Global Water

Progress Report

for Central American Countries

2003

Written by
T.A. Kuepper, REM
Executive Director
Global Water Program Office
3600 S. Harbor Blvd. #514
Oxnard, CA 93035
USA
Website: www.globalwater.org
Phone: 805.985.3057
Fax: 805.985.3688

Global Water Progress Report for Central American Countries - 2003

A variety of water project activities relating to projects in Central America happened in the year 2003. Here are several of the projects and the disinfection work we conducted:

1) Water Supply Work in Guatemala

BACKGROUND

The Land, the People and the Economy

One of the poorest and most socially polarized countries in the region, Guatemala has suffered from great social disparities, especially at the expense of the native Indian population living in the rural countryside. As a result, it experienced the longest and bloodiest armed insurgency in Latin America, a conflict that claimed 140,000 lives.

Located south of Mexico, Guatemala is a mostly mountainous country that contains one-third of the region's population. Its population of 12 million is composed in nearly equal parts of Latinos (people of Spanish-Indian origin) and westernized Indians of Mayan descent -- and Indians. Nearly two-thirds of today's Guatemalan population lives in rural areas, primarily concentrated in the central highlands. While more than half of all Guatemalan workers are employed in farming, agriculture contributes only 25 percent to the nation's income. This is because many farmers, particularly Indians, practice subsistence agriculture -- producing corn and beans for their individual household use only.

Guatemala City, the country's capital with more than one million inhabitants, is by far the largest urban center in Central America. It struggles to provide employment to a constant stream of rural immigrants. Despite the growth in light industry, the manufacturing sector has been unable to absorb the immigrants. In addition to their struggle against poverty, Guatemalans must make their living in a land where the southern area is subject to occasional violent earthquakes. In addition, the country's Caribbean coastline is vulnerable to hurricanes and other tropical storms.

Community Needs

Building water and sanitation infrastructure in a country fighting against these kinds of conditions is a demanding task. The majority of the population faces health care and sanitation deficiencies. The country has one of the highest infant mortality rates in Latin America, as well as an extremely high mortality rate for children under the age of five. More than half of these deaths are attributed to preventable infectious and gastrointestinal diseases, diseases which are often caused by drinking unsafe water.

Nearly half of the population lacks access to safe drinking water. In many rural villages, women must often walk miles every day to the nearest water supply, only to carry back water that is unsafe to drink. Only 52 percent of the population has access to sanitation facilities. The rapidly growing population -- 2.7 percent a year -- compounds the country's problems.

Global Water in Guatemala

Global Water has worked in Central America in a variety of ways over the years. Recently, we have supported several communities helping them to obtain safe drinking water, sanitation services, and health and hygiene education. The majority of recent Global Water work focuses on villages in the central highlands, where the residents are primarily Mayan Indians.

A typical project in Guatemala costs between $1,000 and $8,000 and is a spring-fed village water system in which faucets are centrally located between several homes or, in some cases, inside individual homes. Other projects include helping families construct latrines, spring protection, gravity water systems, and rain catchment systems. In all projects, the local people contribute their ideas, locally available materials, labor, and money (or barter) to start a maintenance fund.

Global Water works with partner organizations that have established infrastructure in the countries they operate in. These include both government and non-governmental water, sanitation, and health organizations. In particular, Water For People, has been an organization that Global Water has partnered with in Guatemala. Communities where the water projects are located are involved in project planning and decision-making, which nurtures a sense of ownership for completed projects.

PROJECT INFORMATION

2003 funding was used to fund several projects in Central America, including the following project: the Canton Vi'quola community gravity-fed water system in Guatemala.

The community of Caton Vi'qola is located nine kilometers (5.5 miles) northeast of Nebaj. It is approximately 230 kilometers (143 miles) from Guatemala City in the Cuchumantane Mountains of the Guatemalan Central Highlands, at about 1,839 meters above sea level (over 6,000 feet).

The population of Canton Vi'qola has 110 people or 22 families. The majority of the people are indigenous Maya. And the principal language is the Ixil dialect with Spanish as a second language.

The primary occupation of the men is agriculture and the women is housekeeping. Some skilled trades are evident such as carpentry for the men and fabric weaving for the women. The area around Nebaj is considered to be "cold" land and will only support one crop a year. The low production on this land is the major cause of poverty. Many of the families own small "milpas" or land where they grow corn, beans, and potatoes. These crops are used to feed their families, but rarely is it enough to last the year. As a result, many of the men migrate to the coastal areas of Guatemala to find seasonal work on the sugarcane and coffee plantations. Most families own livestock such as chickens, pigs, turkeys, or sheep. Fewer families own cows, horses, goats or mules. These animals are raised only for sale and are considered too valuable to be eaten.

All of the villages in this area were reduced to rubble in the early 1980's though a campaign by the Army to defeat the guerrilla movement. As a result, all structures, water systems, animals, orchards, and crops were destroyed. The villagers lived in exile for about 10 years before returning to their homelands. Over the past six years, families have returned to Rio Azul to farm the land where their village once stood.

In the community of Canton Vi'quola, women walk about an hour a day to fetch water from contaminated holes in the ground and rivers. This drinking water is heavily contaminated due to the presence of cattle and sheep that also drink from the source. This situation explains the high level of diarrhea-related diseases in the village, especially in children below the age of 5 years old.

In November of 2002, the community requested the help of COMENSA, a local non-governmental organization (NGO) and the partner organization in this project to help them organize and build a household water distribution system. COMENSA has worked with rural Guatemalan communities for the past nine years and has an excellent reputation throughout Guatemala. A feasibility study was undertaken through COMENSA that included the collection of topographic and hydraulic information.

With COMENSA's help, the community of Canton Vi'qola bought a mountain spring about 1,200 meters (or ¾ of a mile) from the village. Purchasing a 10-foot by 10-foot square patch of earth where a small spring comes out of the ground is a typical prerequisite to initiate the work necessary to create a safe water system for a rural village in Guatemala. Ownership of the spring insures that the spring will be used solely for the village's water use and not used by any other village or individual in the future. By virtue of the fact that a village is able to organize themselves to purchase a spring, says a lot about the determination of the villagers to create a safe water system. It is the best indication that the village will be motivated to govern the water supply system and maintain its components.

The overall goals met during this project were as follows:

- Identify a natural spring able to supply water to the community
- Build a spring capture box at the location of the spring.
- Build a pipeline from the spring to a new $5m^3$ distribution tank at the village.
- Create a piped distribution system in the village with 22 household connections using PVC pipe attached to the distribution tank.
- Construct a hand washing station (lavamano) for a future school that will accommodate several villages in the area.
- Construct three clothes washing stations (lavaderos) with septic pits.

Additional Information

The water system is designed for a 20 year expansion at 3% growth a year.
Initially, 22 household connections were installed.

In order to actually accomplish this project, COMENSA used its two indigenous employees who served as the onsite masons and construction managers every day of project implementation. One of these employees was Diego Ramirez Cobo, the recipient of the Global Water Technology Scholarship in 2003 for the 2004 school year. In addition, 100 percent of the community contributed to the program through manual labor. This resulted in different households helping each day to dig trenches that would hold the pipeline, install the pipe, cover the trench back up and construct the various tanks and other components of the project. With the help of the village, a roster was designed that listed each household, the number of hours each family had to contribute with specific dates and duties. The system worked very well with most villagers working enthusiastically to accomplish the project in a timely manner.

Disinfection Technology

Although the protected spring is an excellent source of water, the Canton Vi'qola project also included the implementation of a Solar Water Disinfection program using the SODIS method (using solar energy to disinfect drinking water at the point of use – the household level). The aim of this initiative was to provide the community with an effective and low cost alternative to drinking untreated water directly from the tap. A COMENSA health promoter taught the villagers about the SODIS method and provided the materials necessary to implement the SODIS system for each household. In addition, health and hygiene education was provided to the villagers to complete the educational portion of the water system project.

2) <u>Disinfection Technology Evaluation</u>

Disinfection is the most important treatment stage for rural water supplies in developing countries. Typically, water sources in many rural areas of developing countries do not have chemical contaminants (because there is little or no industrial activities), but often are contaminated with microorganisms that can cause a myriad of diseases. Such microorganisms include: protozoa, bacteria and virus and many of these are deposited into a water source because of fecal contamination from humans, livestock and wild animals. In addition, worms are a large problem in many developing countries that have surface water sources used for water gathering for domestic uses and bathing in close proximity to areas used by animals.

In particular, the disinfection of water in rural areas of Guatemala continues to be a difficult problem to solve. The only methods used by those NGO's that even attempt to try to disinfect water are boiling and a point of use system called SODIS (see a description of the SODIS system at the end of this Progress Report). Many believe these two methods best match the requirements in Guatemala from an economic and taste standpoint compared to other methods of disinfection. In particular, chlorination has been rejected by several villages because of taste issues with the villagers, themselves, and their animals (the common belief says that livestock will not drink chlorinated water). In addition, equipment that requires a long term maintenance commitment by outside agencies is not considered a viable alternative because outside support has not been sustainable in the past. Even the SODIS system and boiling are somewhat of a hard sell unless the villagers are educated about the need and methods of application.

Global Water hopes to change these perceptions by rural populations of Guatemala and has initiated a program to do just that -

In 2003, we sent two water disinfection devices to the University of Arizona (UofA) for testing and evaluated a third device ourselves. The University Microbiological team of scientists headed by Global Water's own Technical Advisory Committee member, Dr. Chuck Gerba, agreed to test these devices at no charge to Global Water. The goal was to help us make informed decisions in the future concerning the applicability of state-of-the-art disinfection technologies that could be used in developing countries. The two devices sent to UofA are routinely powered with solar energy in remote areas of the world, and therefore have the potential to provide water disinfection without requiring a logistic re-supply of chemicals or electricity. The two devices were 1) an Ultraviolet Light Disinfection unit that can be powered with a photovoltaic energy source and 2) a solar pasteurization unit.

In addition, I, myself, evaluated a water-powered chemical injection device that can inject a chlorine solution (or other liquid) into a pressurized water pipe without the need for electricity. This work was accomplished at the Navy's Seawater Desalination Test Facility located in California. Although chlorine does require a continuous re-supply of the chemical, bleach (sodium hypochlorite) can be found all over the world for laundry applications. Therefore, it is the most accessible chemical found in rural areas of developing countries that can be used for water disinfection.

All three devices worked well in the manner they were designed to operate. However, all of the devices have characteristics that limit their applications. For example, the rural areas of Guatemala are often cloudy, especially during the summer rainy season making a solar-powered device unreliable if a back-up electrical system is not available. Unfortunately, electricity is lacking in most areas of rural Guatemala. In areas close enough to major cities that electricity is available, the electricity is not consistent and often will shut down for hours at a time. The chemical injection device tested by Global Water satisfied the limitations of the solar powered devices in that it didn't require an external power source of any kind. Instead, it uses the flow of water in a pipe in order to pump a disinfectant solution into the pressurized pipe-flow. When electricity is lost in an area water ceases to be pumped through the pipes. With no flow in the pipes, there is no pumping of disinfectant solution with the device tested. In this way it is self-correcting in that chlorine solution will not be pumped into a water pipe unless water is actually flowing through the pipe.

Global Water has subsequently purchased and sent to Guatemala a water-powered chemical injector to be installed on a pipeline bringing water to a school. During my trip to Guatemala in December, we discovered that the water supply to one particular school was severely polluted with fecal coliform bacteria. Its water source is a nearby lake that is also severely polluted because sewage treatment is lacking in the cities that surround the lake. The one aspect of chlorine use in Guatemala that must be addressed in order for its use to be successful is that its taste must be removed at the point of use when the water is used for drinking. Chlorine is a great disinfectant but its taste will doom water supply projects in Guatemala and there's no use in providing safe water if no one will drink it. In order to correct the taste problem, Global Water is planning to add carbon filters on those faucets specifically identified and used for drinking purposes. Most of the faucets are used for washing hands, but one or two faucets will be identified specifically for drinking water. Activated carbon does a great job of removing the taste of chlorine and it is anticipated that it will work well in this application. Of course, with Global Water's philosophy of supporting whatever equipment and technologies it installs, we will support this school with carbon filters as long as the water supply system is operating. In other words - we're in this for the long-haul. This system is just being installed in 2004 so in next years progress report, I'll be able to report on its effectiveness.

3) <u>Global Water Technology Scholarship</u>

Global Water gave its first educational scholarship in 2003 for school to begin in 2004. We have not provided funding for educational purposes in the past because of our commitment to focus on water supply projects. However, a unique opportunity was presented to us while visiting Guatemala last December (see Guatemala Trip Report). A 32 year old staff member of a local NGO in Guatemala, named Diego Ramirez Cobo, has worked as a mason in the construction of water systems that Global Water has funded previously. As a mason, Diego helped build a wide variety of water supply system components, including: spring catchment boxes, distribution tanks, break-pressure tanks, centralized hand washing stations (primarily for schools), piping systems (some 3 - 5 miles long), and household faucet connections. In addition, Diego helped to create topographical and spring location studies, as well as making maps of water system locations. Diego wanted to go to a Guatemalan University in order to become a specialist in drinking water systems. Since this scholarship was directly associated with learning water supply technologies, Global Water has provided Diego a one year scholarship in 2004 to finish up his secondary education (the Guatemala equivalent of high school) and to start his first year at the University. His course of study will require three years at the University and Global Water plans to fund all of Diego's educational requirements.

4) <u>SODIS Water Disinfection System</u>

The SODIS is a simple water treatment method using solar UV-A radiation and temperature to inactivate water-borne pathogenic microorganisms, especially those causing diarrhea. As such, it is a point of use solar disinfection system that uses solar radiation to irradiate water in small containers. Typically, several transparent plastic 2 liter soda bottles are used to create a SODIS. The bottles may be placed at an angle to maximize their surface area exposed to the sun's rays on the roof of a building or on a table built away from other structures. Also, aluminum foil or other metal is placed underneath the bottles to cause reflection of the sun's rays into the bottle. The water to be treated should be filtered to remove as much turbidity as possible before water is placed inside the SODIS bottles. The SODIS bottles are placed in the sun all day (6-hours minimum) to affect disinfection, but since cloudy water will reduce the radiation intensity, longer periods of time are necessary for cloudy water. Since cloudy days also reduce solar radiation intensity, the SODIS would not work well during a rainy season. Complete information describing the SODIS system can be found on a website dedicated to SODIS information at www.sodis.ch.