 28: School Tank REC Test



Figure 29: School Tank Nitrate/Nitrite Test

8.4.2 System Images



Figure 30: Proposed Platform for Storage Tanks



Figure 31: Temporary School Tanks



Figure 32: Centro Tanks



Figure 33: New High School Construction

8.5 Rio Oeste

Rio Oeste is a neighboring community of Quebrada Pastor, roughly 5 miles (8 kilometers) away. Angel Caballero approached the travel team after reporting concerns with the water supply and distribution system currently present. The families that use this water system are relatives of Angel. While the work in this community is not necessarily within our agreed project scope, data was collected to assist in the improvement of the distribution system.

8.5.1 Maps

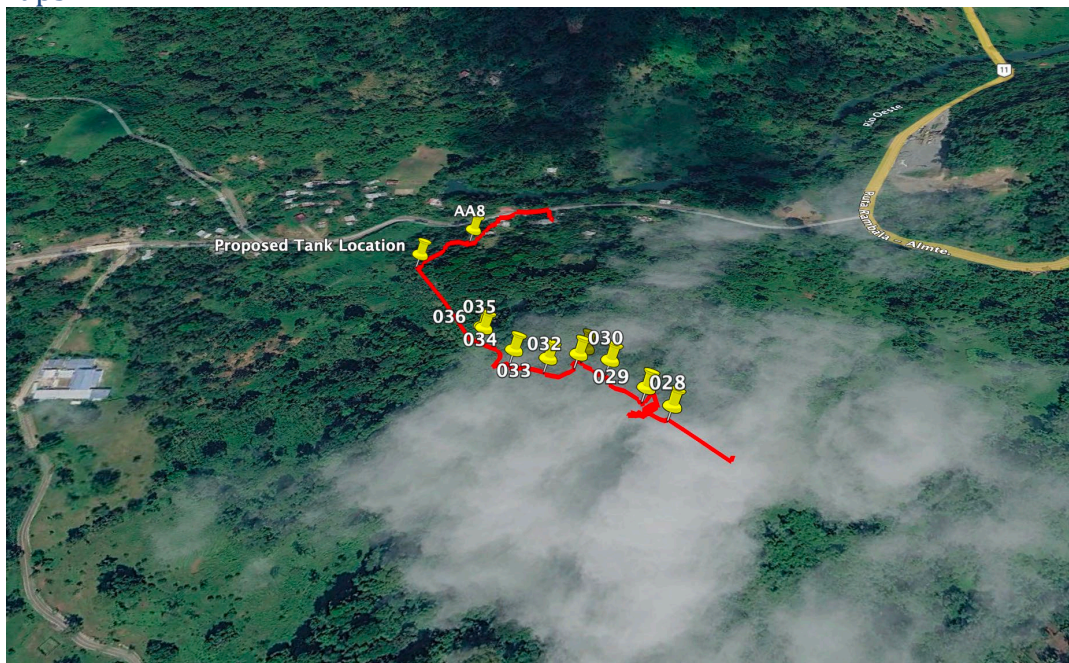


Figure 34: Rio Oeste System Pipeline

8.5.2 Flow Rates

To help with system improvements, the team assisted in gathering ballpark flow rates using a one-liter plastic bottle and a stopwatch. The average flow rate was determined to be 0.29 L/sec or 17 L/min.



Figure 35: Flow Rate Testing at Rio Oeste

8.5.3 System Images



Figure 36: Rio Oeste Intake



Figure 37: Rio Oeste Pipeline



Figure 38: Rio Oeste Pipe Elbow



Figure 39: Rio Oeste Trench for New Proposed Pipe

9. Summary of Findings

The community of Quebrada Pastor has a well-organized water committee that is responsible for the maintenance of the existing water distribution systems. Upon meeting with the water committee, it appears that members are completing their duties and that, apart from their desire to recruit more members, there are not many changes desired to the structure of the committee.

The three different distribution systems, Mario Lopez, including Mario Lopez arriba, Carrisal, and Alfonso Lopez, did not pass according to Panamanian drinking water standards. However, the main issue is the lack of a proper chlorination system. When meeting with the school principal, she stated that the Mario Lopez tank is chlorinated with a chlorine tablet by MINSA once a month. However, this is not an approved, standardized process, as the levels of chlorination are not checked afterwards, and there are no records of the routine chlorination. Having an efficient chlorination system would greatly improve the consistency of water quality. The main priority is securing a consistent amount of water supply to feed into the school system, and maintaining the existing distribution systems.

10. Next Steps

The CWRU student chapter plans to proceed with the closeout of the Quebrada Pastor project with WEFTA, as we no longer have a Responsible Engineer on the project. Additionally, the CWRU student chapter is a chapter with limited funding and believes another volunteer chapter may be able to support the Quebrada Pastor community to a greater capacity. The student chapter will provide a Spanish translation to the community of Quebrada Pastor and the water committee for their review. This report can also serve as a reference for future volunteers, and the CWRU student chapter is willing to remain a reference contact for future volunteers.