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# PROJECT SUMMARY

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## Guaricayán : Potable Water System

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January 2011 – March 2011

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## INTRODUCTION

### Location

The Community of Guaricayán is within the jurisdiction of the municipality of San Juan de Flores, in the department of Francisco Morazán in the central region of the country, located approximately 65 kilometers from Tegucigalpa.



Home in Guaricayán

### Access

Guaricayán can be accessed by the highway that connects the city of Tegucigalpa to the municipality of San Juan de Flores. The route begins as 55 kilometers of paved road until Compania Azucarera Tres Valles and is then a dirt road for another 10 kilometers to Guaricayán. The road conditions are good, however in the rainy season it is often necessary to take a much longer route due to water levels in the Choluteca River.

### Public Services

The following public services are offered in Guaricayán: an elementary school, a church, cellular telephones, and electricity. Few houses have concrete floors and most are without functioning latrines and pilas. The nearest health center is in El Zarzal, which is over an hour away on foot.



Guaricayán's church

### Population

There are a total of approximately 35 houses in Guaricayán, including all houses that are inhabited, uninhabited, and in construction. The total population including men, women, and children is approximately 250. Population data was used in order to calculate the future population for the design of the water system.

### Socio-economics

The principal economic source in Guaricayán is agriculture, primarily consisting of cultivating basic grains such as beans and corn. Due to its low elevation coffee cannot be grown in Guaricayán. Lack of water for irrigation makes plantain growth difficult and thus is rare within the community. Average family income is estimated at 2400 Lempiras per month, which calculates to less than \$1 per person per day.

## Background

The community of Guaricayán was relying on a drinking water supply system that did not meet all of the adequate conditions of a correctly working system in terms of water quality and quantity. The previously existing water system was constructed 24 years ago by the Honduran government. No monitoring or follow up was provided after construction. The original system was constructed to supply a total of less than 20 households without taking into account the growth of the community. Houses which were not originally connected to the system were forced to get water by carrying it from a nearby stream. Pipe diameters in the

original system design were not sufficient to provide water consistently to all of the houses that were connected. After functioning well for the first few years, the system began to fail and people connected to the system were forced to retrieve water from neighbors or streams as well.



Water connection of previous system. Faucet was found open, but had been without water for eight days.

The Water Council had only five members who were not complying with any of their responsibilities. Due to lack of organization in the Water Council and poor water service the vast majority of community members were not paying the established 10 Lempira water fee. This lack of organization and general infrastructural failure caused the community to stop treating its water. The health center of El Zarzal, which serves six communities in the area reported Guaricayán as having by far the most cases of water and sanitation related illnesses.



Liana Lopez who lives in the higher part of Guaricayán rarely received water from the old system

As a very under resourced community, Guaricayán did not have the funds to improve their existing system, or to consider constructing a new system. The community had previously solicited support from government organizations without receiving any help. A Honduran government institution had been working with community members in planning a water system with a completely new water source which was located over 20 km away from Guaricayán. The institution had required the people of Guaricayán to make a financial contribution in order to pay an engineer and a surveyor to identify

this water source and design a pipeline from the source to the community. Community members made this contribution and after many months of waiting, the institution reported that the project would cost over 4,000,000,000 Lempiras ( $\approx$  \$212,000) and that there was currently no funding for the project. Water Brigades came to an agreement with the community of Guaricayán to assist in the complete reconstruction of their potable water system.

## SYSTEM DIAGNOSTIC

Water Brigades began visiting the community of Guaricayán in October 2010. The purpose of these visits was to complete a diagnostic of the previously existing system to determine all existing problems. The following was found:

- The system was 24 years old and was only serving a portion of the homes in the community. Houses without water connections were either without water, were gathering water from streams or other sources, or were getting water from their neighbors when possible.
- The dam at the water source was a simple concrete wall and there were suspected losses due to the porous geology where dam floor and side walls had not been built.
- The flow in the water source at the dam site was sufficient to provide water consistently to the population of Guaricayán.
- The intake structure at the dam was a simple 1" PVC pipe with small holes drilled in it, placed in the reservoir behind the dam and directly connected to the piping in the conduction line.
- There were no working control valves in the system.
- The lack of cleaning and air valves in the conduction line prevented the community from being able to properly clean and maintain the system causing sediment to collect in the piping.
- The diameter of the piping in the conduction line (pipeline between the tank and dam) was a combination of 2", 1 ½" and 1" piping, not a sufficient diameter to provide water to the population.
- The elevation of the storage tank was only 1-2 meters below that of the dam at the water source.
- Flow entering the storage tank was measured as under 4 gallons/minute (gpm), less than a third of the flow necessary to provide all 35 houses in Guaricayán with the recommended minimum of 25 gallons/person/day.
- The storage tank was poorly constructed, too small, and the chlorination system had been damaged and was not working.
- The community was not chlorinating due to the fact that their storage tank was empty for such long periods of time.
- Houses in the higher areas of the communities were rarely receiving water due to lack of flow rate entering the tank and poor distribution network design.



Previously existing dam



Intake structure of original system



Original storage tank

- Broken and leaking pipes and household connections were causing constant water losses.
- The watershed of the existing water source was unprotected. Some deforestation had taken place near the water source.
- Water quality testing was performed at the water source. It was determined that the water was safe for human consumption if properly treated. The water had high hardness levels which do not, however, present any threat to human health.
- The Water Council consisted of only five members of the required seven. However, their participation was minimal and they had not received proper training. The Water Council had stopped holding meetings, operating, maintaining, and administering the system correctly.
- A Basic Sanitation Committee did not exist.
- Based on discussions with community leaders and observations it was determined that almost all community members had stopped paying their monthly water fee.



Water source in Guaricayán

## PRE- IMPLEMENTATION

Once the problems and needs in Guaricayán had been determined Water Brigades worked with the community through a series of visits and community meetings prior to executing the project in order to plan and design a new water system. They also worked to ensure that there would be a high level of understanding and collaboration during implementation. The pre-implementation process can be broken down into two phases:

### Planning & Design

- A preliminary GPS study was performed to verify the elevation of the water source, and identify a potential storage tank site and conduction line route.
- A detailed study of the previously existing distribution network was performed with the support of community members where all houses and community buildings were visited and mapped.
- All new pipelines were measured to determine the amount of piping, glue, valves, accessories, and other materials that needed to be purchased to complete the reconstruction.
- Necessary pipe diameters for all branches of the distribution system were determined based on branch distance and number of homes served by each branch.



Water Brigades staff measuring pipeline routes in Guaricayán

- Due to water hardness the conduction line was designed using an absolute minimum amount of galvanized iron piping to avoid solid deposits inside the piping.
- In collaboration with community leaders a plan was drawn up for the reforestation and protection of the watershed.

### Community Organization & Documentation

- An agreement was reached with the community that a reconstruction of their water system was the best solution to their water related problems.
- The community was presented with the methodology of Water Brigades.
- A full seven member Water Council was established by the community with the support of Water Brigades.
- A Basic Sanitation Committee was established by the community with the support of Water Brigades.
- A Contract of Construction and Cooperation was established outlining the responsibilities of both Water Brigades and the community of Guaricayán.
- All right of ways were obtained for new piping which was to cross private property.
- The work requirement for each home in Guaricayán was determined so that each home could retain or obtain its household water connection.
- A work plan was developed with the community to organize work groups and group coordinators to record days of work completed by each community member.



Community meeting with Water Brigades staff and homeowners in Guaricayán

### IMPLEMENTATION

The project was implemented between January - March, 2011 with Water Brigades groups from the University of Southern California, University of Virginia, Saint Louis University, Boston University, Stony Brook University, Johns Hopkins University, Mount Allison University, the University of Victoria and the North Carolina School of Science and Mathematics. The following was worked on during this time: the [water source and dam](#), the [conduction line](#), the [storage tank](#), the [distribution network](#), [house connections](#), a [system test](#), and [educational seminars](#). [Water Council](#) training was done in early May and the [Basic Sanitation Committee](#) will also be completely trained.



Student volunteers work with community members on construction of new dam

### Water Source & Dam

Work at the water source began with clearing large rocks and debris from the dam site. While the site was prepared, community members carried all cement, rebar, and necessary tools from

the community to the dam site. In order to begin laying the foundation of the dam, the water from the stream was diverted to one side to maintain a relatively dry work site. A simple dam was built with a sealed concrete floor, side and front walls with a height of 80 centimeters, a spillway with a width of 80 centimeters, two 4-inch cleaning pipes, an intake structure, and an outlet valve.

### Conduction Line

The conduction line was constructed of both PVC (plastic) and GI (Galvanized Iron) pipes. Wherever possible, trenches (60 – 100 cm deep x 30 cm wide) were dug in order to lay the relatively less expensive PVC pipe. Students and community members installed 48 meters of 3" GI pipe in the conduction line. Concrete anchors were constructed to sustain the GI portion of the piping. Over 800 meters of trench were dug by community members and student volunteers. Where trenches began, 3" and 2" PVC pipe was installed until reaching the site of the new storage tank.



Student volunteers dig trenches with community members where they would later install piping for the new conduction line

In addition to the piping, 6 valves were installed over the length of the conduction line. The valves installed were the following:

- 1 Outlet Valve: allows the quantity of water leaving the reservoir and entering the conduction line to be controlled.
- 3 Cleaning Valves: installed at low points of the conduction line, these valves allow for any sediment that does manage to get into the pipeline to be flushed out.
- 2 Air Valves: installed at a high point of the conduction line, these valves allow for any air that has built up in the pipeline to be released.



3" Galvanized iron pipe installed for the first 48 meters of conduction line

A valve box was constructed for each valve for protection of the valve and security.

### Storage Tank Construction

A 5,000 gallon steel reinforced concrete storage tank was constructed. To create a level construction site the necessary groundwork was performed before the foundation could be laid. A chlorination tank was constructed on top of the storage tank so that the members of Guaricayán will be able to properly treat their water. All necessary valves and



Construction of the new 5,000 gallon storage tank in Guaricayán

connections were installed including: an inlet valve, an outlet valve, a cleaning valve, and an overflow pipe.

### Distribution Network

All piping from the existing distribution network was replaced. The design of the distribution network was changed where necessary, and new branches were installed to ensure that water arrived consistently to all sectors and domestic connections. Over 2,800 meters of trench were dug by student volunteers and community members. PVC and GI pipe of the following diameters was installed: 2", 1 ½", 1" and ½". Control valves and valve boxes were installed where determined necessary for the proper control and operation of the system.



Student volunteers installing PVC piping in the distribution network

### Household Connections

New household connections were fabricated using GI pipe and faucets. Connections were installed in all houses including those without a previous connection. Once completed, 100% of the houses in Guaricayán were connected to the water system.



Woman in Guaricayán testing her new water connection for the first time

### System Test

Once the conduction line and distribution network were complete, the system was tested. Water was allowed into the conduction line by slowly opening the outlet valve at the dam. Each subsequent valve on the line was then closed slowly as water filled the pipeline. Water arrived successfully at the new storage tank site at a rate of over 40 gallons per minute, while the community only requires 10 gallons per minute in order to provide the required 25 gallons/person/day. Water arrived to all houses in Guaricayán.

### Educational Seminars

Brigade groups executed a series of educational seminars throughout the first stage of implementation in Guaricayán. Seminars were directed at children. Through various educational methods (skits, games, visual aids, etc.) the following topics were covered:

- Water and the environment
- Water conservation
- Watershed protection



Student volunteers delivering educational seminars in Guaricayán

- Water quality and illness
- Water treatment
- Sanitation
- Hygiene
- Hand washing
- Plumbing and water system maintenance

In addition to educational seminars, student volunteers worked with the elementary school students and community members to complete the following activities:

- **Reforestation:** over 200 trees were planted in the area surrounding the water source.
- **Community cleanup:** garbage (composed mostly of plastic) was collected and taken to a disposal site outside of the community.
- **Sign posting:** Signs were created and posted with messages related to watershed protection, the importance of water, etc.
- **Drinking water storage buckets:** Proper drinking water storage buckets were distributed to each house in Guaricayán and family members were trained on how to properly use, clean, and maintain them.



Student volunteers making signs to post in the community with children from the school in Guaricayán

## Water Council Training

Water Brigades staff trained the seven member Water Council of Guaricayán in the first week of May 2011. The community plumber was also trained. The training covered the following topics:

- Leadership
- Organization
- Community participation
- Monthly water fee
- Book keeping
- System administration
- System operation
- System maintenance
- Parts of a water system
- Watershed protection
- Water treatment
- Honduran water law
- Water Council roles and responsibilities

## Basic Sanitation Committee Training

The Basic Sanitation Committee (Comité de Saneamiento Básico) in Guaricayán will be completely trained. The Committee will be trained in how to properly execute the Healthy Homes and Schools Program (ESCASAL). The Committee's responsibilities include being sanitation and hygiene experts in their community and making visits to all houses in their community to educate on and monitor: household water storage, latrine maintenance, household cleanliness, and personal hygiene.

## PROJECT SUMMARY

While a relatively small community, Guaricayán had a great need for an improved water system. Water rarely arrived to the majority of homes in the community and was not treated in any way. Based on information from community members and the nurse who oversees the nearest health center water, sanitation, and hygiene related illness was a significant problem in Guaricayán. While people were not paying for their water and the

Water Council was inactive when Water Brigades arrived to the community, Water Brigades staff was greeted with open arms which extended as well to all student volunteers who worked in the community. Community members were punctual and very collaborative in every aspect of the project.

The following project components were completed:

- A new dam and intake infrastructure were constructed.
- A conduction line was installed.
- All necessary cleaning, air release, and control valves were installed.
- A 5,000 gallon storage tank and chlorinator were constructed.
- The entire distribution network was redesigned and constructed.
- All houses were connected to the new system.
- The Water Council was established and trained.
- A Basic Sanitation Committee was established and will be trained.
- Educational seminars were implemented covering a range of water, sanitation, and health topics.



Finished storage tank in Guaricayán



Finished and functioning dam of new system

- A community clean up was done.
- The watershed was reforested.
- Each home received a drinking water storage container and training on how to use it.
- A flow rate of 40 gpm entering the tank was achieved, four times the quantity of water that the community currently needs.

Guaricayán was a great example of a community which was not complacent in its situation, something that can be found in other rural Honduran communities where Water Brigades has worked. With minimal support from the government, community members of Guaricayán had been active in pursuing a water solution in their community up until Water Brigades arrived. With the incredible support of many brigade groups and all the people of Guaricayán, the project was finished with great success in only two months. All houses in the Guaricayán now have sufficient treated water at their faucets.



Student volunteers with children from Guaricayán's school at water source