Water Supply, Distribution and Storage
San Pablo de Amali , Ecuador

Project Description:

The Peace Corp reached out to the Engineers for International Development (EfID), a student organization comprised of forty student engineers, to provide a completely new drinking water supply for the San Pablo de Amali community. Their existing water system failed leaving them with no access to clean drinking water. The scope of work for the project included finding a new clean source of water, new intake screening, impoundment, piping, storage, distribution piping, and direct connections to multiple houses. To complete the project, EfID provided the assessment, planning, design, and construction of a new reliable water system for the 200 people who live in San Pablo de Amali. Funding came from 2.5 years' worth of student fundraising events. What cannot be captured in photos or enough words is how this project significantly changed the lives of the 40+ student engineers and professionals who helped to complete the project. If EfID wins the NCEES award, 100% of the award money will go towards the second phase of the water project in San Pablo de Amali, Ecuador.

A Community Member fixing a leak in the existing water system.

Knowledge or Skills Gained

Communication is a key component while problem solving, especially in the field. Along with communication amongst the students and professional engineers, the team realized how important it is to communicate with the community to ensure the product is what was expected. The significance of a client-partner relationship with the community positively impacted the students and facilitated the understanding that although a perfect design may be constructed, if it does not meet the "client" or intended usage needs, it is a worthless effort. Knowing that the clients' needs are the top priority is an invaluable skill that these students' will be able apply in their futures as engineers.

One of the students listening to community leaders express their expectations. (Left to Right: Community President, Professional Engineer and Chillanes Director of Public Works, Chillanes County Mayor, and one of the Mechanical Engineering students.

Collaboration of faculty, students, and licensed professional engineers

Since the start of this project in 2018, there have been as many as 40 students working on the project as well as several licensed professional engineers, faculty, and staff. EfID has been under the guidance of a practicing licensed professional Civil Engineer since its inception. The students have been holding weekly project meetings for over two years during which Licensed Professional Engineers and/or Engineers in Training (EITs) are in attendance. During the assessment trips and implementation trips to Ecuador, the students were broken up into small teams, and always had a P.E. accompanying them.

Professional Engineer and students reviewing system maps

Protection of health, safety, and/or welfare of the public

Prior to the implementation trip in 2020, many of the community members needed to walk ¼ mile to get drinking water which was contaminated with bacteria. The community's gardens were under producing and their livestock were malnourished. The lack of a consistent water supply was a negative impact on the quality of life, community production, and public welfare. Without a consistent water supply, the community members were spending a significant amount of their time finding and collecting water rather than tending to the community.

Nothing but smiles from the Mayor, DPW Director and Community !

Multidiscipline and/or allied profession participation

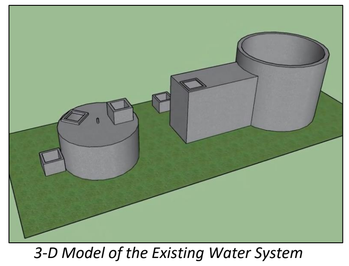
Environmental Engineering: During the assessment trip, students collected and analyzed water samples on site. They took samples for turbidity, bacteria, and pH. The team also brought back water samples to the U.S. and worked together with their local municipality to compare the data against the U.S. EPA's maximum contaminate levels.

Results of the Bacteria Test

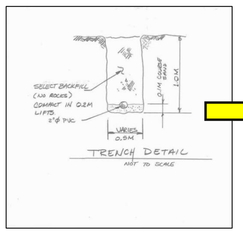
A P.E. and a student testing water samples

Principles and Practice of Surveying: By consulting with a licensed Land Surveyor, the students selected a sturdy handheld GPS receiver to collect needed topography. During the assessment trip, the students collected thousands of GPS data points and countless measurements of the existing water system. The data was downloaded and imported into ArcMap for further analysis.

Student collecting GPS data



3-D Model of the Existing Water System

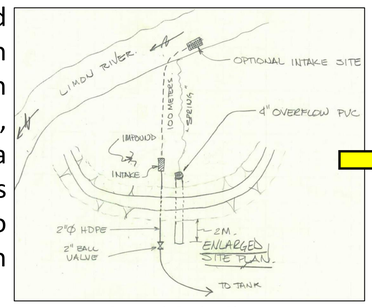


Designed Trench Detail

Construction of the Distribution Piping

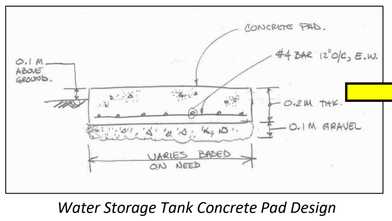
Civil: Water Resources Engineering: While working with multiple Civil Engineers, the team developed both schematics and detailed design of the entire new water system. The system included service connections, several miles of water lines, water storage, a well, and a well pump. The design had fifteen technical memorandums which detailed every existing and proposed water feature.

Geotechnical Engineering: Using existing land features the students sited a 40,000-gallon drinking water reservoir. They worked with P.E.s to develop a six-foot-high, compacted, composite earthen dam. The dam included a soil base, geomembrane core and it was topped with very large imbricated stone. To protect the dam, the team also installed an adjustable emergency overflow standpipe.



Reservoir Design Plan

Reservoir Construction

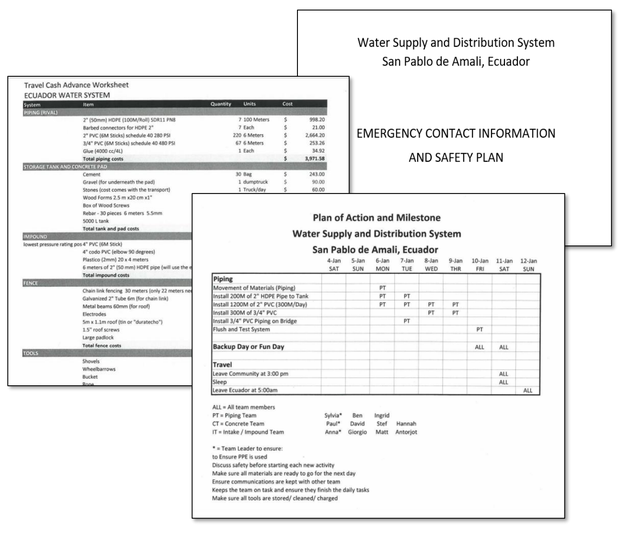


Water Storage Tank Concrete Pad Design

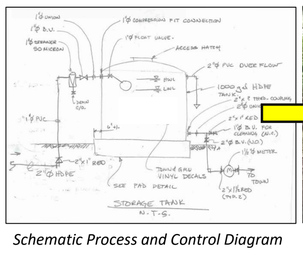
Water Storage Tank Concrete Pad Construction

Structural Engineering: During the entire life of the project, the students had many structural features to design and install. These features included a concrete pad and pipe hangers.

Mechanical and Control System Engineering: Working together with a P.E., the students designed and installed a level control system, flow meter, strainers and shut off valves.



Emergency Contact Planning Documents, Cost Estimate and Project Implementation Schedule



Schematic Process and Control Diagram

Water Storage Tank Construction

Civil Construction: Prior to the ten days construction period, the team consulted a Professional Construction Manager to assist in developing a critical path method schedule, overall cost estimate, and safety plan. Due to the large volume of work that needed to be completed in the short amount of time, multi-tasking was necessary for various components of the construction. The team worked hard to finish the project on time and under budget with zero safety-related accidents.