Document 522
Post-Assessment Report

Chapter: South Houston Professional
Country: Thailand
Community: Maejanoi
Project: Water Containment and Quality

Prepared By:
Giana Morini
Tom Bryan
Chris Rossi
Mai Lee Chang

Submittal Date:
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Post-Assessment Report Part 1 – Administrative Information

1.0 Contact Information *(correspondence regarding report reviews will be sent to the listed President, Project Leads, Mentors and Faculty Advisors)*

	Name	Email	Phone	Chapter Name or Organization Name
Project Leads	Giana Morini Tom Bryan	g.morini03@gmail.com treasurer@ewb-jsc.org	702-370-2564 832-633-6258	Central Houston South Houston
President	Michael Ewert	president@ewb-jsc.org	281-483-9134	South Houston
Responsible Engineer in Charge	Giana Morini	g.morini03@gmail.com	702-370-2564	Central Houston
Traveling Mentor				
Additional Mentor				
Faculty Advisor (if applicable)	N/A			
Health and Safety Officer	Mai Lee Chang	mlchang8@gmail.com	920-203-9403	South Houston
Assistant Health and Safety Officer	Chris Rossi	rossi.chris.m@gmail.com	267-987-0336	South Houston
Education Lead	Mai Lee Chang	mlchang8@gmail.com	920-203-9403	South Houston
Planning, Monitoring, Evaluation and Learning (PMEL) Lead	Giana Morini Tom Bryan	g.morini03@gmail.com treasurer@ewb-jsc.org	702-370-2564 832-633-6258	Central Houston South Houston
In-country Community Contact	Be Pitanee	nawbibay@yahoo.com		
In-country NGO Contact	Johanna De Koning	leaf.thailand@gmail.com	+66817542350	LEAF
In-country Local Government Contact	Be Pitanee	nawbibay@yahoo.com		

2.0 Travel History

Dates of Travel	Assessment or Implementation	Description of Trip
Nov 1-15, 2014	Assessment	First trip to community

3.0 Travel Team

Name	E-mail	Phone	Chapter	Student or Professional
Giana Morini	g.morini03@gmail.com	702-370-2564	Central Houston	Professional
Tom Bryan	treasurer@ewb-jsc.org	832-633-6258	South Houston	Professional
Mai Lee Chang	mlchang8@gmail.com	920-203-9403	South Houston	Professional
Chris Rossi	rossi.chris.m@gmail.com	267-987-0336	South Houston	Professional

4.0 Health and Safety

4.1 Incident Reports

Did any health or safety incidents occur during this trip? ___Yes _x_No

If there were any health and safety incidents during the trip, check "Yes" and submit your completed 612 - Incident Report document as a separate attachment with this report. For further details, refer to this section in the 522 – Post-Assessment Report Instructions. If there were no incidents, check "No."

5.0 Planning, Monitoring, Evaluation and Learning

5.1 Canceled/Non-functioning Projects

Has the status of any of this program's past-implemented projects changed to Canceled or Non-functioning? ___Yes _x_No

5.2

If this was the first assessment trip for the program, is the 901 – Program Plan and Baseline Study included with this report?
_x_Yes ___No ___Not the First Assessment trip

5.3

If this was not the first assessment trip for the program, is the 901B – Program Impact Monitoring Report included with this report?
___Yes ___No

5.4

Is the signed 902 - Project Partnership Agreement included as an appendix to this report? _x_Yes ___No

6.0 Budget

6.1 Project Budget

	BUDGET *(PRE-TRIP)*		ACTUAL EXPENSES *(POST-TRIP)*
DIRECT COSTS			
Travel + Logistics			
Airfare	$6,000		$4,922
Food + Lodging	$2,900		$789
Other Travel Expenses (ex: Rental Vehicle, Taxis/Drivers, Exit Fees/Visas, Innoculations/Medical Exams, Insurance)	$2,140		$3,344
Sub-Total*	**$11,040**		**$9,055**
Labor			
In-Country Logistical Support	$0		$0
Local Skilled labor	$0		$0
Sub-Total*	**$0**		**$0**
EWB-USA HQ (this section is auto-calculated based on trip type)			
Program Quality Assurance/Quality Control + Infrastructure*	$2,000		$2,000
Less EWB-USA HQ Subsidy*	$1,395		$1,395
Owed by Chapter Sub-Total*	**$605**		**$605**
Project Materials + Equipment (itemized, as appropriate)			
Sample bottles	$65		$58
Petrifilm count plates	$50		$316
Mapping (quadcopter, distance measures)	$0		$478
Other water test materials	$0		$13
Medical kit and other misc items	$0		$146
Sub-Total*	**$115**		**$1,010**
Misc. (details required)			
Sub-Total*	**$0**		**$0**
TOTAL DIRECT COST*	**$11,760**		**$10,670**
IN-KIND CONTRIBUTIONS			
Community In-Kind Contributions to Project Costs			
Labor			
Materials			
Logistics			
Sub-Total*	**$0**		**$0**

TOTAL IN-KIND CONTRIBUTIONS*			
FUNDS RAISED			
Funds Raised for Project + Grants Received			
Cash from community (EWB-USA requires a minimum 5% contribution)	**$0**		
Total $ in Project Fund at EWB-USA HQ	$0		
Total $ in Project Fund at University			
Total*	**$0**		
Funds Raised for Chapter			
Total $ in Chapter General Fund at EWB-USA HQ	$34,068		
Total $ in Chapter General Fund at University			
Total*	**$34,068**		

6.2 Professional Mentor Team Hours

Name(s) of Professional Mentor(s)	Pre-trip hours	During trip hours	Post-trip hours	Total Hours
1. Giana Morini				
2.				

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
_x__ Water Distribution
_x__ 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

8.0 Project Location

Latitude: 19° 8'14.98"N
Longitude: 97°59'42.34"E

9.0 Project Snapshot for Publicity

9.1 Problem identification *(one sentence)*

The Maejanoi community identified an issue of shortage and rationing of water during the dry season and concerns with water quality due to animal contamination at the source and chemicals used for farming.

9.2 Project goal *(maximum three sentences)*

The primary goal is to improve the current water storage system of the community and ensure supply will meet demand throughout the dry season. The project will also address the water quality and implement treatment as required.

9.3 Project status *(maximum 100 words)*

This was the first trip of a new program. The team met with the NGO, government, and all villagers to ensure understanding of EWB, prioritize goals, seek permissions, increase understanding of community, and obtain technical data (water source mapping, village mapping, water samples) to determine the project feasibility.

This trip ensured that all personnel (government, community, NGO) agreed to a partnership with EWB and collected data to develop solutions for the community identified problem.

With the knowledge and data acquired, the team can move into development and design, with community feedback.

Post Assessment Report Part 2 – Technical Information

1.0 Executive Summary

This report addresses the South Houston Professional Chapter's first trip to Maejanoi, Thailand, for the Water Containment and Quality, Project #11881, during the time period of November 1 - November 15, 2014. The assessment trip included both cultural and technical goals because it is the first project within a new program.

The goal of the project is to develop a water containment (storage) system that is capable of supplying the community with water throughout the dry season for cooking, bathing, drinking, and vegetable gardening and to ensure the water meets required quality standards for uses. This project will determine storage (volume of water) required to supply the community through the dry season, evaluate current means of storage (quality of tanks and proper use), and address quality concerns and treatment options.

Maejanoi is a rural village located in the mountainous northwest region of Thailand. The community has approximately 40 homes. The village is considered centralized, as all homes are within walking distance of the next. There are two distinct neighborhoods in Maejanoi - those affiliated with the Buddhist sect (10 homes), and the rest affiliated with the Christian church. There is an estimated population of 200 people, with ages ranging from <1yr to 90 yrs. The Project Partnership Agreement was presented to the community during a public meeting on November 9th. This document was provided in English and in Thai, and verbally translated into Karen. This document was signed by Tom Bryan (EWB-SHPC), Johanna De Koning (LEAF), and Phu Yai Ban (government official of Maejanoi).

The Maejanoi program was approved by EWB-USA and adopted by the South Houston Professional Chapter in July 2014. The first project in this program is to improve the containment of water for use during the dry season and to address any quality issues. This assessment trip (November 2014) was the first trip for this project.

The tasks of this trip can be categorized into three groups: cultural, technical, and community data. For the cultural task, the EWB assessment team familiarized themselves with LEAF (NGO), the Community Board, community members, and local government. This included understanding the priorities of the community and Karen culture, the mission of EWB and how it relates specifically to this project, and the partnership among all stakeholders through various meetings and discussions. Technical tasks included assessing the current water system (water quality testing and measurements) and scouting hardware stores for materials. The team conducted bacteria tests, turbidity tests, and measured the pH level. The pipes and water tanks were measured and recorded. For the community data task, the physical layout of Maejanoi and information pertaining to land ownership were documented. A map was created showing key points in the community and water system.

Data gathered on this assessment trip included GPS measurements for mapping the community, water quality testing, measurements of the current water system, and availability and price of local construction materials. From the mapping data, there are approximately 40

homes (about 200 people). The water quality test results revealed that water quality is a concern. E. coli and coliform were present in most of the bacteria tests. There is little to no turbidity, and the pH was consistently around 7. Twelve water samples were returned to Houston for further analysis. Each of the four primary village storage tanks can hold approximately 2300 gallons. All necessary materials can be obtained in Mae Hong Son. Prices vary with bargaining, quantity purchased, and the purchaser.

Based on the information gathered during this assessment trip, the South Houston chapter plans to begin design for this project. The next phase of this project is the design and testing of a test article. Data gathered about material availability, current water system, and the community map will be crucial for completing the design with implementation targeted for 2016.

2.0 Program Background

The village of Maejanoi is located in the northwest region of Thailand. It is a relatively new community comprised of men, women, and children who have come down from the higher mountain areas in an effort to improve their living conditions. The community consists of members of extended families. Most of them are members of the Karen tribe.

The community has been looking for ways to improve their circumstances but does not have the technical knowledge and financial means to begin development on their own. It is hoped that this project will be used as a model to teach neighboring communities about improved water management and distribution. This will result in improved relationships and cooperation among the communities.

The community is in need of a water containment (storage) and treatment system. The majority of the water currently comes from a mountain source into storage tanks, which does not provide enough water during the dry season. The community currently uses PVC piping to direct the water from the mountain source to the village, but this system is damaged annually due to brush fire and fallen trees, requiring continuous repairs. The water contains bacteria, and there are concerns about chemicals.

3.0 Project Description

The community identified shortages in the water supply during the dry season as their top priority. While there is enough for drinking, they ration the water in the dry season, and there is not enough water for their vegetable gardens.

The primary water source is a stream located across the road and uphill from the village. This will be referred to as the village water source throughout the document. Water flows down to that level from further up the mountain. The PVC pipes start at this source, water flows from them into a rectangular cement tank near the source, then pipes continue toward 4 larger cylindrical cement storage tanks near the road. A valve is located a few meters downstream from the rectangular tank, it is used to shut off flow when pipes are being repaired. The rectangular tank has a cover, but there are openings in it. The pipe system goes under the road via an existing tunnel. Small (1 inch diameter) pipes branch off the main line going to each house – every house has at least one faucet. Most of the pipes on the hill side are above ground since it is too rocky to dig. Some pipes have been damaged by forest fires (which occur

almost yearly) and by falling trees and rocks. The villagers say that this source dries up during the dry season, though there is some flow at night. In the village some pipes are above ground, others are buried. A small number of families have small storage tanks next to their homes, but most cannot afford them. The map in Figure 1 shows the location of the source, tanks, and village.

Figure 1: Water system mapped in Google Earth

This distribution system has been in place for 3-4 years. The materials were originally donated by an outside group, and the system was built by the villagers. The storage tanks by the road were also donated. A maintenance fee of 10 baht/month is currently collected from each household to pay for repairs to the system – responsibility for maintenance rotates with 3 households every month. This existing PVC pipe distribution system is in good shape and is maintained. Consideration may be given to better protection against fires and falling trees (possibly using stone walls).

Another source is located downhill from some houses which is used in the dry season. An intake pipe is connected to a pump (donated by the local government) to bring water to the highest house, however this pump rarely works. The villagers use small buckets to carry water up from this source.

It rained during the first few days of the assessment trip, and the travel team saw that the storage tanks were overflowing with the excess water just flowing onto the ground. After a few days without rain, there was no overflow. There is currently no collection of rainwater – the villagers thought it would be good to do so, but cannot afford a collection system.

The travel team's suggested project is rainwater catchment and storage of excess water from the wet season, including water treatment. One possibility is a small dam. The team visited a spot near a waterfall that one villager believes would be a good location for a dam. Additional storage tanks and rainwater collection at houses may be possibilities as well.

There are concerns about the water quality which will likely require treatment. The villagers reported an oily or filmy residue when bathing (worse in the dry season), and believe that the quality is worse in the homes than in the streams, especially compared to rainwater. Some of the households (about half of those surveyed) currently boil their drinking water. Since the water source is an exposed stream and ponds at the point where it enters the pipe system, it is vulnerable to contamination from animals. The EWB travel team found E. coli and coliform in the water source, storage tanks, and in the homes. Chemicals used in farming could be contaminating the water supply as well. The travel team photographed a bottle of these chemicals for reference. Water samples were brought back to Houston for further analysis, which will determine treatment options. See Section 5.0 for a more detailed water testing description and data.

Another major priority identified by the community is improving the road going into the village. It is unpaved except for a short stretch, and is almost impassable during the wet season. In addition, some villagers and the local government were intrigued by the team's mention of a previous solar fruit drying project. Some of the harvested fruit is wasted because it spoils before it can be sold. Road improvements and fruit drying may be future projects for EWB following implementation of the water supply and treatment system.

The local government is interested in EWB's help with neighboring villages in the future.

4.0 Trip Description

The goals of this assessment trip were to 1) meet with the community board and members and NGO (LEAF) to establish a relationship and come to consensus on the partnership agreement, 2) assess the condition of the water source, tanks, and distribution system, 3) map the community and water source, and 4) identify materials at local sources to potentially be used in the system design.

LEAF was at the project site with EWB from November 3 – 9 and served as translators between English and Thai. Maejanoi resident Be Pitanee and her husband, Ke, translated from Thai to Karen and vice versa. Be and Ke speak some English. Accomodations were at the Pitchaporn Guest House located in Phabong, which is 12 km south of Mae Hong Son and 12 km north of Maejanoi. The mode of transportation to and from the Guest House and Maejanoi was via a 12-passenger rental van. Ke was hired to drive.

At the beginning of the trip, three meetings were held (local government officials, community board and members, and the subdistrict government that is referred to as OBT). In the meeting with the local government officials, there were about 30 attendees including the Phu Yai Ban (community leader), forestry officials, border patrol, assistant to OBT, and community elders. The government identified deforestation as their top concern. They also identified chemical use for farming as another concern. All land is owned by the government. The villagers are allowed to live on and use the land but they have no property rights. They expressed support for EWB and approved EWB's use of the quadcopter to gather aerial photos and videos. EWB would

need to ask for permission before doing anything on the land and need to avoid damaging trees when possible. No official paperwork is required.

In the meeting with the community board and members, about 21 adults attended. They identified water supply during the dry season and the road during the rainy season as top priorities. During the dry season, there is not enough water for their vegetable gardens. They believe that the water quality is different in the homes compared to the streams. Their concerns included a filmy/oily residue after bathing (worse in the dry season) and bladder stones. In addition, they are concerned about the 5% capital requirement (currently 2000 baht ($60) saved after 8 months). They also approved EWB's use of the quadcopter.

The purpose of the meeting with the OBT was to understand the government's current and future projects for the surrounding area. Current water projects include a United Nation Development Program (UNDP) hydro power project and dams for water containment. They've never performed water testing in the area. They also expressed concerns about the chemicals due to farming and forest fires. They are supportive of EWB and interested in EWB's involvement in other villages in the future.

Towards the end of LEAF's stay, there was a Partnership Agreement meeting where all parties were present. Dick de Koning (LEAF) translated the agreement to Thai and Be orally translated it into Karen during the meeting. After each section, questions and comments were welcomed. Tom Bryan (EWB-SHPC), Johanna de Koning (LEAF), and Phu Yai Ban (community leader) signed the agreement.

The travel team assessed the condition of the community's water by performing the 3M petrifilm bacteria test (E. coli and coliform), pH test, and turbidity test along with taking measurements and video for flow rate data. Data was obtained for the source, storage tanks, distribution system, and water at the homes in different parts of the village. The team also mapped these water locations and the houses using GPS tagging and obtained aerial pictures of the village. Please see the Data Collection and Data Analysis section for details.

The travel team also scouted for materials in Mae Hong Song. Cost and dimensions of materials and tools along with the suppliers' contact information were obtained.

5.0 Data Collection And Analysis

Data collection was a primary goal of the assessment trip. Collection included GPS measurements for mapping, water quality testing, measurements of the current water system, and availability and price of local construction materials.

GPS measurements using smart phones helped map key points in the community and water system in Google Earth. By turning location services on in the standard smart phone camera app, all photographs taken by the phone are tagged with a GPS measurement if available. Photos of easily identifiable landmarks or labels on a dry erase board allowed the team to match the GPS tag to a known location in the community. Additionally, one knowledgeable villager pointed out key areas when the EWB team showed the community in Google Earth. His input was valuable in understanding land ownership and usage in the surrounding area. Figure 1 (Section 3.0) showed an example of map of the water system created using village knowledge,

traveler knowledge, and GPS measurements. Figures 2, 3, and 4 below show additional maps made from community knowledge and Google Earth.

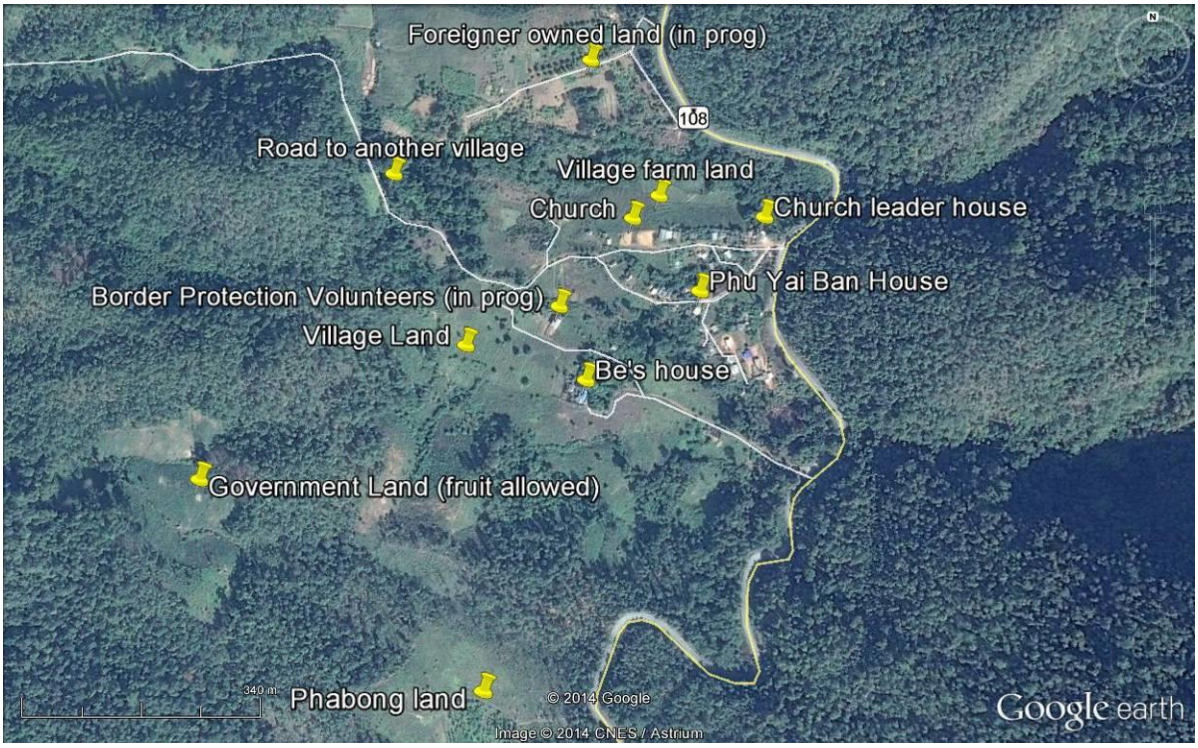

Figure 2: Map of Maejanoi and surrounding area

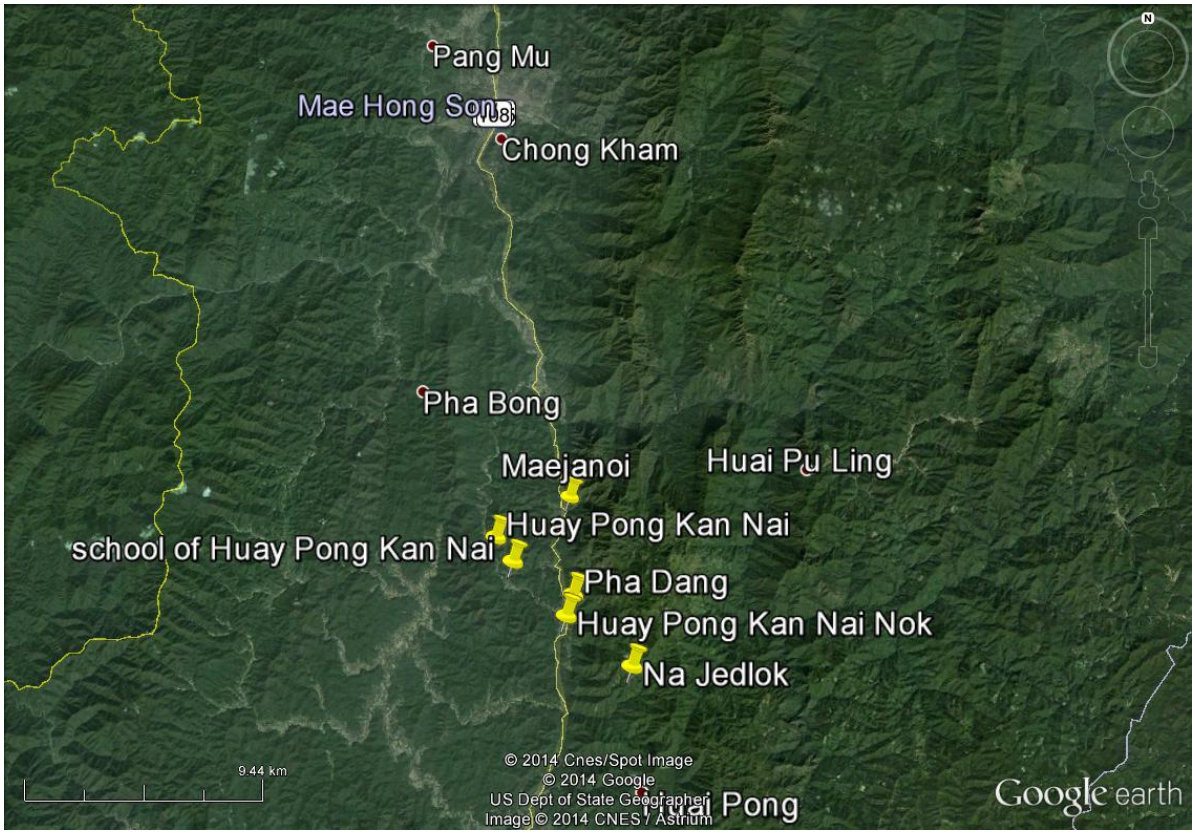

Figure 3: Maejanoi region with major towns and the 5 villages (Maejanoi, Huay Pong Kan Nai, Phua Dang, Huay Pong Kan Nai Nok, and Na Jedlok) under the Phu Yai Ban based on input from Be and Ke

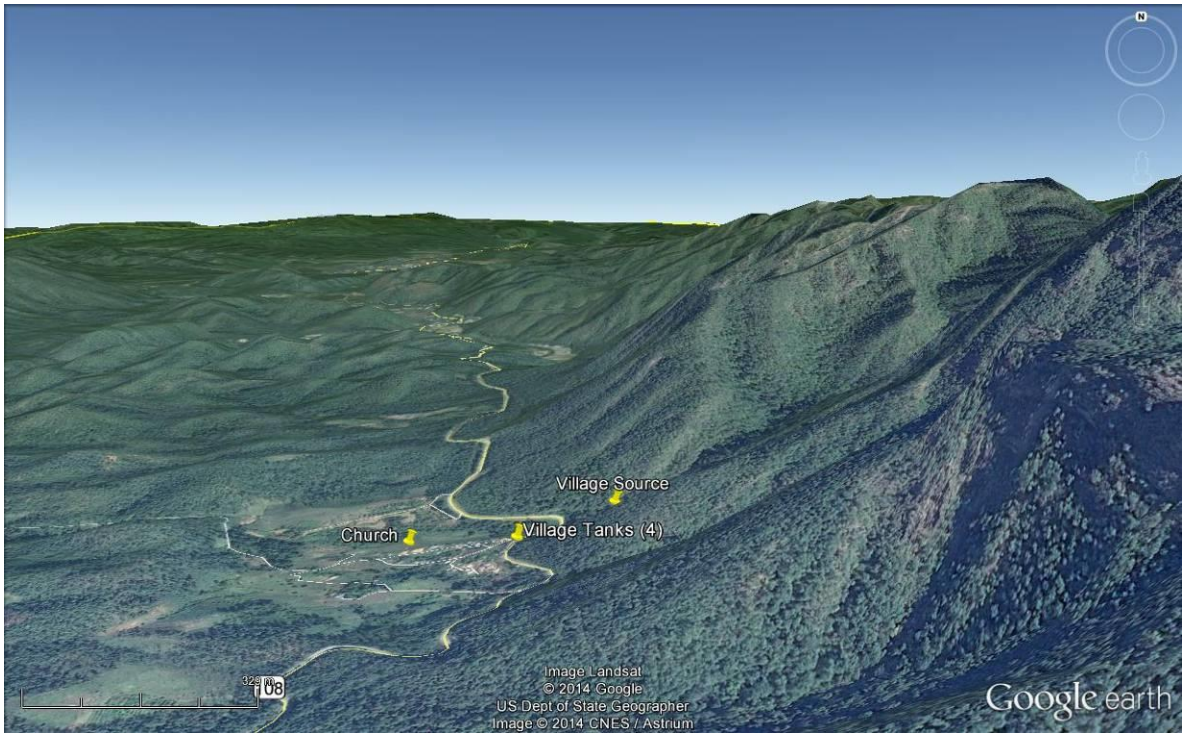

Figure 4: Google Earth view of village to illustrate terrain

Quadcopter photographs provided complementary mapping data. After approval from both government officials and community members, the travel team flew a commercial quadcopter (Parrot AR.Drone 2.0) at a height of about 20 meters in spots with sufficient flying room away from trees and power lines. Community members were enthusiastic about the technology and the aerial cameras provided images and videos not possible from the ground or Google Earth. Section 6.0 has an example photograph from the quadcopter.

Water testing was performed at critical points along the current water distribution system. This included water testing at seven houses located at various elevations (highest, middle, and lowest) to assess how the water quality changes. Village members were encouraged to participate through taking water samples and seeing the results. Testing materials were left in the community so that testing can be done throughout the year and results emailed back to Houston when requested.

3M petrifilm was used to confirm the presence of E. coli and coliform bacteria. For each petrifilm sample, a 1 mL water sample is placed in the film and allowed to sit for two days. After two days, a count is done on the number of blue (E. coli) spots and red (coliform) spots. Figure 5 shows an example petrifilm after cultivation. Table 1 shows the full collection of data with the pertifilms. E. coli was found in most samples and across the water distribution system, including in the source. Numerous coliform are also present in most samples. Some of the villagers boil their drinking water and samples of water boiled by villagers showed no sign of bacteria, confirming that the water was properly boiled and safe to drink. pH strips were used to measure potential acidity in the water; all samples were a pH of 7 except for one noted in the table that was 8.

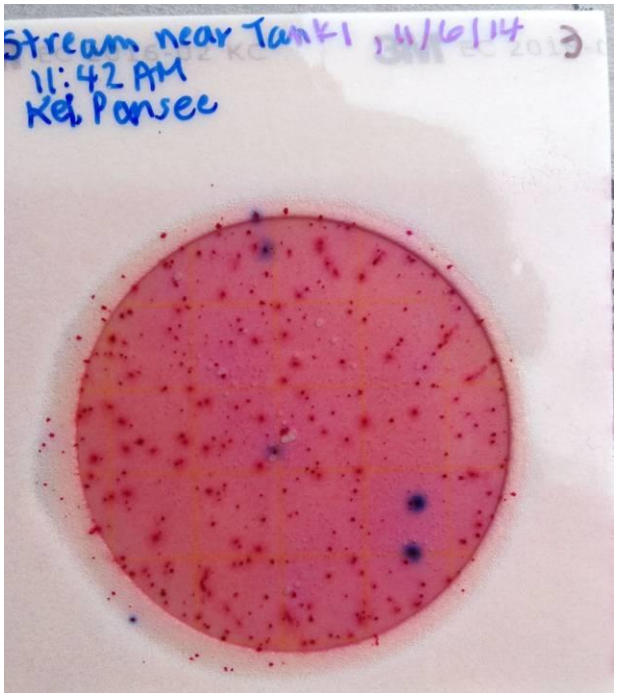

Figure 5: Example 3M petrifilm after 2 day cultivation. Blue dots are E. coli colonies and red dots are coliform bacteria

Table 1: 3M Petrifilm Sample Results

Sample Number	E. coli Count	Location Details	Hours Cultivated	Start Date	Start Time	Notes
1	5	Village Tank 1	44	11/6/2014	12:00 PM	
2	2	Village Tank 1	44	11/6/2014	12:00 PM	
3	4	Stream next to Tank 1	44	11/6/2014	12:00 PM	
4	3	Pipe Leak upstream of Tank 1	44	11/6/2014	12:00 PM	
5	6	Pipe Leak upstream of Tank 1	44	11/6/2014	12:00 PM	
6	1	Village Source	44	11/6/2014	12:00 PM	
7	2	Village Source	44	11/6/2014	12:00 PM	
8	0	Be's sink faucet	40	11/6/2014	4:00 PM	
9	1	Be's sink faucet	40	11/6/2014	4:00 PM	
10	0	Be's sink faucet	40	11/6/2014	4:00 PM	
11	3	Village road tanks (overflow)	44	11/7/2014	4:30 PM	
12	0	Village road tanks (overflow)	44	11/7/2014	4:30 PM	
13	1	Village road tanks (overflow)	44	11/7/2014	4:30 PM	
14	4	Be's fish pond	44	11/7/2014	4:30 PM	pH=8 at pond
15	1	Be's fish pond	44	11/7/2014	4:30 PM	
16	1	Be's fish pond	44	11/7/2014	4:30 PM	
17	0	Be's source	44	11/7/2014	4:30 PM	
18	4	Be's source	44	11/7/2014	4:30 PM	

19	0	Be's tank outflow	44	11/7/2014	4:30 PM	
20	5	Be's tank outflow	44	11/7/2014	4:30 PM	
21	0	Be's tank inflow	44	11/7/2014	4:30 PM	
22	2	Be's tank inflow	44	11/7/2014	4:30 PM	
23	0	Be's tank inflow	44	11/7/2014	4:30 PM	
24	1	House 1 (Pansee) (top of the village)	49	11/8/2014	9:30 AM	
25	2	House 1 (Pansee) (top of the village)	49	11/8/2014	9:30 AM	
26	0	House 2 (Namfopon)	49	11/8/2014	10:15 AM	
27	0	House 2 (Namfopon)	49	11/8/2014	10:15 AM	
28	0	House 2 (Namfopon)	49	11/8/2014	10:15 AM	
29	0	House 2 (Namfopon)	49	11/8/2014	10:15 AM	
30	0	House 2 fridge storage (not boiled)	49	11/8/2014	10:15 AM	
31	0	House 2 fridge storage (not boiled)	49	11/8/2014	10:15 AM	
32	0	House 4 (Phu Yai Ban father) (personal tank)	49	11/8/2014	10:45 AM	
33	0	House 4 (Phu Yai Ban father) (personal tank)	49	11/8/2014	10:45 AM	
34	0	House 4 (Phu Yai Ban father) (personal tank)	49	11/8/2014	10:45 AM	
35	1	House 5 (Phamoji)	44	11/8/2014	3:15 PM	
36	1	House 5 (Phamoji)	44	11/8/2014	3:15 PM	
37	0	House 5 (Phamoji)	44	11/8/2014	3:15 PM	
38	0	House 5 (Phamoji) (boiled)	44	11/8/2014	3:15 PM	0 coliform
39	0	House 5 (Phamoji) (boiled)	44	11/8/2014	3:15 PM	0 coliform
40	0	House 5 (Phamoji) (boiled)	44	11/8/2014	3:15 PM	0 coliform
41	0	House 6	44	11/8/2014	4:00 PM	
42	1	House 6	44	11/8/2014	4:00 PM	
43	0	House 6	44	11/8/2014	4:00 PM	
44	0	House 7	46	11/9/2014	4:00 PM	
45	0	House 7	46	11/9/2014	4:00 PM	
46	1	House 7	46	11/9/2014	4:00 PM	
47	0	Dry season source pipe	46	11/9/2014	3:30 PM	
48	0	Dry season source pipe	46	11/9/2014	3:30 PM	
49	0	Tank 1 (after no rain 3 days)	53	11/10/2014	2:00 PM	
50	0	Tank 1 (after no rain 3 days)	53	11/10/2014	2:00 PM	
51	0	Village Source (after no rain 3 days)	53	11/10/2014	2:00 PM	
52	0	Village Source (after no rain 3 days)	53	11/10/2014	2:00 PM	
53	1	Village Source (after no rain 3 days)	53	11/10/2014	2:00 PM	

Turbidity was examined visually using a graduated cylinder. The goal was to create a quantitative measurement index by recording how full the cylinder could be before it was not possible to see the bottom of the cylinder. However, all samples were clear enough that the bottom of the cylinder was always visible. Water near the source was very clear while water from faucets in the homes was slightly cloudy. Figure 6 shows a comparison of bottled drinking

water on the right to cloudier water from Be's faucet on the left to illustrate the turbidity. Samples returned to Houston may have turbidity measured quantitatively using a turbidity meter.

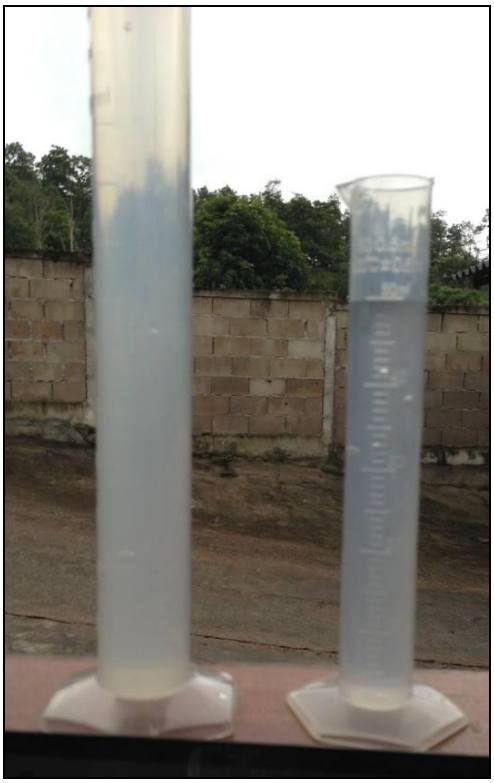

Figure 6: Cloudy water from kitchen faucet (left) compared to bottled drinking water (right)

Twelve water samples were returned to Houston for further analysis with equipment not available in the field. Table 2 shows the list of samples returned and Table 3 shows a log of rain activity during the trip dates for context. The samples were chosen to represent key points in the distribution system and before and after rainfall. Future testing may include conductivity, major ions, pH, turbidity, and chemical content.

Table 2: Samples returned to Houston for further analysis

Number	Location details	Date	Time
1	Village tank 1 (after rain)	11/6/2014	11:26 AM
2	House 1 faucet	11/8/2014	9:30 AM
3	Be's tank outflow	11/9/2014	2:30 PM
4	Village Source (after rain)	11/6/2014	12:15 PM
5	Be's sink faucet	11/6/2014	4:13 PM
6	Village Source (after dry 3 days)	11/10/2014	1:30 PM
7	Be's source	11/7/2014	4:30 PM
8	Village tank 1 (after dry 3 days)	11/10/2014	1:30 PM
9	House 4 personal tank	11/8/2014	10:45 AM
10	Village Road Tanks	11/7/2014	3:00 PM
11	Dry season source pipe	11/9/2014	10:00 AM
12	House 7 (lowest in village)	11/9/2014	2:00 PM

Table 3: Rain activity during trip dates in community

Rain log	
11/3/2014	Dry
11/4/2014	Light rain
11/5/2014	Light rain
11/6/2014	Light rain
11/7/2014	Light rain
11/8/2014	Dry
11/9/2014	Dry
11/10/2014	Dry
11/11/2014	Dry

Dimensions of tanks and pipes in the current distribution were measured with a tape measure and documented with photographs. PVC piping near the source was on the order of 4 inches in diameter while piping in the village was roughly 1 inch. The tank near the source (labeled tank 1 in the maps) is approximately 49x38x89 inches, giving a volume of about 700 gallons. Each of the four primary village tanks (near the road in the maps) are cylindrical with a 112 inch height and 79 inch diameter. Therefore, each tank can hold approximately 2300 gallons. Each house has at least one water faucet.

Figure 7: Example photo documentation of water system dimensions

Three hardware stores were surveyed in Mae Hong Son for materials for the implementation trips. Materials such as piping, cement for tanks, plastic storage tanks, and tools were scouted for availability and price. Only limited price lists were available because exact pricing does not exist in practice. Prices vary with bargaining, quantity purchased, and the purchaser. Ke has

good relationships with owners of the stores and will be relied on to purchase materials at a fair price in the future. The stores in Mae Hong Son can order materials from Chiang Mai if they don't have something in stock.

6.0 Photo Documentation

Figure 8: EWB travelers, LEAF, and community leaders after partnership agreement signing

Figure 9: EWB travel team presents to members of various government organizations

Figure 10: EWB travel team, LEAF, and community members after introductory presentation to the village in the church

Figure 11: Ke presents EWB slides to OBT leader and officials

Figure 12: Phu Yai Ban signs partnership agreement for Maejanoi and Johanna de Koning signs for LEAF

Figure 13: Example of burnt pipe section damaged by forest fire

Figure 14: Example of broken pipe section after tree fall

Figure 15: Water distribution system piping in the forest. Water is brought from the source to the 4 major storage tanks near the road. Pipes are above ground due to the rocky landscape.

Figure 16: Four primary village tanks near the highway

Figure 17: Water distribution system pipe in village. Pipes may be covered or above ground in the village due to mudslides.

Figure 18: Water point of use for one household

Figure 19: Example community home. Most homes consist of two buildings (main house and separate kitchen).

Figure 20: Travel team discusses water system with community members over a cup of tea

Figure 21: Phu Yai Ban teaching his son how to sample water

Figure 22: Ke and community member sample water at point of use

Figure 23. Everyone, including the very young ones, helped with the water tests at the village!

Figure 24: Ke and community member sample water near the source

Figure 25: Quadcopter photograph of village using side camera facing West

Figure 26: Example pipe selection at hardware store in Mae Hong Son

7.0 Lessons Learned

Travel:
Allow plenty of time for going through customs and passport control during connections from international to domestic flights.

Translation:

Get any documents (partnership agreements, introduction materials, etc) to the translator well before the trip. Introductory slides should be short, simple, and rely on illustrations rather than words. A half-day was spent with the NGO to translate the partnership agreement to Thai during the trip (it had been sent over only a few days prior to travel). It would be helpful if pre-translated versions of the partnership agreement were available from EWB-USA for countries with active projects.

Consider hiring outside professional translators for meetings to reduce any potential for bias.

Ensure that translators are available during the entirety of the time in the village. Most of the trip would not have been possible without LEAF due to two layers of translation (English - Thai - Karen). Although a couple villagers speak some English, any difficult or in depth conversation or questions could not be relayed. There were difficulties trying to shop in town and communicating with the guest house owners.

Meetings:
Carefully consider meeting locations. The initial meeting with the community was held at a Christian church in the village, many of the Buddhist villagers did not attend.

Consider having a second meeting with the community later in the trip so that more people can attend and so that follow-up questions and discussions can take place as things come up.

Health and safety:
Be careful of overconfidence in travelers' ability to hike. The hiking (to water source, etc) was much more difficult than assumed – some trails were very narrow, steep, and slippery. For the villagers, much of the terrain is familiar and easy, but for the travelers, it was new and difficult.

Quadcopter:
Flying the quadcopter was challenging due to the many trees and low electricity lines. In the future, consider programming the GPS coordinates ahead of time and have the quadcopter fly via those coordinates.

Supplies to bring:

- Flashlights/headlamps – for walking in the dark through the village
- Water shoes/rain boots - for trekking through wet/dense jungle and wading through streams
- Thermometers - taking temperature of water samples
- Sandals - customary to take shoes off before entering any shop, house, temple, office, etc.
- White paper sticky labels (waterproof) - difficult to write directly on water sample bottles when wet or humid, also would help if relabeling is required
- Antihistamines - be specific when listing what type (pills vs. cream).
- Need a sturdy container to carry all water testing materials - the use of tupperware to carry 3M petrifilms was a good practice.
- Small gifts from USA - to show appreciation for hospitality
- EWB banner - would have been nice for photos with large groups from the community
- Daily change of clothes on hand - in case clothes get wet or muddy
- Reusable water bottles - would diminish trash being carried into the village

Communications:
The travel team sent daily updates via email to the EWB team in Houston, including what they did that day and plans for the following day. The Houston team reported that they enjoyed receiving these updates. In the future travelers could add a Twitter feed or other social media posts during trip. The travel team consolidated and reviewed notes regularly during trip. These sessions helped the team think of additional questions for clarification and follow-up.

8.0 Project Status

Assessment Continues	Design	Cancelled
	X	

9.0 Project Monitoring

9.1 Project Status Table

Project Type	**Project Discipline**	**Date of Completion** (mm/dd/yy)	**Functionality** (enter one range per project)			**Periodic Maintenance** (yes or no)	**Community Capacity** (yes or no)
			0-50%	50-75%	75-100%		
Water supply	Water storage, water distribution, water treatment	N/A	N/A			N/A	N/A

9.2 Project Functionality Indicators (Include **3** per Project Type)

Project Type	**Project Functionality Indicator** (select from Document 906)	**Monitoring Result**
Water supply	Quality of water at water points	N/A
	Quantity of water available to each household during dry and wet seasons	N/A
	Number (or percentage) of community members satisfied with the project	N/A

9.3 Periodic Maintenance Indicators (Include **3** per Project Type)

Project Type	Periodic Maintenance Indicator (select from Document 906)	Monitoring Result
Water supply	Existence of broken components, i.e. valves, pump lever	N/A
	Level of cleanliness of water storage tanks	N/A
	Observed evidence of routine maintenance on the system done accurately without EWB-USA	N/A

9.4 Community Capacity Indicators (Include **3** per Project Type)

Project Type	Community Capacity Indicator (select from Document 906)	Monitoring Result
Water supply	Duplication of any element of the system without EWB-USA	N/A
	Balance available in maintenance fund	N/A
	Chapter observed community members training others	N/A

9.5 Additional Information

10.0 Professional Mentor Assessment

10.1 Professional Mentor Name and Role

The professional mentor for the South Houston Professionals assessment trip is the REIC, Giana Morini.

10.2 Professional Mentor Assessment

This report was a collaborative effort between all the travelers. Overall, the trip was very successful in terms of accomplishing all objectives on time, under budget and with minimal issues. Important relationships and open dialogue between local government officials and community were established through the assistance of the local NGO LEAF and dedicated translators. A community partnership agreement was reached between residents of Maejanoi, Thailand, LEAF, and EWB-SHPC. The existing water distribution system was photo-documented, terrain of interest was mapped with all resources available including an unmanned aerial vehicle, Maejanoi residents were interviewed, and water samples were obtained. The results of the water quality tests, in combination with information obtained directly and indirectly in Maejanoi, will determine the next phase of the project.

It is clear that a water collection and storage system is needed in order to sustain the Maejanoi community through the dry season. At this point, the full extent of water quality issues is still unknown. However, because of the open communication that has been established between all parties, I am confident that a water collection and distribution system can be designed and implemented by the EWB-South Houston Professionals chapter that will meet the needs of the community and be sustainable in the future.

10.3 Professional Mentor Affirmation

As Technical Lead for this project, I attest to my involvement in the development of the assessment trip plan and acknowledge and accept responsibility for the course of this project.

