Document 526
POST IMPLEMENTATION REPORT

CHAPTER: Worcester Polytechnic Institute
COUNTRY: Guatemala
COMMUNITY: Guachthu'uq
PROJECT: Rainwater Catchment

PREPARED BY:
Jennifer Moutinho, Chris Sontag, Lexa Vresilovic, Laura Pumphrey, Tom Moutinho

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ENGINEERS WITHOUT BORDERS-USA
www.ewb-usa.org

Post Implementation Report Part 1 – Administrative Information

1.1.0 Contact Information

	Name	Email	Phone	Chapter Name or Organization Name
Project Leads	Chris Sontag	cdsontag@wpi.edu	978-870-2060	EWB-WPI
President	Lexa Vresilovic	avresilovic@wpi.edu	518-265-8234	EWB-WPI
Mentor #1	Matthew Gamache	GamacheM@cdm.com	857-389-2170	Boston Professionals
Mentor #2	Patricia Austin	Pat.austin@state.ma.us	508-792-7423 x204	Boston Professionals
Faculty Advisor (if applicable)	Laureen Elgert	lelgert@wpi.edu	508-450-3313	EWB-WPI
Health and Safety Officer	Laura Pumphrey	lmpumphrey@wpi.edu	806-817-5275	EWB-WPI
Assistant Health and Safety Officer	Tom Moutinho	tjmoutinho@wpi.edu	207-831-7011	EWB-WPI
Education Lead	Creighton Peet	cpeet@wpi.edu	508-315-9395	EWB-WPI
NGO/Community Contact	Michelle Banks	paatitzat@gmail.com	502-4556-5763	

1.2.0 Travel History

Dates of Travel	Assessment or Implementation	Description of Trip
7/20/2010 - 8/03/2010	Assessment	First trip for health surveys, water sampling and meetings with community members and town officials
7/23/2011 - 08/07/2011	Assessment	Collected more data on water consumption, existing rainwater harvesting practices, and developed a memorandum of understanding with the community
12/31/2012 - 1/10/2013	Implementation	Implemented rainwater catchment systems at two households, assessed homes for future implemented, and initiated a monitoring system.

1.3.0 Travel Team

#	Name	E-mail	Phone	Chapter	Student or Professional
1	Lexa Vresilovic	avresilovic@wpi.edu	518-265-8234	EWB-WPI	Student
2	Tom Moutinho	tjmoutinho@wpi.edu	207-831-7011	EWB-WPI	Student
3	Jennifer Moutinho	jmoutinho@wpi.edu	207-831-2964	EWB-WPI	Student
4	Laura Pumphrey	lmpumphrey@wpi.edu	860-817-5275	EWB-WPI	Student
5	Chris Sontag	cdsontag@wpi.edu	978-870-2060	EWB-WPI	Student
6	Laureen Elgert	lelgert@wpi.edu	508-450-3313	EWB-WPI	Professional
7	Patricia Austin	Pat.austin@state.ma.us	508-284-4356	Boston Professionals	Professional

1.4.0 Health and Safety

1.4.1 Incident Reports

Did any health or safety incidents occur during this trip? ___Yes _X_ No

1.5.0 Monitoring - Current Status of all Past-Implemented Projects in Program

This report describes the first implemented project for this project site.

Project Type	Project Discipline	Date of Completion (m/d/y)	Functionality (enter one range per project)*			Periodic Maintenance* (yes or no)	Demonstration of Knowledge Transfer* (yes or no)
			0-50%	50-75%	75-100%		

***Please read accompanying instructions for information on how to complete these columns.**

1.6.0 Budget

1.6.1 Project Budget

Project ID: 6871

Type of Trip: Implementation

Trip type: A= Assessment; **I**= Implementation; **M**=Monitoring & Evaluation			
Trip Expense Category	**Estimated Expenses** ***(Fill in from Pre-trip Report)***		**Actual Expenses**
Direct Costs			
Travel			
Airfare	4200		6000
Gas	0		0
Rental Vehicle	0		0
Taxis/Drivers	1500		1000
Misc.	0		0
Travel Sub-Total	$5700		$7000
Travel Logistics			
Exit Fees/ Visas	235		66
Inoculations	0		0
Insurance	0		0
Licenses & Fees	0		0
Medical Exams	0		0
Passport Issuance	0		0
Misc.	0		0
Travel Logistics Sub-Total	$235		$66
Food & Lodging			
Lodging	930		945
Food & Beverage (Non-alcoholic)	0		0
Misc.	0		0

Food & Lodging Sub-Total	$930		$945
Labor			
In-Country logistical support	1000		475
Local Skilled labor	0		
Misc.	500		
Labor Sub-Total	$1500		$475
EWB-USA			
Program QA/QC	$0		$0
EWB-USA Sub-Total	$0		$0
Project Materials & Equipment (Major Category Summary)			
All of the construction Materials	1650		1249
Project Materials & Equipment Sub-Total	$1650		$1249
Misc. ***(Major Category Summary)***			
Report Preparation	0		
Advertising & Marketing	0		
Postage & Delivery	0		
Misc. Other	0		
Misc. Sub-Total	$0		$0
TOTAL	$8865		$9735
EWB-USA National office use:			
Indirect Costs			
EWB-USA			
Program Infrastructure	$1000		$1000
EWB-USA Sub-Total	$1000		$1000
TRIP GRAND TOTAL (Does not include Non-Budget Items)	$9865		$10735

Non-Budget Items:			
Additional Contributions to Project Costs			
Community			
Labor	0		200
Materials	0		100
Logistics	0		0
Cash	0		75
Other	0		
Community Sub-Total	$0		$375
EWB-USA Professional Service In-Kind			
Professional Service Hours	0		200
Hours converted to $ *(1 hour = $100)*	$0		$20000
Professional Service In-Kind Sub-Total	$0		$20000
TRIP GRAND TOTAL (Includes Non-Budget Items)	$9865		$31110
Chapter Revenue			
Funds Raised for Project by Source	**Raised Before Trip**		**Actual Raised by end of Trip**
Source and Amount *(Expand as Needed)*			
Engineering Societies			
Corporations			
University			
Rotary	800		800
Grants - Government			
Grants - Foundation/Trusts			
Grants - EWB-USA program	8500		8500

Other Nonprofits			
Individuals			
Special Events	600		600
Misc.			
EWB-USA Program QA/QC Discount Amount			
EWB-USA Program Infrastructure Discount Amount			
Total	$9900		$9900

1.6.2 Professional Mentor/Technical Lead Hours

Name(s) of Professional Mentor(s) (student chapters) Technical Lead(s) (professional chapters)	**Pre-trip hours**	**During trip hours**	**Post-trip hours**	**Total Hours**
1. Patricia Austin	20	80	0	100
2. Matt Gamache	0	0	0	0

1.7.0 Project Discipline(s): Check the specific project discipline(s) addressed in this report. Check all that apply.

Water Supply
____ Source Development
_X_ Water Storage
____ Water Distribution
____ Water Treatment
____ Water Pump

Sanitation
____ Latrine
____ Gray Water System
____ Black Water System

Structures
____ Bridge
____ Building

Civil Works
____ Roads
____ Drainage
____ Dams

Energy
____ Fuel
____ Electricity

Agriculture
____ Irrigation Pump
____ Irrigation Line
____ Water Storage
____ Soil Improvement
____ Fish Farm
____ Crop Processing Equipment

Information Systems
____ Computer Service

1.8.0 Project Location

Guachthu'uq is on the outskirts of the municipality of San Cristóbal which is in the state of Alta Verapaz.
Longitude: 90º 29' 24.37" W *(Degrees, Minutes, Seconds)*
Latitude: 15º 22' 13.04" N *(Degrees, Minutes, Seconds)*

Post Implementation Report Part 2 – Technical Information

2.1.0 Executive Summary

Through working with the community of Guachthu'uq, EWB-WPI has identified individual rainwater harvesting systems as the most appropriate to help each family of Guachthu'uq eliminate the need to walk several kilometers to a small reservoir supplied by a stream that runs dry in the winter months. EWB-WPI had completed two assessment trips, one in the summer of 2010 and one in the summer of 2011, used to meet with the community, assess their needs, and take in depth measurements of the homes. These dimensions were used in a dynamic model of a rainwater harvesting system for individual families which also took into account the roof area available, average monthly rainfall data, and the size of the family (or total water consumption rate). During our first implementation trip during January 2013, EWB-WPI implemented this catchment design on two homes as part of a pilot project . The systems will be monitored closely over the next year and a half to ensure that the model correctly accounted for all factors. EWB-WPI is planning a trip in May 2013 to solidify the monitoring system to ensure good information is collected before further implementation. On a return trip in May 2014, EWB-WPI hopes to implement on six to eight homes of the 37 within the community. EWB-WPI hopes to continue traveling each May completing work on all 37 homes in five to six years.

2.2.0 Introduction

The Engineers Without Borders chapter at Worcester Polytechnic Institute has been working with the community of Guachthu'uq in Guatemala. Through previous assessment trips in 2010 and 2011, EWB-WPI has determined with the collaboration of the community that the lack of a sufficient supply of sanitary drinking water is the community's greatest challenge to overcome. EWB-WPI plans on accomplishing this goal by implementing individual rainwater catchment systems which will provide greater overall collection and larger volumes of storage to each household to supply them over the entire year. An important consideration was that each house is located on vastly different terrain and varying plot sizes. The condition of each home differs greatly including current ability to collect rain water. The plans EWB-WPI creates will take into consideration the different present rainwater catchment systems by incorporating and improving the existing systems or creating entirely new rainwater catchment systems. To ensure that these systems are successful and meet the needs of the community members, EWB-WPI implemented two pilot rainwater catchment systems to be monitored over the course of the next year.

This report presents the designs implemented as well as the changes made to the individual rainwater harvesting systems planned for the two pilot homes described in the pre-implementation form (Form 525). The designs included only local materials and basic tools creating a system that the community members would be able to maintain in the future. The construction of the two systems employed only community members enabling EWB-WPI to both teach and learn from the community members. With the existence of systems already in the community, EWB-WPI has observed the success of these designs. The rainwater catchment tanks require no energy, being gravity feed, thus they are a cost effective design for a community largely independent of electricity.

Education of both the maintenance of the systems as well as the conservation of potable water from the catchment tanks will be an important aspect associated with the success of this project. This education will not only be presented to the families of the two pilot homes, but also to the community as a whole. EWB-WPI hopes that the community members will learn to be more sparing with sanitary water usage by having a complete understanding of what rainwater should be used for. Ultimately the education of the community will be the greatest challenge with language and cultural barriers; however it was also an important aspect of this implementation trip, to ensure that all members of the community understand that the rainwater harvesting systems already present can be used more efficiently.

2.3.0 Program Background

The community of Guachthu'uq is located in a northern, mountainous region of Guatemala and is home to about 280 people in 37 homes. Their lack of access to clean water year round is one of the greatest concerns. Michelle Banks, a volunteer for the Pacayas Project, voiced the community's needs to EWB-USA in early 2008. The EWB-USA student chapter at Worcester Polytechnic Institute accepted this project in 2009 and successfully completed two assessment trips in the summer of 2010 and 2011 respectively. In this section, we will review each of the previous forms, summarize what we have accomplished on previous assessment trips, and outline our actions up to this point. We will also cover the important aspects related to the water project and how it influenced us to continue the project with individual rainwater catchment systems.

During the dry season (February to May), the community relies solely on a spring water diversion box located approximately one-kilometer downhill from the center of the community. This water source is located on a private estate, which the locals call the "Finca." The community has had some problems in regard to accessing the Finca source. In 2006, the landowner and the families who live in the communities that access the spring (Guachthu'uq, Las Arrugas, and La Reforma) agreed to restrict access to the actual source and to construct a spring diversion box about 100 meters downstream where families can collect drinking water and wash clothing. This has helped community relations, but the distance between the spring and the community of Guachthu'uq continues to be a problem since families have to make multiple trips each day. There is also concern about the quality of the spring water. The source does not receive any water treatment, and many people in the community, especially children, suffer from dysentery and parasitic worms. During the rainy season (June to January), the community gathers water in rainwater collection tanks that were donated by the municipal government in 2009. The dry season in the region has reportedly become longer and the rainy season is beset by rising temperatures and decreased rainfall. Though these collection tanks have eased some of the community's water problems, not all of the families in the community own a collection tank and many of the collection systems are used inefficiently.

The EWB-WPI team acquired rainfall data for the town of San Cristobal from the University of Coban and other local researchers. The data spans 1979 through 2001, from which monthly averages were calculated. To add to this data, we receive updates from the rain gauge we installed in San Cristobal on our second Assessment Trip. These data have been added into the monthly calculated averages as they are received.

There are years that received abnormal amounts of rain, for example in 1994, when 1073 mm of rain fell (lower than average), and in 1984 when 2198.9 mm of rain fell (higher than average). Clearly, there is a large variance in rainfall, however usually it is not this drastic. In the design calculations, we will pay close attention to how the system will work in drier and rainier years. With monthly averages, the fluctuations in annual rainfall will be accounted for when designing the rainwater catchment systems.

First Assessment Trip

As is the case with most EWB groups, the majority of data collection occurred during the Assessment Trips. The objectives of the first Assessment trip completed in July/August 2010 were as follows:

- Assess the feasibility of each of the possible water solutions
- Test the quality of the available water
- Make connections within the community, and the surrounding area

The following data was collected during this trip:

- Met with a geologist at the University of San Carlos in Cobán, to learn about the geology of the land in the community and obtain rainwater data. The following information was conveyed during these visits to the University:

    - Karst formations cause water to seep down into the ground very quickly due to the porous material of the earth. Consequently resulting in a lack of water filtration and lack of stability for a structurally sound well. The crevasses and the porous material cause the water quality to be very poor.
    - A deep well may be required to reach the water table.
    - A 300 page report of rainwater data was provided to the group. This report consisted of rainfall data from San Cristobal ranging from 1981-2001. This information was vital to the assessment for rainwater collection.
- Water quality sampling
    - The team was able to test the water quality of the local spring (Finca) and rainwater from three water catchment tanks. These water quality tests included iron, hardness, turbidity, nitrates, conductivity, alkalinity, total suspended solids, and pH.
- Layout of the community
    - A large portion of the trip was spent in the community identifying the plausibility of a water distribution system.
    - Consistent electricity does not exist throughout the community.

Once home, this data was analyzed and the following steps were taken:

- Analytical Analysis
    - The rainwater data was used to calculate monthly rainfall averages to provide a basic understanding on how much rain falls in the community.
    - All of the rainwater data was entered into a dynamic excel model.
- Chemical Analysis
- Physical Analysis
    - Due to the lack of electricity in the community, a distribution system was ruled out.
    - A well was not plausible because the geology of the land in the community is not viable.

Description of Alternatives

Groundwater

The ideal location for the construction of a well would be in the center of the community; but in reality would be located wherever water could be found. Water would be collected by means of a bucket and brought to the home for use. However after meeting with the geologist at the University of San Carlos in Cobán, EWB-WPI learned that the geology of the land in the community consists of karst formations which cause the water to seep into the ground quickly due to the porous nature of the karst material. The karst formations cause a lack of proper water filtration resulting in poor water quality as well as creating a lack of stability for a structurally sound well.

Surface Water

A small reservoir currently exists in the community; however, the community members have to walk to this reservoir multiple times per day to fetch water. A distribution system would function to transport the water from the source to the homes of the community members. However this is not feasible due to the low elevation of the cement containment box compared to all the homes. An energy source would be required to pump the water uphill to the homes. The community currently has no source of electricity and an alternative energy such as solar or biomass was determined to be inappropriate for the situation at hand.

Atmospheric Water

The high volume of rainfall the community receives during the wet season makes individual rainwater catchment tanks a feasible option. Each home would receive its own tank(s), depending on how many people live in the

home. The rainwater would be collected on the roof and then funneled into the catchment tanks using a gutter system.

Communal rainwater catchment tank(s) has been considered as being a feasible option as well. A communal tank could be constructed at a high elevation in the community. This option would allow for gravity distribution if there were resources to construct a distribution system. Alternatively, multiple communal tanks could be implemented in clusters to serve groups of families. After community meetings and assessment of land ownership in the community, EWB-WPI was unable to find any usable land for purchase. For a shared tank the community would need to buy the land as a community; a strong resistance to implement this plan has been expressed by the community.

Second Assessment Trip

Based on the data analyses conducted over the course of the 2010/2011 academic school year, a 2nd assessment trip was deemed necessary. The group felt that they were not yet ready to complete an alternatives assessment at that point in time because of the following data/information gaps:

- Needed detailed information on each of the houses in the community in order to have a better understanding of their specific needs.
- Needed to know if there was land available for the community tank.
- Needed a more comprehensive materials assessment.
- Needed more rainfall data because of its primary focus in the project.
- Needed to conduct additional water quality tests.

With all this in mind, the following objectives and corresponding activities were laid out for the 2nd assessment trip:

- Individual home assessments for 36 of the 41 homes (5 homes chose not to participate)
    - Home assessments were conducted to obtain a comprehensive understanding of each of the homes in the community. With the information from these assessments, the group intended to add to the existing model, understand the specific needs of each house, develop blueprints of each house, have general information about each house, know how much water each house uses daily, and have the overall condition of the house. In order to accomplish this, the following data was collected:
        - Interviews with the family members (i.e. Family name; Size of family; How many months they go without water; How much water is used daily and for what purposes)
        - Measurements of the inside and outside of the homes including roofs, gutters, and existing water tanks.
        - Took pictures and drew rough outlines of each house.
        - Completed in-depth drawings of the current roof system including: Roof quality; Slope of roof; Tree coverage; Quality of current gutter system
    - The team made a map including all the homes in the community.
- Determine if there is land available for a community tank
    - Took a tour of the community and viewed land plots large enough to house a community tank. However, these land plots were either already owned or for sale.
    - Met with a lawyer specializing in land transactions to determine the necessary steps to acquire land to build a community tank on.
        - The community would have to purchase the land as a whole.
- Conduct a materials assessment
    - The group visited five different construction stores and recorded prices and relative quantities of materials necessary for the construction of rainwater catchment systems.

- Collect more rainwater data
    - Rainfall data was obtained from an anonymous source ranging from 1979 – 2010.
    - Because rainwater was the primary focus of the project, the group invested in a rain gauge. This rain gauge was purchased through the University of San Carlos, and is set up close to the community. The gauge records rainfall daily and the group receives this information via email from the sponsoring NGO.
- Water quality tests
    - The team was able to further test the water quality of the local spring (Finca) and rainwater from three water catchment tanks. E-Coli and Fecal coliform tests were conducted.
    - Chose three houses to serve as pilot homes for implementation during the second assessment trip
    - The community government chose houses with different structural conditions and water demands for design and implementation on the next trip.
    - During a phone call with the community after the trip, EWB-WPI learned that some of the families do not own the property. EWB-WPI was not sure if it was appropriate to build in rented land and it was not possible to work out an agreement over the phone with the actual property owner of one home, so EWB-WPI planned to construct on only two of the three homes in January 2013.
    - These homes will serve as models for the development of individual systems for the rest of the community. The houses, both categorized by the team as average condition, have very different characteristics and will provide adequate data for post-implementation analysis. With these variations in structure and size, the team was able to effectively test the plausibility of designs.
    - From the home assessments and future monitoring the goal was to find an appropriate water consumption rate for the families in the community. Unfortunately, no trend was determined to relate number of family members and water consumption across the community. After this trip we created an excel computer model that estimates the amount of water in a storage tank based on average rainfall data, roof area, water consumption, and storage volume.

2.4.0 Trip Description

Over the course of an eight day implementation trip in Guatemala, EWB-WPI improved water harvesting systems on two homes in the community chosen during the last assessment trip. These two homes will be monitored over the course of the next year helping EWB-WPI understand the accuracy of a dynamic model created to help engineer individual systems for each family. EWB-WPI collected a significant amount of information through construction that will aid all future implementations. A thorough assessment of several construction stores in San Cristobal conducted with a few community members allowed EWB-WPI to gain an understanding of the prefered stores, and material brands and types. During construction EWB-WPI worked collaboratively with members of the community throughout the whole process.

EWB-WPI has received help from CeCEP when organizing lodging and transportation over the past few years. On this past trip however, EWB-WPI strengthened this relationship with CeCEP by having many discussions with Sucely, the head of CeCEP. EWB-WPI felt that her opinion was valuable because she understood the objectives of the project and the thoughts of the community members, considering both when she spoke with EWB-WPI. Sucely also helped EWB-WPI set up a monthly monitoring system with a local individual who she has been working with through CeCEP. By the completion of the trip, EWB-WPI had confirmed with Sucely that CeCEP will be taking over as the main NGO for EWB-WPI.

As EWB-WPI considered the following trip and further implementation, a surveyed was completed of the whole community to create an updated map. When EWB-WPI mentioned that that homes needed to be chosen, there was hesitation. This is understandable because there are 35 homes all interested in working with EWB-WPI during the

next implementation, but EWB-WPI asked that only six homes be picked. For this reason rather than the COCODE choosing the homes, EWB-WPI suggested a lottery be performed with a few members of the COCODE present. Each home was entered and six homes were drawn. EWB-WPI then spoke with each of the six families executing an assessment of the houses and gained a better understanding if their needs in preparation for implementation.

As a result of poor communication and possibly misunderstanding arising from communication with the community being conducted through Michelle Banks, EWB-WPI work closely with the whole community holding three meetings to eliminate these confusions. EWB-WPI spend time explaining the organization, the objectives of our project, and expectations for the project. For example, several other governmental sponsored organizations have completed projects in the Guachthu'uq and the surrounding communities. This lead to the community believing that money was no object. EWB-WPI needed to explain that all money used to travel and implement systems was raised by a handful of students during the year. While this trip was short, the presence of EWB-WPI within the community and during the community meetings helped solidify a stronger relationship with the community individuals. Towards the end of the trip, EWB-WPI was told that the community of Guachthu'uq had formed a Water Committee in the community to collaborate with our group in the future. The community members understood that this is a long-term project and formed this committee to help facilitate education between implementation and labor during implementation.

2.5.0 Community Information

2.5.1 Description of Community

Demographics

Guachthu'uq/Rehquensal is a rural Mayan Poqomchi community of 37 houses, about 280 people, located about three kilometers west of San Cristóbal Verapaz. While many women are monolingual in Poqomchi', many community members speak both Spanish and Poqomchi'. The residents are a mix of Protestant Evangelicals and Catholics and are involved in traditional Mayan spirituality as well.

Community Infrastructure

There are five local communities that make up one micro-region, all connected by one road. These communities, in order from the top of the mountain to the bottom, are Pamac, Rexquix, Guachthu'uq/Rehquensal, and Las Arrugas. There is one mostly unpaved road that goes through each community starting at San Cristóbal and ending at the highest community of the micro-region (Pamac). Most families in Guachthu'uq do not own a transportation vehicle or bicycle, so walking is their primary means of transportation. There are power lines running up the road but only a couple of community members can afford or have access to electricity in their homes. The houses are spread throughout the community with most houses located approximately 50 yards from the next one, though some areas have two or three houses within close proximity. This typically occurs because one of the family members married and built a house next door to their parents. Most houses in the community are made of wood and have iron corrugated roofs.They have dirt floors that often flood in the rainy season. The trip walking from San Cristobal to the first home part of Guachthu'uq is about 45 minutes uphill and the return trip is 20 minutes downhill.

Work

The women primarily take care of the home although a few (particularly younger women and some girls as young as eleven years old) work in the town of San Cristóbal as domestics. The women and children gather water every day and tend to the house, while the men gather wood for fuel. Some men might travel to work at a large farm for weeks at a time. Their main year-round water source is located at a private "finca," or estate, at the bottom of the community. There, the women do laundry and gather drinking water with their children. Depending on where the

family lives, it takes anywhere from a half-hour to an hour and a half to bring water to their homes. Most of the families do not own much land, if any at all, so they usually buy their food and wood from others who own land. There is almost no livestock in the community. The average family may own one or two chickens at most, which provides eggs and meat occasionally.

Education
Children attend school when they are not working with their parents. The children from Guachthu'uq/Rehquensal have two primary schools to choose from. One is in the neighboring community of Rexquix (uphill) and the other is in Las Arrugas (downhill). The schools terminate at sixth grade and boys are more likely than girls to reach the higher grades (4th- 6th). Most children do not attend school after the 6th grade, but if they do, then they must travel to San Cristóbal and attend the schools there. Some children drop out for a year or more to provide assistance to their families. For this reason, ages of students in each grade are not consistent. Information on health and hygiene are rarely covered in the schools. The children's education revolves primarily around basic math, and reading and writing Spanish.

2.5.2 Community Relations

Due to this miscommunication that EWB-WPI was unaware of, very few families attended the first community meeting held. Once EWB-WPI explained the intent of the implementation and the families explained their understanding, a second meeting was scheduled and many more families attended. During this meeting EWB-WPI explained the project would implement plastic tanks and gave the community the ability to vote on the payment option. The two options given were as follows: each family would pay the same amount regardless of the type of implementation or each family would pay 5% of the cost of the system after implementation. The community voted to that each family responsible for paying 5% of the system cost, which we estimated to be around 300Q. The community explained that they felt that if some families need more extensive systems, that family should be expected to pay more.

During the implementation on Roberto and Cristobal's house, the communication was excellent. EWB-WPI hired a translator who could speak English-Spanish-Pocomchi allowing the translation of any technical terms. Ms. Elgert could also translate from English-Spanish, which was very helpful since many of the community members could speak varying degrees of Spanish. While building, EWB-WPI students would explain the necessary additions and how they should be constructed. If the homeowner or any of the three to four men helping had a different idea, they would explain their idea of EWB-WPI students. Often there was a discussion to understand and form a conclusion on how the construction would be conducted, followed by one or two EWB-WPI students helping three or four community members construct that part of the system. During all discussions, EWB-WPI students allowed the community members to explain their thoughts and EWB-WPI students either agreed or taught why it was not possible to build the system in the suggested manner. While EWB-WPI provided the majority of the funds to purchase the materials for the two rain water harvesting systems, the families and others in the community provided labor during construction. For example, EWB-WPI wanted to build a concrete base on which to place the 2500L tank. While we had plans as to how the base should be built, after explaining our intent, the four men from the community began to discuss and plan based on their construction experience. They were even teaching us what to do at some points.

Key Contributors
Political Government - The current COCODE (Community Development Council) meets regularly with the entire community (both men and women) to generate and discuss solutions for issues that affect them. In general, the EWB-WPI project team found the COCODE to be very organized. The president of Guachthu'uq's COCODE is Don Domingo. He is also the Vice President of the COCODE for the micro-region. The community recognizes that their limited access to water is also an environmental issue, and they are committed to the creation of a

program that is both sustainable and has a positive impact on their environment and health. They are aware of deforestation in the region and the contamination of natural resources. Meetings with the COCODE have enabled us to organize community contributions in terms of labor, tools, and some materials (e.g., clay and wood) to the EWB-WPI project. Overall, the COCODE enables our project team to communicate effectively with community members.

CeCEP - In Guatemala, EWB-WPI has established a strong relationship with a local NGO servicing the local Pokomchi community through social and educational services: CeCEP (Centro Comunitario Educativo Pokomchi). As Pokomchi is a Maya dialect which many of the Guachthu'uq families speak in their households, EWB-WPI's project falls closely within the objectives of CeCEP. CeCEP is located in San Cristobal and provides logistical support to EWB-WPI including transportation, translators, and housing. Sucely Ical Lem is the head of CeCEP and has been a great resource for any cultural questions that arise.

Most residents of Guachthu'uq speaks Poqomchi (a Mayan language). While one or more of the travel team members spoke Spanish, EWB-WPI hired two translators, Gerson and Abelino, who can translate from Pokomchi to English. EWB-WPI has been working with both translators on each of the previous trips. This provided a great advantage since both recalled the project and its history, decreasing the amount of explanation that was required at the start of the trip.

2.6.0 Project Summary

2.6.1 Project Description

EWB-WPI is working in Guachthu'uq, Guatemala to increase their access to clean water. The project began to implement individual rainwater harvesting systems. EWB-WPI aims to provide all of the members of Guachthu'uq with clean drinking water year round.

2.6.2 Summary

EWB-WPI implemented on two different homes. In the first home Roberto was the head of the household. The house has a total of four roofs; three of them are part of the main living structure and the fourth is isolated covering a tank. In the second home Cristobal was the head of the household. The house has three roofs making up two different structures, one of which is separate and is built over one rainwater storage tank.

At Roberto's house, EWB-WPI build a concrete base close to the main house structure to hold a tank. The tank was then connected to the roof through gutters and piping. A dome screen was made and placed at the end of the gutter to help prevent debris from entering the piping. This created a second separate rainwater harvesting system for Roberto's household in addition to the existing isolated system. On the side of both tanks a clear tube was added so that the level of the tank could be visually seen. EWB-WPI hopes that this component of the design will help the family limit consumption during the start of the dry season.

At Cristobal's house, EWB-WPI added a tank to a base that was built for their current tank. While this placed two tanks side-by-side, EWB-WPI did not connect the two systems. This created one system made up of the original tank connected to the separate roof and a second system made up of the new tank connected to the roof of the house structure. Gutters and piping were added to complete the second system and dome screens were added to both. Clear tubes were also added to both tanks. EWB-WPI explained the importance of taking from both tanks to limit overflow.

2.6.3 Difference Between Planned and Actual Implementation

While EWB-WPI encountered many differences between the Planned and the Actual Implementation, many of these differences were quite small. For example, when EWB-WPI students assessed the location for the cement base, the slope of the ground was actually much steeper than expected, requiring the base and tank to be relocated. After speaking with the homeowner however, a conclusion was reached to take down a section of the house and move the whole system away from the slope and into the home. While this didn't change the overall design by much in the end, EWB-WPI did need to reassess and determine new options. There were also challenges due to a lack of information from the previous assessment trip. For one of the houses, EWB-WPI was adding gutters to the main house structure so that the rain could be collected. However, the house ran parallel with the road up the mountain, and as a result the gutters would have been tilting slightly down hill. During the last assessment trip, the house was never checked to be level, and while planning, EWB-WPI made the assumption that it was. On sight however the students determined that the house was in fact not level and the tank was placed uphill from the house. Deviating from the TAC approved plan, EWB-WPI raised the corner of the roof by about eight inches on the downhill side in order to have the water flow the correct direction down the gutter.

EWB-WPI also chose to not implement the first flush system as stated in the Pre-Assessment form. The design included an automatic release to help prevent stagnant water and bacterial growth. Due to the length of the trip, EWB-WPI did not feel that there was enough time to properly educate on the importance of cleaning the first flush system. While assessing each home, EWB-WPI also realized erosion is a great worry for these homes build on a mountain with little vegetation around and was concerned that the automatic release would increase erosion.

The largest challenge that EWB-WPI faced on this trip were the misconceptions that the community had developed during time away. As a result, during the first community meeting on Tuesday, very few families attended and we needed to schedule another meeting the following Saturday. While this did not delay our construction on the two homes, it did delay our ability to assess homes for the next trip. EWB-WPI also faced challenges during construction. Since the community was a 50 minute walk up a mountainous dirt road, when it was determined that an additional part was needed, a large amount of time was required to purchase it, or construction had to wait until the next day.

The project timeline was affected since construction on each house was only expected to take a few full days, but instead took several half days due to missing parts and unexpected challenges. While EWB-WPI was able to complete all the goals set for the trip, the timeline itself did not run as originally planned. Instead, assessment and monitoring originally scheduled for the latter half of the trip was started in the first half by part of the travel team to make up for the extended construction.

2.6.4 Drawings

During the trip, we created several drawings in the community. The first set of drawings was a map of the community. This was important because over the time since our last trip in 2011, families have moved and home locations have moved. We created a community map at the same time that we did the lottery for the next set of implementation homes. See Appendix A for community map.

After the homes were selected, we performed in depth assessments of the first six of the selected homes. For five out of six of the homes, two teams of two went around each home. One team took photos of the home (one person taking the actual photos, one person drawing the photo location). The second team did drawings of the home with measurements (one person drew the house and recorded measurements, and one person physically measured).

2.6.5 Operation and Maintenance

To ensure that the project continues to be sustainable in the future, EWB-WPI only purchased materials from local construction stores. This allows family members to have access to the materials needed to replace any broken parts. The plastic tanks are estimated to last 35-45 years without any abnormal wear and tear as stated by the supplier, Rotoplas. The added gutters and piping were made out of plastic and PVC. During all steps of the construction, EWB-WPI ensured that the homeowner was helping. This enabled EWB-WPI students to teach important maintenance procedures while working, such as the importance of removing leaves from the gutters to keep the rain water clean as it passes through the system.

EWB-WPI also led three community meetings to help explain the background of the organization. Through emails and phone conversations over the past year, there was confusion as to how much each community family must financially contribute and the general plans for the project. The community also didn't fully understand or remember the reasons why the project only enables a handful of families to receive systems each trip. EWB-WPI explained again that our organization is composed of college students who raise all the funds for the trip during the year while not traveling. Previous organizations, such as the Peace Corps and the Spanish Embassy, had large grants from the government enabling the construction of different projects to occur at once. These whole community meetings were essential for EWB-WPI to clarify and fully explain any misconceptions.

EWB-WPI also set up a monitoring system which will continue throughout the year with a member of CeCEP. EWB-WPI has hired him to meet with the two families who received the implemented systems as well as 10 other families, some of which we will be working with during the next implementation trip. He will meet with them once a month to ask general questions about the system as well as their water consumption. EWB-WPI has also provided each family with a calendar and has asked them to draw a tank and mark it with the water level. This will help our chapter monitor how well the systems are working or if any modifications are needed in the designs.

2.6.6. Education

In Guachthu'uq our community members have showed that they have a good understanding about how their current water supply is not the most sanitary. Also, they understand the importance of cleaning the rainwater harvesting systems. The role of our chapter has moved to enforcing and further educating our community members about how often to clean their systems. While construction the two pilot projects we talked with the home owners and talk about cleaning the gutters and tanks. Also, we implemented a simple screen design to reduce the amount of plant debris that goes into the tanks. The home owners really liked the screen idea. This shows that they want to keep their systems cleans, but they just don't always know the most effective ways to do so.

During a community meeting we presented posters and talked about the basic ideas behind increasing the volume of water that the harvesting systems collect. We talked about increasing roof area and gutters. Our team believes that they may not fully understand this concept; we plan to more effectively talk each family through our reasoning behind the designs of our harvesting systems.

Our team plans to continue educating on the importance of cleaning the systems and we are researching the most culturally acceptable treatment plan for the storage of the water. Also, we hope to indirectly educate the community members about water conservation by adding clear tubes to the sides of the existing tanks in hopes that the families will conserve more water during the dry season if they are able to see the level of the water in their tank.

2.7.0 Monitoring Approach

2 7.1 Current project monitoring

The monitoring process began during the last few days of this implementation trip, as the travel team completed more in depth surveys (both physical measurements and a questionnaire) of homes that are scheduled for the next implementation. The homes that were chosen to be implemented on next were chosen by the COCODE of Guatchu'uq, in a lottery system where all the names of the participating families were placed into a drawing and 10 homes were chosen randomly to be those that will receive systems next. EWB-WPI projected that the next implementation trip will realistically allow for seven homes to be completed and so those next seven homes were assessed during the end of the implementation trip. The knowledge from the construction during this trip, of what dimensions of homes and other information needed for the design process, was important in determining any new measurements or data that needed to be collected from these home assessments. Also the information from the families was also altered during these home assessments.

The home assessment questionnaire (Appendix B) was completed at the seven homes that will be receiving the next systems. The conversation about water usage was important for the consumption data and to compare that data to the previous assessment trip data. Questions about any plans for future construction to their homes and what they wanted to have implemented on their homes was also discussed in order to better design systems for these homes so that they will be best accepted into the homes.

In order to continue optimum communication with the community of Guatchu'uq during the time in between trips, and to strengthen our partnership with the CeCEP cultural museum EWB-WPI travel team established an employee of the museum to visit Guatchu'uq on a regular basis. He will be providing EWB-WPI with any information or communication from the families of Guatchu'uq as well as providing the community with any information from the team from the US. Also, he will also be asking supplemental questions about water usage during the year so that the data that has been collected during the past two trips can be revised by this regular data that EWB-WPI believes will be more accurate.

2.7.2 Monitoring of past-implemented projects

(refer to listed projects in Part 1, Section 5.0 of this report)

- Functionality Status Supporting Information
- Periodic Maintenance Supporting Information
- Demonstration of Knowledge Transfer Supporting Information

2.8.0 Community Agreement/Contract

EWB-WPI worked to update the previous community agreements during a discussion-based meeting during the trip. One of the topics discussed was the payment plan. During the previous trip, the community agreed to raise the funds as a whole. EWB-WPI brought this point up for discussion because no money had been raised over the year and a half. The Memorandum of Understanding was not fully translated to Spanish however due to time constraints during the trip. Since all changes were made during a meeting and minutes were recorded, EWB-WPI feels that these changes are accepted and will be followed in the future. This MOU is shown in Appendix C and will be translated so that a hard copy can be brought on the next trip. This MOU has sections describing the roles of the community, the COCODE, and the EWB-WPI team during the project.

This revised MOU further defines roles of the community, EWB-WPI, the COCODE, and the newly created Water Committee. Specifically, this document addresses financing for the project, and what each family must contribute in order to receive a rainwater harvesting system.

The additions to the MOU detailed what each family needed to provide at the time of implementation. The family receiving the system must pay 5% of the construction materials cost for whatever material their home requires to receive water year round. This percentage can be lowered through in kind donations of the homeowner for any materials we would otherwise have to purchase. These donations would lower the total materials cost of the project, therefore lowering the 5% cost. It is also expected the labor is provided. During our most recent trip, community members worked out a deal to help each other out with labor on each others homes. EWB-WPI will not specify who provides the labor, and that detail is up to the homeowner.

With the COCODE/Water Committee we detailed our new communication plan with the community to ensure success over the long-term. We are currently planning on monthly phone calls or emails with those involved with the project in Guatemala to continue our "presence" in the community even when we cannot be there in person. With the community, we set guidelines for them to address any suggestions or concerns with the project directly to EWB-WPI, through CECEP, through Alvaro, or through the COCODE/Water Committee. Each of these parties will be in continued contact with our group.

Finally, we set out a strict penalty for the a homeowner if they decide to sell their tank that we provided to them. This has happened once or twice in the community with other projects, and we are trying to ensure our group is not taken advantage of (and the tanks are actually used for their intended purpose).During our next trip, potentially in May 2013, one of our top priorities will be to explain and sign the new MOU.

2.9.0 Photo Documentation

Construction of the Cement Base at Roberto's House

Discussion about the Piping Design at Roberto's House used to connect the gutter with the tank

Cristobal and his whole family helping during construction

Cristobal carrying his new tank with support from others

A Screen made to cover the down spout of the gutter leading to the piping

The community created a Water Committee while we were in Guatemala. Shown is the ACTAS book that was purchased for all meeting notes and a stamp that will be used on all official documents related to the water project. Each family in the community contributed 2Q to buy the book and stamp.

2.10.0 Lessons Learned

Our team learned valuable lessons on this trip. We gained a better understanding of the technical skills, the social dynamics of the community, and our own student team dynamics required to complete our project. Through implementation and collaboration with the community, we learned the best methods of construction and how to work with the materials locally available to us. We also learned how to work in the field with community members efficiently and effectively.

Working side by side with community members also helped us to learn more about how our project will impact the community. We learned that this rainwater collection system will enable the community to better provide for their families, improve their standard of health, and free more time for education.

Finally, this trip challenged our own teamwork skills. For many of our travelers, this was their first trip working in a different country. A rapidly-changing project, in an unfamiliar environment can put stress on team dynamics, but we learned how to improve our team communication skills and flexibility. This will be an extremely valuable learning experience for all travelers in future EWB trips which will be applicable to any career.

2.11.0 Project Status

Implementation Continues	Monitoring	Cancelled
X		

2.12.0 Next Phase Of The Program

EWB-WPI plans to travel this May to conduct an assessment trip, our team hopes to evaluate the most effective way to implement in more home during each trip and maintain the proper quality that we would like to hold our project to. We will also solidify the monitoring system and taking water quality tests. EWB-WPI hopes to then travel every May starting in 2014 implementing on at the very least six homes each time. Each trip will continue to emphasize monitoring to ensure that the designs are helping each family in their individual needs.

2.13.0 Professional Mentor/Technical Lead Assessment

2.13.1 Professional Mentor/Technical Lead Name (who provided the assessment)

Patricia Austin, P.E.

2.13.2 Professional Mentor/Technical Lead Assessment

I have been working with the student chapter for over 2 years, and travelled with them in January. I have an extensive background in watershed management and water resources engineering. For me, the trip reinforced the student's previous assessment that a community system is not feasible for Guatchu'uq. The reasons include land ownership and other political issues, the physical layout of the community, and of lack of local water resources. I believe that the plan that the students have developed is the only feasible approach for this community. In addition ,on this trip the students have a developed a very strong relationship with the community and laid the groundwork for an ongoing relationship that includes data collection to provide very useful assessment information. I think this project could serve as a pilot to provide information for decentralized approaches for water needs in other communities.

The major goal is to provide water using rain collection to decrease the amount of time the women and girls of the community must use to walk to the river for water and reduce the need for some families to hire contractors to truck water up from the river. It is also very likely that the rainwater will be of better quality than the river water. The families that received water tanks were very, very pleased to get a tank. We are working, and will continue to work on the water quality issues. We did preliminary water quality testing on a previous trip and are developing water quality testing plans for the next trip. We have developed first flush systems that we will work to implement on the next trip. Installing roof collection systems is a major accomplishment for this community.

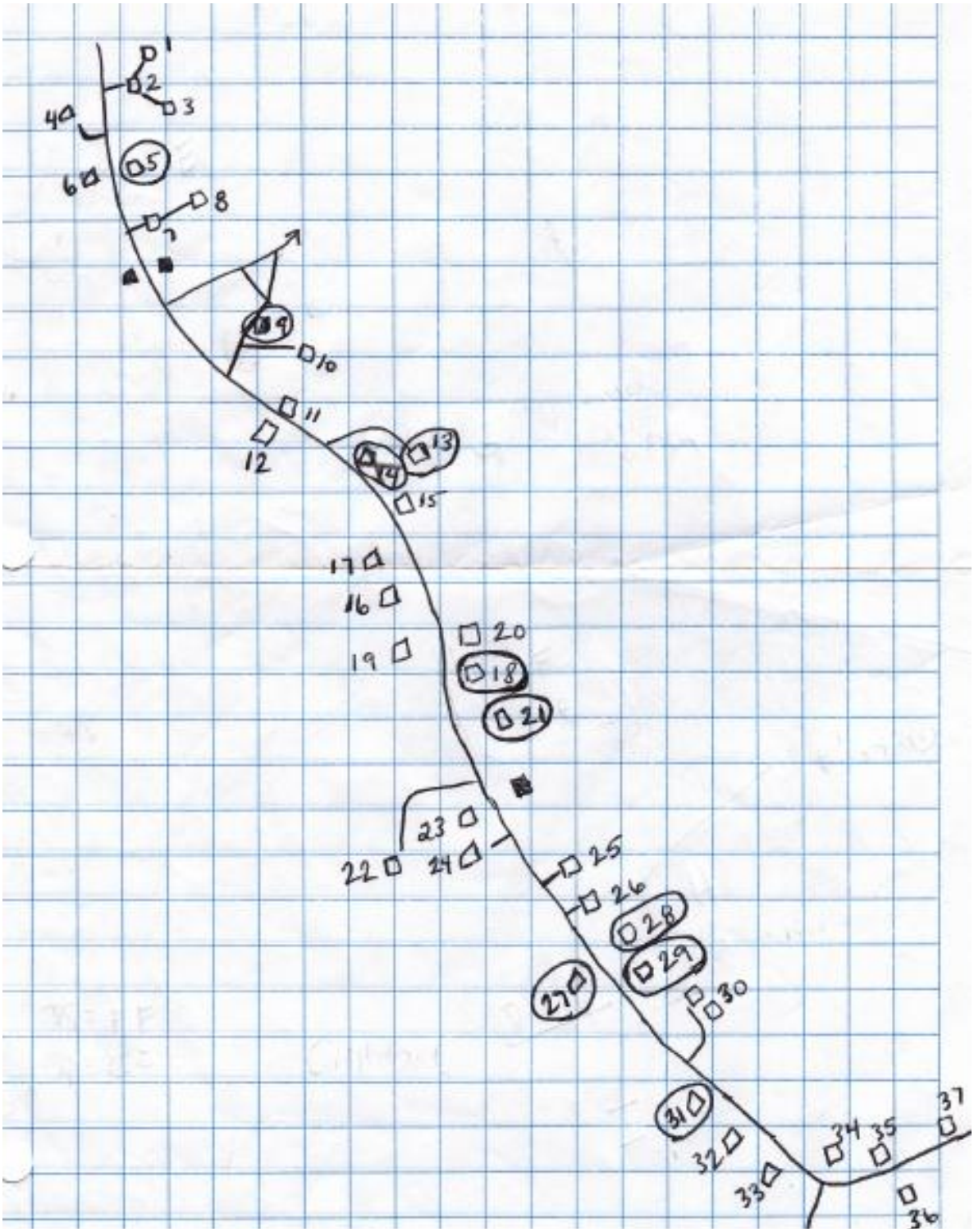
The students worked very hard during our trip. They dealt successfully with a number of problems that arose as we worked in the community to build our systems. They were very respectful of the local community, and I feel that community members had a very positive impression of our team. Overall, the implementation trip has provided a real input of positive momentum for the project. Although we do have a long timeline for implementation, I am very encouraged about the overall feasibility of our project.

It was a pleasure, and an honor, to work with these students.

2.13.3 Professional Mentor Technical Lead Affirmation

I travelled with the students on the implementation trip. I believe the project is following the best possible course to provide improved water for this community.

Appendix A – Current Map of Community



List of Families

1. Oscar Vicente Laj
2. Mateo Caal Cal
3. Julio Jalal Latz
4. Estanislado Caal Nio
5. **Filomena Gualim Caal**
6. Carlos Jan Yuja
7. Jose Emiliano Sis Xuc
8. Cristobal Laj Cujoc
9. **Cristobal Lem Suran**
10. Santiago Lem Moo
11. Sergio's Fathers House
12. Raul Coc Chub
13. **Yermo Jom Gualim**
14. Juan Chah Laj
15. Leandro Yuja Lopez
16. **Elvira Cal Chun**
17. Edgar Etrain Yuja
18. **Domingo Caj Pop**
19. Victor Caij Cu
20. Mario Enrice Chul
21. **Migel Caj Pop**
22. Terease Yuja
23. Abelino Caal Cal
24. Cerapio Chub
25. Emilio Che Gualim
26. Roberto Chacoj
27. **Cristobal Coy Max**
28. **Alfozo Xona Jul**
29. **Ricardo Gualim**
30. Erlinda Velazque
31. **Marcela Cal Moran**
32. Emilio Cualim Ical
33. Ajelina Quej Cal
34. Abelina Gualim Pop
35. Gonzalo Vinoch
36. Luis Jilberto Cojoc Yuja
37. Valeriano Cualim Sis

Appendix B - Home Assessment Questionaire
Questions:

1. How many people (kids and adults) live in the house?
2. How many containers are used each day during the dry and wet season?
3. How much tank water is used each day for drinking, cooking, laundry/cleaning, bathing
4. How much finca water is used each day for drinking, cooking, laundry/cleaning, bathing
5. How many months do you go w/o water in your tank?
6. Does/when the tank overflow?
7. Do you prefer taste of finca or tank water
8. What do you think you need to have for your system to have clean water year round?
9. Do you have any plans for construction for the next year and a half?
10. Then with each home we talked about monitoring, how the homes were picked via lottery and made sure they would be able to afford and what they would have to pay(5% and labor)

Notes: 1 tonele= about 5 gallons
tinaja = about 2.5 gallons

#5 – Filomena Gualim Caal

- She bought the house from her brother, and he is coming back at some point(not sure when) to take his tanks with him. So she will not have any tanks when he takes those
- building on right side (when looking from road) was her old kitchen that she moved into the porch area
- okay with 5% and labor, know about monitoring

How many people (kids and adults) live in the house?

5 kids and 3 adults

How many containers are used each day?

use tank only to drink and finca to wash
dry = go to finca until tired, small 2.5 gallon jug each time per person
wet= use tank water to drink and wash clothes but still not enough, need to go to finca for the rest

How much tank water is used each day?

dry= no water in tank, get four 2.5 gallon jugs per day to drink, cook, wash dishes(clothes always at finca)
wet= depends on rain, use one 20 gallon tonele
the tank gets filled sometimes and then lasts for 1-2 weeks

How much finca water is used?

drinking – 1.25 galons (half a 2.5 jug) from tank
cooking – two 2.5 gallons
laundry – when no water they go to finca, everyday, use about 1 tonel(20 gallons)
bathing – five 2.5 gallons every three days
go to finca for everything in the dry season and use roughly the same amount

How many months do you go without water in your tank?

Go about 5 months without water, when it does they will stop doing laundry when it gets low and go to the finca

Does/when the tank overflow?

4-5 times overflow during end of may, june, july, august

Do you prefer the taste of the finca or tank water?

doesn't matter, just want water. She boils the water

What do you think you need to have clean water year round?

improve gutter to move water and new tank because they are going to be taken by brother at some point . would prefer a tank on the left of the house

Do you have any plans for construction for the next year and a half?

no construction plans

#9 (Midwife) Cristobal Lem Suran

- she has tons of laundry and works late hours and is elderly
- there are lots of fights near the places where she washes clothes because people don't keep it clean and put soap into the water which ruins it for other people. The finca has problems because not everyone takes care of it.
- said she was ready to start saving and be able to pay 5%
- has two tanks but only use one because the other doesn't have a gutter

How many people (kids and adults) live in the house?

5 people(2 kids),

How many containers of water are used each day?

wet: four 2.5 tinajas for washing dished, drinking, eating

clothes – 3 times per week, 10-12 2.5 tinajas

when it rains a lot they can do laundry with tank water, they'll take advantage of it and use more water

dry season: 4 turns to 2 tinajas

-conserve about drinking coffee everyday,(ie: non necessary things)

How much tank water is used each day?

dry: 1 tinaja from tank only for eating(sometimes from tank or finca)

wet: 4 tinajas for everything

How much finca water is used each day?

dry: up to 10 tinajas ->pays 12/13 year olds to bring up to their house because they can't (2Q/tinaja)

they sometimes try to go but can only get 3 or 4 at a time which isn't enough

How much tank water is used each day for drinking, cooking, laundry/cleaning, bathing?

drinking and cooking: 1.5 tinaja

laundry: 3 times/week 10-12 tinajas each time

bathing: kids everyday with 1 tinaja total and 3 times a week for adults with 1 tinaja each (adults everyday when rain season)

taught/teaches to keep kids healthy by bathing them everyday

How many months do you go without water?

march, april, may

Does/when the tank overflow?

june july – once in a while only in those months

Do you prefer the taste of the finca or the tank water?

tank is kind of backup(wash with chlorine every 2 months)

finca they think is fine to use

What do you think you need to have clean water year round?

want more gutters because they lose a lot of water now, and connect them to their tank. They don't use the extra tank because they don't have those gutters. Because not everyone takes care of the finca they prefer their private water collection because they know it's clean

Do you have any construction plans for the next year and a half?

plan to expand the larger house to the right away from entrance (alvaro will take pictures) because one adult is married and building off house. 2 other adults(their kids) come part time to the house because they work in the city

#27 – Cristobal Coy Max

- only has a base, family living here before but they took the tank with them (currently use base to sleep on)
- other people who owned the tank moved to another community, so they don't own the land they rent it from the owner who they have been working for 30 years and have been living in house for about one year. Right now they don't have plans to move because they have good relations with the owner because they have been working with him for so long

How many people (kids and adults) live in the house?

4 adults, 6 kids

How many containers are used each day?

4-5 toneles per day (wet)

pay someone to bring up, can cost up to 85Q per week(1Q per time), which they can't really afford but they can't handle doing it themselves

use more in summer(dry)because hot: up to 7 toneles

How much tank water is used each day?

no tank

How much finca water is used each day?

drink, cooking, dishes – 3- tinajas(2.5 Gallons)

bathing – 7 toneles/week (kids everyday)

laundry, cleaning- 8 tonels/week

How many months do you go without water?

march, april, may – none so they need to go to finca

when no water at their house they take 10-15 trips per day

Does/when the tank overflow?

no tank

Do you prefer the taste of the finca or your tank water?

finca is better than their tonele because when cars pass on the road the dirt settles in gutters and makes water dirty

What do you think you need to have clean water year round?

gutters, tank; not a final solution because they will still need to carry water but it will save money to use for education

Do you have any construction plans for the next year and a half?

sister moving in so may build another house where the chicken coup is

#18 – Domingo Caj Pop

- wood house is son-in-law
- could put tank in sitting area but behind might be easier
- could be behind or on side as well
- do they share water w/ son in law? Says they share with the 3 houses
- it's be really good to have canals
- what they gather here(just a few toneles and other random buckets) is just for eating and drinking
- observation: they had bought a jug of purified water that was in their house
- 1 tonele = about 5 gallons

How many people (kids and adults) live in the house?

(possibly 4 or 5?)

How many containers are used each day?

toneles: about the same for dry and wet because just have these containers to collect water
when no water theytake 6 trips to fill tinaja and they conserve water only for eating and drinking
always wash clothes in finca (2 toneles per day)
bathing : 1.5 tonele por media

Does/when the tank overflow?

their containers always overflow

Do you prefer the taste of the finca water or the tank water?

kids prefer finca taste

What do you think you need to give you clean water year round?

want tank, would prefer it behind the house (far side from sitting area)

Do you have any plans for construction for the next year and a half?

plan to bring house out to the edge of the sitting area where the meetings where (extend the fancy house out)

#29 Ricardo Gualin

How many people (kids and adults) live in the house?

Home has 1 child and 4 adults

How many containers are used each day?

a. Wet - 8 containers/day (20 gallons)
b. Dry - 15 containers/day --> (summer) (37.5 gallons)

How much tank water is used each day for: drinking, cooking, laundry/cleaning, bathing?

If a tank is full can use for about 2 months until empty.

How much water is used from the finca each day for: drinking, cooking, laundry/cleaning, bathing?

5 containers/day (12.5 gallons/day) to cook and in the summer the finca is used to wash clothes.

How many months do you go without water in your tank?

4 months; March - June

Does/when does the tank overflow?

It never overflows

Do you prefer the taste of finca or tank water?

No preference

What do you think you need to have clean water year round?

Canals and tanks

Do you have any plans for construction for the next year and a half?

There are not plans for construction.

Appendix C - Updated MOU in English

COCODE and Committee of Water Systems Guachthu'uq with support from Engineers Without Borders Agreement

We agree, as members of the governing body of Guachthu'uq, to work with the Engineers Without Borders student chapter from Worcester Polytechnic Institute (EWB-WPI) to the best of our abilities. This agreement to work with EWB-WPI centers on providing general organization of the community. We understand that the implementation of any type of water system in the community will need to be monitored. The responsibility of watching the development of the community of Guachthu'uq around the project lies with the Cocode and Water Systems Committee. Assistance with communication between individual households, the general community, and EWB-WPI is crucial for the success of the project. We agree to relay information, concerns, questions, and suggestions between the Guachthu'uq community and EWB-WPI. This is a community based project, and the inputs of the community are extremely valued. The Cocode and Water Systems Committee is responsible for passing on the opinions of the community. As leaders of the community, we understand that we will also have to pass on project updates received from EWB-WPI. These updates will be received through monthly phone calls or emails with EWB-WPI and through monthly monitoring.

We also understand that labor and monetary support of the project will be contributed to some degree. Funding the project, including the pilots, will require saving and fundraising by the individuals. We understand that communication with the local municipality of San Cristobal, Alta Verapaz, including application for government funds, will be directed and completed by the members of Guachthu,uq and the Cocode without the direct involvement of EWB-WPI. As decided by the community at the meeting on January 5, 2013, individuals receiving a water system will be responsible for 5% of material costs as well as provide construction labor. This is a strict number set by Engineers Without Borders Nationals.

We understand that this pilot project is a test and it may not be successful when EWB-WPI first implements it. It will take time and communication from all parties, the community of Guachthu'uq, the Water Systems Committee, the Cocode, and EWB-WPI, in order to make adjustments so the designs can be perfected. Support of the pilot project will be demonstrated by the Cocode. If there are changes in attitudes toward the project, by individuals, the Cocode, or the entire community, they will be communicated to EWB-WPI either directly or through Cecep and Alvaro.

Community Project Agreement Form

We plan to work with the Engineers Without Borders student chapter from Worcester Polytechnic Institute (EWB-WPI) to the best of our ability. We will provide labor and monetary support towards the completion of the projects. Each family receiving project implementation will provide 5% of materials cost associated with the project as of January 5, 2013. It is required that the community organizes labor on all implementation trips. We understand that we have to be dedicated to the project by conveying any concerns, questions, or suggestions about how to make the project more applicable to our community to EWB-WPI or the Water Systems Committee. This is a community based project, and the inputs of the community are extremely valued and necessary to the success of the project. We understand that communication with the local municipality of San Cristobal, Alta Verapaz, including application for government funds, will be directed and completed by the members of Guachthu,uq and the Cocode without the direct involvement of EWB-WPI.

We understand that a drawing will select the future homes for the rain water catchment systems. We understand that the families who are not selected are not forgotten. These few pilot homes will be actively working to ensure that the designs meet the individual's needs. Once the EWB-WPI group and the community have decided that the designs are satisfactory, we will start working with other families to implement the rain water catchment systems. We will choose homes for the next set of implementation, each time EWB-WPI travels to Guatemala until the project has finished.

We understand that these pilot programs are a test, and they may not be entirely successful when EWB-WPI first implements them. It will take time and full communication from both parties, both the community of Guachthu'uq and EWB-WPI, in order to make adjustments so the designs can be perfected. We will address any suggestions or concerns with the project directly to EWB-WPI or through Cecep and Alvaro. Also, the Cocode will be responsible for passing on these suggestions and concerns to us.

We understand that the projects EWB-WPI has proposed will require a long process over a number of years. This is because EWB-WPI intends to ensure that the designs are effective and will work with each family to train them in how to use the designs properly. This will ensure that if something happens, either if something breaks or requires standard maintenance, we will be able to fix the systems and understand proper upkeep and maintenance. We understand that each family who owns the rainwater catchment system will be responsible for maintenance and repair of said system. We understand that if we choose to sell our tank, we will be required to pay EWB-WPI for the whole cost of the tank. The Project Committee and Alvaro will enforce the above statement for the entirety of the EWB-WPI Water Project.

Engineers Without Borders student chapter from Worcester Polytechnic Institute
Agreement Form

We agree, as members of the Engineers Without Borders student chapter from Worcester Polytechnic Institute, to work with the Community of Guachthu´uq, Alta Verapaz, to the best of our abilities. Each year we accept the drawing of the project homes within a meeting where both the Cocode and EWB-WPI is present.

We agree to update the community with any changes in the project, whether it is in regards to designs or costs. This may require very frequent communication, which we are prepared to conduct. We will do our best to make the designs fit the needs of the community and take into consideration all of the input the community has given us thus far. This includes keeping the project as low in cost as possible without sacrificing the correct functioning of the designs and their long term maintenance.

EWB-WPI is going to ensure that the designs are effective, and we will work with each family to train them how to use the systems properly. This will ensure that if something happens, either if it breaks or needs simple maintenance, the families of Guachthu'uq, will be able to fix the systems. We will continue to work on the project until all systems have been completed to the community members´ satisfaction.

EWB-WPI will assist in labor towards the completion of the projects. EWB-WPI will purchase all materials in full at the start of the implementations as of January 5, 2013. Each family receiving ownership of the materials will contribute 5% of the material cost. This will be collected by EWB-WPI at the completion of the project or brought to Cecep on the first of the month for the maximum length of five months with a minimum of 20% required each month.

