

Potable Water for El Salvador:  
Community Las Mercedes/El Naranjito  
Engineers Without Borders  
Oregon State Chapter



## Site Assessment Trip

March 24-31, 2006

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### 0. Context

The Oregon State University chapter of Engineers Without Borders recently adopted a water distribution and purification project in rural El Salvador. They sent a preliminary site assessment team consisting of Evan Miles, James Nursala, Vanessa Varbel, and Kelly Wilson to the communities of Las Mercedes and El Naranjito during the week of March 24-31, 2006. This report summarizes the findings of this assessment.

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## 1. Community Description

### 1.1 Location

The Las Mercedes/El Naranjito (LM/EN) community is located in the western portion of El Salvador, in the department of Ahuachapán. They fall under the jurisdiction of the mayor of Tacuba, a town of ~5000 people, 10 kilometers to the north of LM/EN. This region of the country remains forested and contains the nationally-protected park 'El Imposible.' The department of Ahuchapán shares a border with Guatemala and shoreline with the Pacific Ocean, and LM/EN is 16-24 kilometer from both.

Access is easily available to both Ahuachapán and Tacuba from San Salvador (the capital of El Salvador) via maintained, paved roads. However, access to LM/EN is much more difficult, due to the single unpaved, under-maintained road which comes from Tacuba. Since EN/LM is located on a set of mountain ridges above Tacuba, the dirt roads are very steep and frequently on the edge of a sharp drop-off. During the winter months, these roads become nearly impassable by vehicle due to the erosion caused by the constant, heavy rains. Driving from Tacuba to LM/EN takes approximately 1 hour; the same uphill route can be hiked in a very strenuous 2-3 hours.

El Salvador is the most volcanically-active country in the Americas, and undergoes frequent earthquakes and eruptions. It should be emphasized that the ridges upon which LM/EN sit are geologically recent volcanic results. The sides of these ridges are extremely steep for most of their 1280 m altitude.

### 1.2 Demographics

Las Mercedes/El Naranjito contains about 450 to 750 people. The discrepancy comes from the fact that some of the community has recently moved to the area, since the last official census. The gender distribution is approximately equal, possibly with a few more women than men. Households frequently contain 3 generations, but most houses accommodate 4-5 people. Two elementary schools offer education up to sixth grade for the nearly 200 children.

The roles taken on by adults are traditional. Men work on coffee plantations while women stay in the home, preparing food, washing clothes, and cleaning. Children take on their parents' roles at an early age (~12 years), as additional schooling is not easily accessible (the nearest upper school is Tacuba or Ahuachapan, and transport is not available). Some families choose to send their children away for schooling, but most simply do not earn enough to have the freedom of this decision.

The community members are Spanish-speaking, mestizo-decent Salvadorans. The Spanish spoken is rough and informal, and incorporates many aspects of slang. There are 3 Christian churches in the community. Additionally, much of the community is superstitious to some extent, so visitors are cautioned to be careful with cultural issues.

As typical people from the campo, the community members were very curious about us, and very welcoming.

In terms of income, all of the community members live at or below our level of poverty. Few families earn more than three to five dollars per day. This being said, income is a very difficult thing to assess in the community. The peoples' income is based on the current price of coffee, which is variable. Some community members seem to be slightly better-off due to a stronger economical understanding. The lack of financial resources in the area is significant because it will severely limit the ability of the community to maintain whatever water system is put into place.

There is no public transportation from Tacuba into the site area. The only form of arriving at the community which is up about 3000 feet and about 10 km from Tacuba is to walk, drive or hitch a ride with the occasional vehicle traveling the route. We saw a fair number of people walking the route when we drove up and down to the community. Few members of the community have their own vehicle.

Some of the homes have access to a television and radio. Cellular phones are used by many in the community, and reception is quite good as there is a cellular tower located in La Cumbre. The Peace Corps volunteer reports good network coverage.

One important characteristic of this community is geographic dispersion. Although on paper there are two distinct, finite communities (EN/LM), this is not the case. In reality, there are many small groupings of houses distributed over the ridges. Some of these call themselves part of Las Mercedes or El Naranjito, but some consider themselves La Cumbre, and there are a few additional clusters that are significantly distinct from any of these groupings. El Naranjito and Las Mercedes created a joint ADESCO to recruit projects such as us and for that purpose, this project considers all parts as the same community. The ADESCO is an 11-member community-elected group of individuals that seeks, promotes, and supports community development through projects, education, and health clinics.

There are many areas of health concern that occur within this community, affecting different portions. These will be introduced and addressed in section 2.

### 1.3 Community Response

Members of EWB-OSU interacted in many ways with community members, and received many responses from community members, overall positive. All of the community members regarded the availability and/or cleanliness of water as a critical need, so they were excited to see people investigating their situation. Some of this excitement may be attributed to cultural factors, but overall the community supported our project and actions.

It must be noted that previously, two non-governmental organizations had separately assessed the possibility of carrying out a water project in the community and decided not to pursue it. Additionally, in several occasions there have been projects carried out in

neighboring communities, but not LM/EN. As a result, the community generally feels passed-over and overlooked. Thus, there was some reluctance to get excited for a water project without any evidence that our group has the desire to carry it to completion.

That being said, the house visits carried out by the team did a great job of demonstrating enthusiasm and commitment to the community. Valuable information and opinions were collected and processed by the team, and many community members volunteered their own spring location for us in the project.

This positive response was best demonstrated by the exceptional ADESCO meeting which occurred while the project team was visiting the community. While the EWB-OSU team was on-site, the ADESCO hosted a general meeting which was open to all community members. Nearly 100 community members (and 6 from the ADESCO board) attended the meeting to hear the goals and status for our project and a road project. This attendance was noted as exceptional by Eric Anderson, the Peace Corps Volunteer. Furthermore, he noted that the community members were abnormally attentive and participatory. Some community members present at the meeting helped the OSU team construct a map of housing locations from the GPS map we had constructed.

Overall the community support for the project is excellent. Although the community lacks the financial strength to fully support a large project, they have other resources, such as labor, lodging, and food. With any community, there are people that may not desire to participate in the project. The ADESCO understands this possibility and that it will need to elect a water board that can deal with this sort of situation. The people do seek a solution to their water issues and understood that that is also the desire of EWB-OSU.

## 2. Baseline Health Assessment

An assessment of the health and sanitation issues facing the communities of El Naranjito and Las Mercedes was performed in March 2006 through interviews with the following:

- 1) Local Peace Corps volunteer, Eric Anderson
- 2) Local health promoters
- 3) Teachers in local elementary school
- 4) Many community members throughout the area
- 5) Regional contact for CALMA in Tacuba

A significant amount of time was spent by the team conducting house visits with many families of Las Mercedes and El Naranjito. The purpose of these visits was two fold. First, the team wanted to ensure that the health demographics reported by community representatives were similar to the actual health issues directly reported by individual families. Second, the team worked to establish a level of comfort with the community to begin a long-term relationship between the communities and the EWB-OSU chapter.

## 2.1 Regional Health Demographics

An estimated 120-125 families live in the site area, comprised of the villages of Las Mercedes and El Naranjito. The vast majority of the community depends on wages from working on the two large coffee plantations that surrounds the community. A small portion of the community travels to Tacuba to work, a trip of around 10 kilometers one-way.

Through data reported by CALMA for the area of Tacuba, which includes the site area, there are approximately 446 people living in the two communities. (However, the general feeling in the community as reported by the Peace Corps volunteer and other community leaders, is that the overall population could be greater-between 500 and 750 people) According to CALMA, the total population of Las Mercedes is 319, with 159 men to 160 women, and for El Naranjito, 177, with 90 men, and 87 women. The racial profile is largely mestizo, a mixture of Spanish and native descent. A breakdown of the child population from CALMA is as follows:

Ages	Las Mercedes	El Naranjito
< 1 year	10	5
1-5 years	88	40
5-9 years	62	29
Total	160	74

There are generally, more girls reported in the child population than boys.

## 2.2 Community Illness/Injury

Through interviews with Eric, the health promoters, the teachers, and the individual families there are five community illnesses/injuries (reported in priority order):

- a) Stomach aches/diarrhea/Gastro-Intestinal Illnesses
- b) Acute respiratory illness
- c) Tuberculosis
- d) Dengue Fever
- e) Chagas (skin disease)

Gastro – intestinal issues are generally considered the major health issue of the community. The major symptoms are stomach aches, and diarrhea, especially significant with the infant and child population. The cause of is a lack of access to clean and safe drinking water and lack of quantity of water during the dry portion of the year. Additional contributors include lack of adequate sanitation and malnutrition. Many of the communities interviewed must travel up to 30 minutes, one way, to a reliable water sources. There are a few resources locally. The most frequent treatment is oral rehydration salts, but many of the people we talked with don't actually take these, it is more common to simply drink more water to rehydrate. The doctor visits the community once a week, otherwise, if the child is very sick, they travel to a staffed health care facility up to 10 kilometers away.

A second major community illness is acute respiratory disease. Symptoms include coughing, and the common cold, frequently referred to locally as 'gripe'. The cause of these acute illnesses is most likely the inefficient and poorly ventilated kitchen stoves. Most of the families cook over an open burning stove that may not contain a chimney to take the exhaust away. This traps excess smoke in the home and causes the families, generally women and children to cough and develop related illnesses. A few families have built a more efficient stove, that uses less wood, and is better ventilated, or they have an extra room for the kitchen that does not also serve for the bedroom or living room.

Other less common illnesses reported are tuberculosis, dengue fever, pneumonia, and chagas- a skin related disease due to insects that hibernate in the walls of the homes of a few community members. A medical worker travels door to door occasionally to test for and treat these diseases. If a case is severe, the family or individual must travel to the staffed health care facility in El Sincuyo or Tacuba.

Malaria is not considered a problem in the site area. Nonetheless, it is recommended that travelers to the area take 'chloroquine', a malaria oral pill, taken once week, before travel through four weeks after return. Sexually transmitted diseases, such as HIV/AIDS, are not reported to be a greater problem in the site than for the normal population.

### 2.3 Morbidity & Mortality Information

Statistics from CALMA indicate that the average life expectancy for women in the community is 55, 60 for men. An estimated 1-2 births occur each year. During 2004, there were 65 children ages less than 2 years that died in the entire Tacuba municipality, an area with a population of about 15,000. This rate may not be accurate for LM/EN, but nonetheless underscores the issue of infant health and lack of clean water and sanitation infrastructure. Malnutrition and related gastro-intestinal illnesses are the greatest causes of death in Las Mercedes/El Naranjito.

An illness specific to a certain time of year in the community is referred to locally as 'mal de Mayo'. During late February through early June of every year there are more reported illnesses. It is believed to be due to low flows of the area's water sources, which creates a higher overall concentration of contamination in the water source. This problem apparently decreases when overall water quantity increases in the rainy season, beginning in June and July.

### 2.4 Information on Daily Living

Water is obtained from existing springs and streams, rainwater collection, while some homes have individual household taps from a remote water source. A large percentage of the community must carry water from remote sources up to 30 minutes to their homes, over very steeply graded roads and trails. The water sources are generally located in the drainage valleys of the site, down from the ridge tops where most of the community lives.

This hauled water is generally used for drinking and cooking, and limited washing around the home. Additionally, much of the community bathes and washes clothes at the water springs or streams, causing a problem of water contamination for downstream sources. There was trash, left over laundry and soap wrappers, seen at some of the water source areas. Flow data from a few locations is contained in section 3.

Water is carried from the springs to the homes in 2 ½ to 5 gallon ‘canteros’, plastic jugs which are carried on the back or head. Once in the home the open jugs are often covered, and poured into a smaller container for washing, cooking, and drinking. Only a few of the homes visited had ‘pilas’, or large sinks, with three basins, two for washing and one large one to hold water. These were generally the homes that had access to more water, by having an individual tap connected to the house.

During the dry season, late February through June of each year, the water sources’ flows are low, creating a greater strain on the existing water resources to meet the demand of the community. Water purification methods are generally not implemented in the community. The community does not like the taste of chlorine or boiled water, which reportedly tastes too smoky. Education could be key in training community leaders to implement an alternative water purification method, such as leaving water in the sunlight, or storing drinking water in ceramic filters, lined with colloidal silver to treat turbidity and bacteria in the raw water.

The staple food of Las Mercedes and El Naranjito are beans and corn tortillas. Occasionally, there is rice, eggs, or local vegetables in the diet. Poultry, such as chicken, rabbit, or pork, is fairly rare. Coffee is fairly available. The food is generally all grown and raised locally, with the women spending a good portion of the day making tortillas out of a corn and water mixture and cooking them over an open flame. There are a few stores located in people’s houses. These stock simple food, which is carried up from Tacuba, or even Ahuachapan.

There were no obvious signs of malnourishment, such as bloated stomachs, however, it is reported that there are times of the year when there is not enough for all to eat a complete meal three times a day.

## 2.5 Sanitation

The majority of the homes have pit latrines located just outside or downhill from the home. About 80% of the homes have a latrine, however only about 75 % of these (or 60% of the total population) uses a latrine it is estimated. The other 40% of the population uses neighboring fields and does not use a latrine for sanitation. Many of the coffee plantation workers use the fields as there is no other place to go. Compost latrines are not appropriate given the hilly terrain and extra education and maintenance that is required to keep them functioning and aerobic so as to degrade the waste (they waste needs to be dried, aged, and emptied to keep the latrine functioning). There are community bathroom facilities for students at the two schools in La Cumbre and Las Mercedes.

There are no common garbage areas and the community members either burn or simply discard their trash outside their homes. Additionally there was trash found near the water source areas, especially where washing and bathing were done.

## 2.6 Community Health Resources

The nearest health facility for the area is located in El Sincuyo, which is approximately an 8 kilometer walk from the site area. Most members of the community walk this route, which is over very steep road and could be difficult to use during the rainy season. A health aide staffs this facility, which does have constant electricity.

It is estimated that approximately 90-95 % of the children of Las Mercedes and El Naranjito are immunized. Common immunizations for the children include tetanus, polio, DDT, influenza and meningitis. The Salvadoran Ministry of Health provides these immunizations free of cost to the community. The children receive immunizations at the health facility in El Sincuyo, or from health promoters that visit the individual homes on a somewhat regular basis.

To address the problem of malnutrition with young children in the community, a health worker interviewed mentioned that in the community babies are weighed to ensure proper growth and development every month for those children under two years old, and every three months for those between two and five years old.

## 2.7 Potential Health Impact of Project

A public potable water distribution system would greatly benefit the community of Las Mercedes and El Naranjito, and address the greatest reported illness: gastro-intestinal illness due to inadequate access to clean drinking water. A reliable water supply transported to centralized points of distribution near individual homes would increase overall water quantity during the season, when the individual water sources are very low, and the incidence of stomach related diseases increases. Both centralized water treatment in addition to point-of-use water treatment (such as with individual ceramic water filters designed to reduce solids and bacteria for drinking water only) are being considered at this time.

## 3. Data Collected

Although the primary purpose of the trip was to establish communication with the community and perform the health assessment summarized above in section 2, team members were able to collect some significant data as well.

### 3.1 GIS Data

The majority of data collected during this trip were GPS points to form a 3-D map of the community. All known important locations were marked, such as houses, schools, springs, road paths, and landmarks. The data is currently being overlaid to a topographic map formed from fly-over measurements taken by a government organization (SNET) in El Salvador. These data in conjunction should form a 3-D layout by which we can initially plan routes and lengths of pipes before doing a final assessment on-site.

Previous maps of the area exist on file but are very out-of-date. For this reason, the data that we collected was very interesting for the community members to view. The concept of a map was not entirely foreign, but the use of maps within the community is. For this reason, we hope to eventually present the community with a few detailed copies of the map.

### 3.2 Flow-Rate Data

Water spring flow rates were measured or obtained from existing sources when possible. Below are some flow rates for various water springs in the region. The chart lacks a few pieces of data from other locations where we measured flow rates, namely the source at Los Patios, and a stream below the same location.

Source	Flow Rate (liters/sec)
'El Pozo' in El Naranjito – measured	0.021
Tacubaya near Las Mercedes – obtained from ADIC	0.77
El Silencio in Retino Silencio – obtained from ADIC	1.28

### 3.3 Miscellaneous

Some of the data displayed above in the chart was 'obtained from ADIC.' ADIC is a non-profit organization (Asociacion Desarrollo Integral Comunitario) funded by the Spanish organization Manos Unidos. They work extensively in and near the Tacuba region, and have carried out many projects similar to ours. In a meeting with ADIC, they were willing to share information about local dry-season flow-rates, as well as the logistical and governmental difficulties they have run into in carrying out some of their projects. Further correspondence with this group will prove very useful as the project progresses.

Another local non-governmental organization is CALMA, from which we obtained much of the health information detailed above. Much of the necessary information for this project has already been collected. The difficulty lies in finding who has that information and how we can access it. It is our intent to cooperate as much as possible with local groups such as ADIC, SNET, and CALMA in order to carry out the project as effectively and efficiently as possible. Furthermore, continued cooperation with groups such as these could be useful for similar future projects.

## 4. First Stages of Project: Implementation of 3 Pump and Filtration Systems

### 4.1 Summary of Project Scope

As the community is divided geographically into several house clusters, it is necessary to complete the project by providing potable water near each house grouping rather than a single centralized system. Thus a prioritization of locations became necessary, taking into account the number of houses served, level of difficulty, need, distance from source and cost of implementing such a project at each location within Las Mercedes/ El Naranjito. Three of nine locations were chosen as having the highest priority for the implementation of potable water, and will comprise the first few stages of the project. As this is a project of much greater complexity and need than previously thought, the project will involve a long-term relationship between our chapter and the community, likely spanning several graduation classes of students.

### 4.2 Stages 1-3

One of the three first stages is to service the school of El Naranjito and the houses surrounding it, which is considered part of La Cumbre. This location will require installation of a pump, reservoir, spring box, piping and three faucets, and will provide water for 23 homes (as well as the school). This stage will be particularly difficult due to the high site elevation and low availability of water nearby. The spot has great need for the same reasons and due to the proximity of the school, which does not have water. The cost for implementing a project here will be very high.

A second location is the vicinity of Los Patios, a location that previously was used for coffee processing. This site would require a rehabilitation of current spring box and reservoir, extensive piping, pumps, and 6 faucets. The ability to utilize some previous water infrastructure makes this location appealing, and this system would provide for 32 other homes, and the school of Las Mercedes. Carrying out a project at this location would be very involved due to long pipe distances and rehabilitation needs, but has an easy solution and lower cost per house.

The third of the first three locations consists of the homes of El Naranjito. This would require two faucets and possibly a dual pumping system: during the rainy season the area is gravity-fed water from a nearby source at a higher elevation, and during the dry season water is pumped from a spring below. Unfortunately the source at a higher elevation is seasonally very strong, while the source below is steady, but weaker. Both components of the system would require a spring box, reservoir, and piping, and the dry season component would also require a pump.

In terms of water purification, our group has not yet decided which route to go, but all locations will also require a filter, and sophisticated water testing is yet to be done. A possibility is that removing the turbidity of the water will effectively purify the water. Another option is a slow-sand filtration system, but sand is not readily available near the location. Finally, the group is looking into Potters for Peace and UV purification systems.

### 4.3 Materials and Logistics

The next trip to visit the community is currently planned for June 2006, with the purpose of collecting accurate flow-rate data, water quality data, and surveying for the first implementation. This trip will also serve to make contact with the Universidad de San Salvador, which requires its students to participate in community development projects as volunteers. Finally, EWB-OSU hopes to acquire the basic materials needed for the project, to store them until the first implementation is carried out (scheduled for December).

The materials we already know that we need include: strong low-maintenance pumps, lots of tubing able to withstand high pressure, enough concrete to form several foundations and a spring box, and the plumbing required for several faucets (6). Most of these materials are available in either Ahuachapan or San Salvador, according to the Peace Corps Volunteer. However, we plan to research prices prior to June via international phone calls.

### 4.4 Plans for Village Participation and Sustainability

Design and construction of these systems shall proceed only with the assistance and approval of the community members. It is very important that the systems be economically and physically sustainable by the community. For this reason options such as a gravity-fed water system are being pursued ahead of an electrically pumped system.

In the construction of the systems the community members would assist in the work, digging trench for piping and assisting in the implementation of pumps and filters. We hope to provide a small wage of a few dollars a day so that the community members would be able to take time off work to learn about these projects. In assisting in the construction of the system the community members would be learning how the system works and thus how to eventually fix it. Additionally, the hope is that they will take pride in the system and value its importance for their community's well-being.

After system implementation it will be necessary to elect a committee within the community to be in charge of the system's maintenance. This includes collecting electricity fees for the pumps, governing the use of the system, collecting funds for replacement parts, and being in charge of repairing the system in the event of a problem.