

Document 522

POST-ASSESSMENT REPORT

CHAPTER: TUFTS UNIVERSITY

COUNTRY: EL SALVADOR

COMMUNITY: EL PORVENIR

PROJECT: SAN JOSE VILLAVUEVA

PREPARED BY

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Post-Assessment Report Part 1 – Administrative Information

1.0 Contact Information

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2.0 Travel History

Dates of Travel	Assessment or Implementation	Description of Trip
1/3/09-1/14/09	Assessment	Assessment of community needs and site characteristics

3.0 Travel Team

Name	E-mail	Phone	Chapter	Student or Professional
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Note: Professional advisor David Michelson was scheduled to travel with this trip, but had to cancel due to commitments at work.

4.0 Safety

There were no safety incidents on this trip.

5.0 Budget

Airline Tickets	\$2,908.44
Groceries	\$50.00
Fee for Epilogos	\$1,500.00
Water Quality Materials	\$400.00
First Aid Kit	\$20.00
Total	\$4,878.44

6.0 Project Location

Longitude:W089deg17.518min

Latitude:N13deg33.027min

Part 2: Technical Information

1.0 Introduction

This report provides a summary of the status of the Porvenir project following the second assessment trip performed in July 2009.

The intent of the Tufts EWB summer 2009 trip was designed to gather information necessary to evaluate the feasibility of several options for improving the water supply of the small village of Porvenir, in San José Villanueva, El Salvador. Other goals included becoming more familiar with the people of Porvenir, performing post-project evaluation in Arada Vieja, San José Villanueva.

2.0 Background

In 2008 Epilogos Charities, an NGO in San Jose Villanueva, El Salvador, connected Tufts EWB with the community of Porvenir. Tufts EWB performed an initial assessment trip in January 2009. A community meeting was held, a health survey was performed, and existing water sources were evaluated.

Porvenir uses a variety of water sources for household drinking and cooking. Water is collected from a springbox, a well, cisterns, and (during the height of the dry season) the Río Muyapa.

The main water source is a spring box on the side of a hill next to the Río Muyapa behind Domingo's house. Most of the community, or about 100 people, use this as their primary water source. This spring box is about 2 ft deep by 2 ft wide and 2 ft long. It is filled from groundwater that comes out of the ground along a streambank. A perforated pipe extends a few feet across the streambank to increase the water yield. The spring box is open to the environment, and is prone to contamination. During the wet season, this spring box is inundated by the river flows after rainfall. Residents report draining the springbox for cleaning after

storms. The springbox is downhill from a cornfield, and cows also graze on the hill. Although the springbox captures ground water from a shallow spring, it is possible that this water is contaminated from fertilizers and animal waste from the cornfield.

A well is located behind the house of Tomás Urias. This source is used by two households only. During the January 2009 assessment trip, the overflow from this well was 2.75 Liters / minute, but in July 2009, the water level has dropped and there is no overflow to measure.

The rainy season in El Salvador is from approximately May through October. During this time most households have some sort of rooftop runoff collection into a cistern. Cisterns are generally uncovered 55-gallon plastic or steel drums. An *abate* packet is used to prevent mosquitos from growing in the cisterns.

The majority of households interviewed (7 out of 13) reported that there was not a sufficient quantity of water available at all times of the year. Residents report that at the end of the dry season – during March and April – there is not always enough water in the well and the springbox and so most families are forced to drink river water. People know that the river water is not clean and so use chlorine tablets or bleach to disinfect the water.

All residents report using the rivers for bathing and clothes washing.

3.0 Trip Description

Date: July 3, 2009

Location: Porvenir

Subject: Visit to Porvenir

We stop at Porvenir for a quick tour and by an amazing coincidence, the mayor of San José Villanueva (SJV) and his assistant are leading a meeting to choose the new ADESCO Board of Porvenir. With about thirty-five people standing under the “meeting tree”, the mayor’s assistant explains what each position on the Board is about, and what qualifications each candidate should have. By a show of hands, Porvenir chooses a president, vice-president, secretary, treasurer, and a *sindico* .

The mayor's office emphasizes that women need to be involved in the ADESCO, and a "women's representative" is chosen. No two members of the ADESCO are allowed to be close relatives, and this requirement in fact comes into play for the selection of the *representivo de mujeres*.

Don Chepe	ADESCO President
Jesus Antonio Velasquez	ADESCO VP
Felipe Funes	ADESCO Secretary
Carlos Alfredo	ADESCO Treasurer
Tomas Urias Guzman	ADESCO Sindico
Yolanda Elizabeth	ADESCO Womens' Rep.

Date: July 4, 2009

Location: Arada Vieja

Subject: Project Evaluation

We visit Arada Vieja (AV) today, a village where Tufts EWB has recently completed a community water project. The ram pump is working and so are the slow-sand filters. The piping that we repaired from the springs in January has held up during the high river flows of the rainy season. Despite the rain, they only have enough flow to pump for 24 hours on, then take 48 hours off to allow the intermediate tank to refill from the two springs. We have heard from Mike, of our NGO host Epilogos Charities, that there is controversy in AV over the user's fee or "tariff" for the water system.

Ricardo (of Arada Vieja) says that the water board has made sure to remind people that they should be drinking water from the clean *churro* (water spigot), which also has a new fence around it. For whatever reason, because they don't care or because they don't want to, many still drink unfiltered water out of the dirty *churro*. Ricardo says it can take a week for the clean water tank to empty. We tell him that our tests in January found that the water coming from the clean *churro* is not as clean as it could be, and that we think that the water sits in the clean tank for too long, allowing bacteria to grow. We suggest that they use the filtered water as quickly as possible – by as many people as possible, or by some people for all of their water uses (including washing) if not all can be persuaded to use the clean

churro. In addition, the filters are designed to work under continuous flow, so it would be better to pump for 8 hours, then take 16 hours off, as opposed to their current pumping schedule.

We're not sure what Ricardo and Teafilo think about our suggestions to operate the water system differently. What they are more eager to discuss is the problems collecting the user's fee. Ricardo says that several families left the village and so the tariff was increased from \$1 per month per family to \$2 per month, per family. Ricardo says that this is too much to pay and suggests that instead of paying every month, funds could just be raised as needed. He says they have a system for doing raffles as fundraisers. The schemes sound complicated, involving "lists" sold both within and outside the community, and in the past has been subject to fraud and theft. More people gather as we talk, including the deposed Water Committee treasurer Alfonso. Once Alfonso gets a chance to speak he does so with passion. His voice remains low, but he is clearly upset. He tells us that the maintenance fund is necessary if Los Naranjos (the name of the cooperative that owns AV) is going to be independent. He says that the fund was something that EWB had recommended and continuing it was the least Los Narajos could do to hold up their end of the bargain. He says that not everyone fully appreciates how much time and effort EWB and Epilogos (Mike and Susie Jenkins) have invested in the project.

We are hesitant to enter into the tricky, seemingly internal issue of how AV should maintain their water system. They shouldn't continue the fund to please EWB, we feel that they should continue the fund because it is necessary to have money on hand to quickly fix the system when the inevitable breakdowns occur. Teofilo points out that some people, particularly older people do not have cash incomes and are not able to contribute. Besides reiterating that EWB will not be funding future repairs, we do not strongly state our opinions for now. A meeting is initially set up for Monday to discuss these issues further, and Alfonso requests our assistance resolving the issue. Later, however, when Allison and Roxanne encounter Don Goyo (another community leader) and tell him about the meeting, he testily

responds, “Alfonso does not speak for this community! We will have the meeting on Thursday.” We want to help however we can, but clearly this is a serious dispute that is difficult for us to fully understand.

At night we run our samples using Coliscan Easygel tests. No *E. coli* turned up in these tests, but since the Easygel only uses a 5 mL sample, all we know is that the *E. coli* levels are below 20 counts per 100 mL (really dirty by American standards). The total coliform counts are a less accurate health indicator, but in this test show pretty comparable bacteria levels in the dirty and clean *churros*. At least the clean *churro* did not come out worse than the dirty one, like we saw in January.

Date: July 5, 2009

Location: El Porvenir, Domingo’s house

Subject: Introductory community meeting to discuss water access options

Meeting in Porvenir to gauge community interest in a water project, and to discuss what form a project might take. About thirty people gather in and around Domingo’s new house to hear us discuss a possible water supply project. Mike gives us an introduction and says that ideally we would like to build a well in Porvenir. This prospect gets a very excited response. People comment that a well would be a good option because it would provide very clean water. Though we also are of the opinion that a well could be great for Porvenir, we’re a little uneasy to see people latch onto this one option. We suggest a cautious approach to developing a system and bring up the possible obstacles to building a well:

- The people in Porvenir don’t own their land. We worry that once a well is installed, the land will suddenly become valuable and the landowner will want to remove them and sell building lots to wealthy folks from the capital.
- The well will be expensive and it might take a long time to raise the money.

Residents suggest that we contact the mayor and get the well area declared a “Green Zone” where everyone is legally guaranteed access to the water. Every river, they tell us, is a Green Zone for 15 meters on each side, although we are not sure if that is from the edge of the centerline. People say that we should contact ACUA, a

Salvadoran Non-Governmental Organization (NGO) that has experience doing water projects in the area.

At the end of the meeting we showed ADESCO President Don Chepe and Secretary Felipe Funes the draft of the community contract, or memorandum of understanding. We gave them one copy to read and review. We told them they could make changes to the document if they didn't like anything about the contract.

Date: July 6, 2009

Location: El Porvenir

Subject: Health surveys and community observations

Today we went to El Porvenir to do as many health surveys as possible. Susie drove us to El Porvenir in the morning and dropped us off in front of Chepe's house. Chepe was in his house and we asked him whether he wanted to participate in the survey. He said he would be happy to participate and that he would also escort us to other households in the community. As we moved from house to house it became increasingly clear why Mike and Susie identified El Porvenir as the "neediest" community in San Jose Villanueva. There are three pre-fab concrete houses that the Keene Rotary group constructed in February 2009, but almost all other houses have mud walls and corrugated metal roofs. No one has electricity and some families walk more than a mile to get water. Equally significant is the way the community is organized; the community feels very isolated and the houses are relatively spread out – unlike Arada Vieja where houses are centrally located around the school and water source. In El Porvenir there are almost no shared community assets: no soccer field, no community center, no school and no central water access point.

Jack (of EWB) and Vice-President of the Porvenir ADESCO, Jesús Antonio scout a route for a potential water pipeline from the springbox by the river to the conacaste tree in the center of Porvenir. It is not possible to walk a direct route. There is a hill to the northeast of the conacaste not visible on our topo map that would not allow water flowing by gravity to pass. A path that heads east and

downhill to the river and then north along the river bed must be taken. It is pretty far up to the springbox – further than we had pictured. The banks of the river are steep and it seems that it would be quite an undertaking to install enough piping to reach the conocaste. Jack asks Jesús Antonio if he thinks it would be possible to build a new spring box. Jesús says no, but this could be a language-barrier issue.

Date: July 7, 2009

Location: San Jose Villanueva, Mike and Susie's back porch

Subject: Meeting with Elmer Perez from ACUA to discuss water rights

Elmer describes ACUA and how they do their work. ACUA, the Asociación Comunitaria Unida por el Agua y la Agricultura, is a non-governmental development organization based in Zarazoga, El Salvador.

- Key question for Elmer: *If we build a well in El Porvenir would it be possible for the land owners to evict the caretakers and other residents?*
 - Elmer: Yes, the caretakers and other residents have no rights to land or water if they do not own their property.
- Elmer describes ACUA's approach to water projects: Before working in a community, ACUA does a "general diagnosis," which includes a technical and social assessment. Usually ACUA will not consider a project where fewer than 70% of the people own the land they live on. People who don't own their own land are called "cuidanderos" or "colonos." In ACUA's assessment process about six educational workshops or "capacitaciones" are held in the community. Clarifying the rights and responsibilities is an important part of the workshops.
 - There are two different kinds of payments for water users "una cuota fija" (fixed costs) and "una cuota variable" (variable costs). The fixed cost is an equal amount paid by everyone in the community to cover system maintenance. The variable cost amount changes depending on how much water each family uses. A typical project assessment for ACUA takes between 6 to 8 months.

- In El Porvenir only about fifteen percent of the families own their property. However, there are other factors that can prove equally important to the success of a project. These factors include:
 - Presence of a legal ADESCO
 - Landowners who are also ADESCO members
 - A water board with equal authority in the community as a water board.
- Elmer suggested that as we continue with our assessment we should find out more about 1) the ADESCO board members and their history, 2) whether there are other committees in the community, 3) whether there are community leaders other than the ADESCO board members, 4) history of water access issues in the community.

Date: July 9, 2009

Location: Arada Vieja

Description: Meeting about disagreements over fee payments for water system

Today we are meeting with Arada Vieja. We hope to reiterate our belief that the water fund is important, and to hopefully move beyond these money issues to talk about the operation of the filtration system and a possible partnership with the University of Central Americas (UCA) for regular water quality testing.

No one in Arada Vieja except for the Román family (Alfonso, Deysi, Ricardo, Abel, etc.) has been paying the tariff. Nonpayers all have excuses, like Don Goyo's father had been sick and his son in the US had lost his job, but also people have personal beefs with Alfonso, the former treasurer of the Water Board. They had an argument where Alfonso said "Fine, you take the money!" and Alfonso gave Don Goyo the \$80 or so they had saved up, all of which was Alfonso's family's. The slate of who has paid and who hasn't paid has been swiped clean and Don Goyo and company say they want to have a fund, but they don't have the money right now. Alfonso is at work (unlike Goyo and Teofilo who don't have jobs) so he couldn't be present today. Deysi and Abel come in part way through the meeting to represent

Alfonso's camp. Deysi tells Goyo to shut up at one point, Abel says there isn't so much a division in the community, as some people just aren't doing their part.

We say:

It is important that everyone understands that it is the decision of the community how they pay for maintenance and repairs. We recommended that families pay a monthly fee because this is how many communities in El Salvador maintain their water systems. Collecting a monthly fee also ensures that there is always money to pay for repairs as they arise.

Last summer EWB paid for new pipes from David's spring after the black tubing had broken. When the new pipes broke, EWB again paid \$250 to fix the pipes. EWB cannot pay for more repairs to the system. It is your responsibility to maintain the water system. As we move forward, EWB will only be able to offer technical advice and will not be able to pay for any future repairs. This fact is very important because it affects the entire community – not just the people who drink the filtered water. The piping broke twice; if it breaks again water will not be able to be pumped to the two spigots. There has to be a way to pay for this kind of system maintenance.

In the past few days we have heard many people say that 'water comes from God,' and though this is true, the piping and the pump and the filters don't come for free from God. The maintenance fund is not about paying for water, it's about paying for the water system and all its components.

Susie comes in at this point, listens to a few minutes of the two sides complaining about each other to us, and cuts them off. She says that we don't have time to be arguing about Arada Vieja's politics. She says her son doesn't send her any money (in reference to Goyo's excuse), call when you get this figured out, and we pretty much walked out on the meeting.

On the ride home Susie and her friend John lament on how things have gone downhill at Arada Vieja. The reason so many projects have been done in Arada Vieja is because people had always worked together and contributed to each project. When Mike and Susie started, the community was responsible for donating 30% of the money, materials, and labor, but all that has gone away. As other groups have jumped on the AV bandwagon, they have started just giving things to the community with not enough asked in return. This spring Rotary built a couple of houses in AV and Susie says it was disgraceful how little help was given. People relaxed in hammocks and watched as their houses were built for them. Susie says she'll take people out to the restaurant, but basically she is done donating things. The meeting was a real eye-opener for us too, and as much as we have always said that projects

must be community driven, we are worried that in discussing technical options for Porvenir, we haven't been putting enough emphasis on this. The community needs to organize itself, and we should really not be trying to install a well before the village has developed an organizational structure to support the project.

Date: July 10, 2009

Location: The University of the Central Americas (UCA), San Salvador

Description: Inviting UCA student to help with testing of Arada Vieja filtration system

We are greeted at the UCA by Prof. Jaqualine (our contact whom Allison had written to), Prof. Carlos (a UCA professor of civil engineering), and a graduate student (also named Carlos). The UCA people say they would be glad to help us. They have a requirement in their curriculum for community service and so will not need to charge us for their time, only for the agar and other materials needed for the tests. They offer to start sampling almost immediately, which would be great except for the politics in AV. For now, we spare them the details and hope that those matters can be straightened out before we return home.

Date: July 11, 2009

Location: Tekuana Kai, Puerto Libertad

Description: Day off at the beach

Date: July 12, 2009

Location: Conacaste meeting tree, Porvenir

Description: Community meeting to discuss project direction

Second community meeting in Porvenir. We give the following presentation:

[First section of presentation moved to Section 8.3 (Lessons Learned) below.]

We have conducted surveys regarding not just water, but on the economics and health of the community. We did this to better understand conditions in the community and to start a conversation on the most pressing needs in the community. While access to water was the most common response, half of those surveyed reported having enough water to drink. Our samples indicated the presence of bacteria in both water supplies and in many home supplies, but only two families reported symptoms consistent with poor quality drinking water. At our last meeting, many people thought that installing a drinking water well was a good idea, but we ask you all to carefully consider the question of not only is the greatest need, but also what kind of project is most appropriate to start in Porvenir now. The construction of a well is an extraordinarily expensive and challenging project, much greater than, for example, the construction of a house. Perhaps the well can be the eventual goal, but there are smaller steps we can take now building

towards this larger project. Many people said that lights or improvements to road were also priorities. Lights would make it possible to hold meetings at night and a road would help people get to work more easily, increasing the funds available for an expensive well. While the conocaste tree is beautiful, an enclosed public meeting space may be necessary for the extensive planning that must be done for a well project. Installing and protecting solar panels, repairing the road, or building a community meeting hall would be both valuable experience for Porvenir, and these projects would be valuable for convincing potential donors that Porvenir is an organized, cohesive community worthy of the large investment a well would require.

While the political freedoms achieved in El Salvador over the last 30 years are a start, it is still up to individuals to work for progress for their families. As friends of Porvenir, we are willing to work hard raising funds and contributing labor for the betterment of life here, but it is important for all to understand that no gifts we give are as valuable as what Porvenir can do for itself. We live a continent away and can only visit occasionally, so it is you who must be in charge of the project and you who must tell us how we can help. Since we cannot be here often, we suggest that we involve other partners to help us build organizations within the community that can accomplish gradually what seems like huge goals. Just as Hidrotec has experience drilling wells, ACUA has experience organizing people and meetings. We suggest that you invite ACUA to join with us to act as advisors to Porvenir and to help keep EWB updated. We have not discussed this possibility with ACUA prior to this discussion with you, and we do not know if they have time or personnel to contribute right now, but it is in all of our interests to involve all possible resources as we work on this difficult project.

When we finished the presentation we concluded by saying that we hoped to have an open discussion about the ideas presented, specifically whether water was the most important need in the community, the creation of a water board, and the possibility of involving an organization like ACUA in the project. Don Chepe responded first saying that there had a been a water summit and a second water meeting at the mayor's office. At both meetings they had learned about plans to build a golf course in SJV and to bring water to the housing developments, La Hacienda and Miramar. Due to these plans in SJV, water was definitely the most important need in El Porvenir, according to Don Chepe. He also mentioned the word "mecha" several times, which, from our understanding, is a "stub" on piping where new service pipes can be joined. The new projects will benefit Miramar and La Hacienda because there are 500 mechas for these developments and only 23 "mechas" on the new piping for people in SJV.

Felipe Funes, the ADESCO secretary, showed up later and we reiterated our concern that the community must be well-organized around the goal of the water

project. Felipe says all the right things. “We need to involve everyone: men and women, young and old.” This is great but is somewhat sharply contrasted by what is going on at the moment. The same group of men (Don Chepe, Felipe, and Tomás) do most of the talking while everyone else stands off to the side. A constant challenge for our group is trying to tell the difference between genuine statements of opinion by Porvenir and them just telling us what we want to hear.

Elmer (of ACUA) had emphasized the necessity of a water committee. The water committee should exist before any construction takes place because the committee must be highly involved with the planning process. Felipe and Don Chepe explained that at the meeting earlier that day the FMLN discussed creating three committees for water issues at the municipal level. We say that the municipal committees have their interest at the municipal level, while EWB and Porvenir’s concern is about water issues on the community level. Don Chepe immediately seemed to understand our reasoning for a water committee in El Porvenir. We encouraged the community to contact ACUA because they have the expertise in guiding communities through the process of creating a water committee.

At this point in the meeting it was unclear whether people fully understood the point we were trying to make about the water committee and its purpose in the project. In order to see if we were on the same page as everyone at the meeting, I asked what people thought the next step should be. Tomas Urias, the former ADESCO president, was quick to respond with “what does EWB recommend our next step to be?” We suggest that the first step would be to meet with a representative from ACUA and Felipe followed with the idea of setting up a workshop with ACUA. By the meeting’s end, the ADESCO board members all seemed to understand that it was their responsibility – not EWB’s – to establish a relationship with ACUA.

Date: July 14, 2009

Location: ACUA offices, Zarazoga

Description: Meeting to discuss how ACUA can help El Porvenir.

Today we have another meeting with ACUA, this time at their office in Zarazoga. Elmer introduces us to Ricardo, who likely would be the one visiting Porvenir and working on the project. Before this can happen, however, there is a formal process that ACUA requires for the community to apply for ACUA's assistance. ACUA currently has commitments in a lot of communities and would need to make sure that they have time and resources available before agreeing to the four or five months that it would take to organize a water committee in a new village. Porvenir needs to submit a "Letter of Need" to initiate the process. Also, ACUA wants to see from EWB an explanation in writing of the type of relationship that EWB wants to have with ACUA. They want copies of the research that we have done and want to be informed of what kinds of infrastructure we have discussed with Porvenir.

Date: July 15, 2009

Location: El Porvenir

Description: Site visit with consulting engineer Luís.

Luís Carlos Palomo, from the Salvadoran private water development company Hídrotec, is working for us today. We have arranged to pay him for his time, and by the end of the day, we all feel that he has been worth every bit of the \$100 we paid him.

Luís is great for both his experience and for his language skills, having been working on water projects in El Salvador for twenty years after earning his masters degree in Texas. Having a Salvadoran fluent in English is incredibly valuable. He's a funny guy and seems to establish an immediate rapport with Don Chepe and Jesus Antonio, who again meet us at the *conocaste*. Within a few minutes of meeting them, Luís finds out that several wells do exist around Porvenir, which no one had ever mentioned to us, since they are dry and not in use. One is near the *conocaste* and was dug by the landowner about six years ago. It is difficult to determine how deep

this hand-dug well is, but it must be at least ten meters. The well is lined with brick for the first five meters and is about one-and-a-half meters in diameter.

While we are on the subject of the landowner, we discuss land ownership issues with Luís. We say that we are thinking that a water distribution point near the *conocaste* may be convenient, but we don't think that anyone living in Porvenir owns any of the land nearby. A potential solution, Luís says, is to place a well within the right-of-way of the road, which is public property. Determining the exact location of the right-of-way would be important, and a professional land surveyor would need to be hired to do the relevant property research and measurements.

We go down to the springbox in the river and Luís tries to get a sense of the geology of the area, and where it may be possible to draw groundwater. Luís theorizes that the stone river bed may be the best clue we have to the depth of groundwater in Porvenir. Rainwater percolates through the layer of permeable soils (called overburden) on which Porvenir lies between the Río San Antonio to the west and the Río Muyapa to the east. When this water reaches the bedrock, it runs off, perhaps forming an aquifer. The depth of this bedrock layer is difficult to guess, but Luís thinks that it is probably somewhere in the range of the elevations of the rivers on each side of the village. It is likely that the shape and depth of this bedrock layer will be quite variable, since the Río San Antonio has an elevation of perhaps thirty meters below the Río Muyapa (see Porvenir site plan in Appendix A). So, while there is a lot of uncertainty, Luís feels that there is at least some groundwater is present at a depth that can be reached with a drilled well.

After our meeting in Porvenir on Sunday, Chepe and others had casually mentioned that there has already been a Green Zone designated in the village for the purpose of building a soccer field and community center to the west of the main road north of Domingo's house. Huh?!? Every day working with Porvenir we seemed to learn about something that we couldn't believe that no one had told us before. Perhaps the lesson, however, is that we can never ask enough questions. The revelation for today is that some property plans, belonging to the owner of the

land, are in Don Fermín's house (the first place on the left when you come in over the Río San Antonio).

We look at the supposed Green Zone past Domingo's house and Luís thinks that this would be a good place for a drilled well. The topo map shows about a 445 meter contour in this area. The closest point on the Río San Antonio has an elevation of 405 meters and the closest point on the Río Muyapa has an elevation of about 440 meters. Luís later sends us an estimate specifying a well 60 meters deep, using a ½ HP electric pump. Luís say that perhaps a gasoline generator and a car battery could be used to power the pump.

Don Chepe says that they would like multiple distribution points, so that everyone can get water from a place that is convenient to their home. We discuss pumping water to a tank on the highest elevation in the village, so that gravity lines can then be run to wherever distribution is desired. Again to our surprise, Don Chepe tells us that there is already a tank on top of the highest hill. Chepe and Jesús show us the tank, which has not been used for several years. The landowner built the tank for agricultural purposes, taking water pumped from the San Antonio by a gasoline-powered pump, which Chepe helped operate. The tank is about two meters tall, with a fourteen meter diameter. Since it is uncovered it does not appear to be appropriate for drinking water purposes.

Later in the day we examine a set of property plans held in the house of Don Fermín. A discussion of these plans is given in section 7.4 Water Rights.

Date: July 16, 2009

Location: El Porvenir

Description: Meeting with ACUA in Zarazoga

We present ACUA summarizing our work in the Porvenir project to this point. It is a little discouraging when, after we give them the (we thought) complete project summary we have written, they tell us, "OK, now get back to us once you have your materials prepared." When we tell them that we have worked we Hídrotec, they ask us if we have performed a hydrogeological survey – something

way more in depth than the walk-around we did with Luís. This is certainly a valid point for them to bring up, and they reiterate what Luís has said about the difficulty of finding plentiful sources of groundwater around SJV, but unlike Luís, they don't seem to understand that we are only talking about a very small flow. We talk a little more about the letter they want to see from us, addressed to their managers, specifically explaining how and why we want to work with them. We feel like there is some pressure on us to write this letter carefully, and it is not finished until after we return home.

Date: July 17, 2009

Location: Epilogos House, Mayor's Office, and Porvenir

Description: Meetings with El Porvenir ADESCO

Our last day working in El Salvador. We are meeting with the ADESCO of Porvenir to sign the Memorandum of Understanding and to discuss next steps. We assemble the tables into a square configuration on Mike and Susie's back porch and set up the wipeboard so that Porvenir will have a place to put their ideas in writing. The plan is to discuss the MOU between Porvenir and EWB. Hopefully, Porvenir's input into this agreement can be significant, not just an approval of what we have written.

Although Felipe has not arrived by half an hour after the proposed meeting time, we begin by asking the ADESCO to suggest responsibilities that EWB and Porvenir should have for the water project. Porvenir says they will organize a water committee and "take care of" the project, but hesitate to ask anything from us. At first all they want to say is that EWB is doing a great job, but with prompting they suggest that we should help provide information on how to build the system. We feel that the few statements made agree with the essence of our understanding of our relationship with Porvenir and distribute the MOU as we have written it. Again, it is difficult to get much of a response. Don Tomás's response is simply, "*Excelente*". The lack of criticism may reflect a desire by the ADESCO simply not to offend or contradict EWB, but Don Chepe says specifically that the description of Porvenir's responsibilities agree with his understanding. Since no changes have been

suggested to what we have written, we have a little signing ceremony, passing around each copy of the MOU until everyone has signed them all.

From here the discussion moves to a review of Luis's visit and a review of the technical options available to the community. Allison (of EWB) asks if the community wants a system like we have discussed with ACUA with a few *cantonaras* providing water at several locations in Porvenir. "Yes", they say, "and perhaps we could use the old agricultural tank on the hill to save money." Porvenir will look into buying that land and pumping water up to there from a well. Allison states that there are concerns expressed by both Luís and ACUA that a well might not yield sufficient water for the community and that perhaps we should look into alternative sources, such as the spring near the river. The ADESCO replies that there is not enough water in the pila at the end of the dry season. Families that would usually take two *cantores* (5-gallon jugs) only take one during the driest parts of the year, supplementing this supply with river water disinfected using chlorine bleach.

Finally, we pass around the Easygel dishes we have been using to test water from the pila in the river, from the river Muyapa itself, the *nacimiento* (spring) near Tomás's house, and from household pilas. The dirtiest water is the river and a few of the samples we took from some household pilas, such as Don Chepe's. The houses with ceramic filters show no E. coli and the pila in the river varies between samples with no E. coli and some that contain around 100 E. coli counts per 100 mL, perhaps dependent on whether the river has flooded recently.

We all go to the mayor's office where they have a copy of only the first page of the property plans that Don Fermín had. We look at the northern Green Zone together and lament that it is not as large as they had thought it was.

After the mayor's office, we go back to Porvenir to take one more measurement on the flow from the springbox in the river. The time waiting for the water level to rise up again after bailing it out gives us the opportunity to "chat" a little bit. We and Felipe talk about how the Green Zone is on the steep part of the hill, and it will be a problem getting a drilling truck down there. We check out the

cornfield above the springbox and ask about what chemicals are used to grow the corn. Fertilizers, herbicides, and insecticides, it sounds like. We get Don Chepe to write down a list of the products used.

We go to check out another dry hand dug well. It looks deeper than the one we looked at with Luís and would seem to extend below the elevation of the nearby Río Muyapa, which would contradict Luís's theory. We drop in a stone a wait for a splash but hear nothing.

We go to the ACUA offices and drop off the "Statement of Need" that ACUA requires to establish a relationship with Porvenir, and it feels like we have got the project started. We still don't know where the water will come from, but Jesús, Chepe, and Carlos have made the trip to Zarazoga with us, and it feels like we have a good team. We have many months of difficult work ahead, and there is little certainty in the project, but right now it feels like we have all the pieces in place.

4.0 COMMUNITY INFORMATION

4.1 Description of Community

The village of Porvenir is part of the San José Villanueva municipality southeast of San Salvador, El Salvador. The village was settled in the 1960's and there are twenty-five families, with an estimated population of 120. The land is owned by the family of the Ingeniero Francisco Arriaza – who does not charge the residents rent. The roads into the community are poor, but one road to the highway is passable. There is an ADESCO board chosen by the community members to handle matters of mutual concern. The health surveying helped us gain a better insight on El Porvenir. Houses are spread out, however some large families have their homes clustered, creating separate groups of houses throughout the village. Most of the houses are made of wood, clay, and aluminum. The roofs are mostly constructed of metal aluminum. Some houses have televisions, radios, and lights powered by battery. A few houses in the community are made by Habitat for Humanity, made of concrete. Houses are protected by wood/wire fences and wire

gates. Most families have small, domesticated animals such as chickens and dogs. One family had two cows. Most families have gutters on their roof that lead to a basin, which collects rainwater. One house collected rainwater in a tank that was connected to two faucets. The average income of a household was \$100 a month. Heads of the households received an education up to 6th grade. A few children are currently going to school.

4.2 Community/NGO Resources and Constraints

Tufts EWB has a four-year relationship with the NGO Epilogos located in San Jose Villanueva near the village. The residents of Porvenir may have construction skills that will be valuable to the project. They are eager to begin working with Tufts EWB, and they have signed a contract with us confirming their willingness to put forth the required manual labor for whatever project both parties agree upon. The community does not generate sufficient income to hire a professional or buy materials. If we decide to implement a well, it might take a long time to raise the money. The people who live in El Porvenir are known as “*cuidanderos*”, meaning caretakers. Technically, they do not own the land on which they live. Instead, they take care of their plots of land for a landowner who does not live near the village. If a well is installed, the value of the land may increase and the landowner may want to remove them and sell the land as divided lots. It seems as though we are limited to drilling a well in the ‘green zones’ of the village. Unfortunately, the only green zones are many feet from the established road that runs through the community and the in areas that are inaccessible for construction. The flow rate (taken during wet season) of the existing spring box is currently insufficient for being the only source of water for the village. It is likely that expanding the spring box will not provide enough water. Also, piping from the river to a central location will require too many pipes making this alternative cost inefficient and non-sustainable.

4.3 Community Relations

Our primary contact with the community is through Epilogos Charities. Mike and Suzie Jenkins of Epilogos are in regular contact with several residents and are helping us

establish a working relationship. We are in contact with the ADESCO board, which was chosen while we were visiting the community. The ADESCO, *Asociacion para el Desarrollo Comunitario*, is elected by the community. They make decisions about the money that comes into El Porvenir, the water, the education, and any other community issues. We spent the majority of our time working with the President, Don Chepe and the Vice President, Jesús Antonio. The other board members include the Treasurer, the Secretary, Felipe Funes and the “*Cindico*”, Don Tomás.

4.4 Community Priorities

On July 5, 2009, we held our first meeting with the people of El Porvenir to bring forward their priorities, discuss the generalities of EWB’s relationship with the community, and talk about how EWB could help El Porvenir satisfy their greatest needs. The immediate reaction from the community was that they lacked a significant supply of potable water. We responded by presenting a few alternative water sources in the community, which we had researched at Tufts University during the spring. Our purpose for the trip, as we explained to them, was to analyze these alternatives further to determine which alternative was optimal. The community was enthusiastic about the idea of constructing a well. Even after we explained some of the concerns with a well project (cost, discrepancy over land ownership, proper location), their excitement was not curbed. It seemed as though the collective opinion of the community was that the well would be the best way to obtain more water.

We continued to research the priorities of the community by asking individuals. In the health survey, we asked individuals to list the main needs of the community. There was not much variety in the responses. The main needs were determined to be water, electricity, improved roads, and to fix the bridge that was not accessible after hard rains and limited entrance and exit to the community when flooded.

In our final meeting with the community, we wanted to communicate clearly our goals with El Porvenir. Our goal was to have the people identify and organize

the priorities of the entire community. First, we presented the information we received from the health surveys. The surveys showed that the greatest priorities were improving access to water, electricity, and the bridge. We explained that the community would need to take small steps to build their capacity. Ultimately, this would enable them to support and maintain any infrastructure that we would be implementing. In the meeting, the community brainstormed the different steps they would need to take in order to reach their goals. They confirmed that their priorities were improving the access to clean water, obtaining sources of electricity, and improving the bridge that connected El Porvenir to the major highway to San Salvador. They also asserted the need for community capacity building by creating a water committee.

5.0 DATA COLLECTION AND ANALYSIS

5.1 Summary of Data

5.1.1 Interview Results

The survey used during the July 2009 trip was not modified from the version used in El Porvenir in January 2009. The survey contains open-ended questions regarding demographics, health, water use, diet, sanitation, economics, education and communication. Two IRB-certified students from Tufts EWB conducted each health survey. Two members of the ADESCO board, Don Chepe (President) and Jesus Antonio (Vice President), accompanied students to each house and introduced the students to each family. The students entered the property of the residents of El Porvenir and asked if a household representative would be able to participate in the survey. Once the students had explained the purpose of the study, read the verbal consent and received consent from the participants, the students proceeded with the survey questions. One student led the interview, while the second student served as a witness and took notes on the participant's responses. At the majority of households photos were taken of survey participants in front of their houses. Verbal consent was obtained prior to taking photos.

All community members who were asked about taking the survey agreed to participate. As in January, the translation and wording of some survey questions proved confusing to many participants. For these questions, the interviewer either reworded the question or ignored it all together. Because an important part of the July assessment trip was to learn more about water use in El Porvenir, students added a question to the survey to ask how much water residents use for drinking and cooking daily. More than half of the survey participants were women. Almost all homes had dirt floors and families shared living space with pets and chickens. Most families said they had latrines at their homes. No survey participant reported attending school past ninth grade.

Data from the interviews is attached in Appendix A.

5.1.2 Water Demand

Personal demand statistics were determined through interviews with fifteen of the twenty households in Porvenir. Water usage was reported by *cantarada* (container). One cantarada holds about 19 liters.

	"cantarada" per person, per day	liters per person, per day	gallons per person, per day
Average reported water usage	0.77	14.66	3.87
Maximum reported water usage	2.0	38	10

Community water demand statistics were calculated using the maximum reported daily usage and an estimated population of 120 people.

Maximum estimated water demand =	4,560 liters per day	1,200 gallons per day
Maximum estimated water demand =	3.17 liters per minute	0.84 gallons per minute

5.1.2 Water Quality

Bacteria tests were performed using Coliscan Easygel tests and Coliscan Membrane Filtration (MF) tests. Both tests are made by Micrology Laboratories,

L.L.C. The Easygel tests were used in most tests because the luggage containing the MF media was delayed during transit to El Salvador. Details of testing procedures can be provided upon request.

Bacterial water tests were performed at water sources and in household pilas. The springbox in the river and Tomas's well are the main water sources. The river water is a source when no other water is available. Household pilas are noted with the reported source of the water or if filtration was performed in the household.

	Date	Total Coliform (counts/100mL)	E. coli (counts/100ml)	Testing Method
Springbox in river (Domingo's)	7/5/09	2,360	60	Easygel (5 mL)
Springbox in river (Domingo's)	7/8/09	2,060	0	Easygel (5 mL)
Springbox in river (Domingo's)	7/14/09	2,460	20	Easygel (5 mL)
Springbox in river (Domingo's)	7/14/09	3,520	0	Easygel (5 mL)
River Water (Río Muyapa)	7/14/09	TMTC	TMTC	Easygel (5 mL)
Springbox in river (Domingo's)	7/14/09	TMTC	95	MF (100mL)
Springbox in river (Domingo's)	7/14/09	TMTC	148	MF (100mL)
River Water (Río Muyapa)	7/14/09	TMTC	440	MF (5mL)
Tomas' well	7/5/09	TMTC	340	Easygel (5 mL)
Tomas' well duplicate	7/5/09	TMTC	280	Easygel (5 mL)
Don Chepe springbox (rainwater)	7/5/09	TMTC	480	Easygel (5 mL)
Survey house #5 (ceramic filter)	7/5/09	20	0	Easygel (5 mL)
Marta Pabla (rainwater)	7/8/09	TMTC	160	Easygel (5 mL)
Juan Daniel Amaya (springbox at river)	7/8/09	TMTC	0	Easygel (5 mL)
Beatrice (springbox at river)	7/8/09	900	0	Easygel (5 mL)
Clauida Andre Lisano (rainwater)	7/8/09	1,170	0	Easygel (5 mL)

Ana Guadalupe (springbox in river)	7/8/09	630	160	Easygel (5 mL)
Tomas' house (ceramic filter)	7/8/09	TMTC	0	Easygel (5 mL)

The water in the springbox, though not potable by United States EPA standards, was significantly cleaner than the river water. It rained heavily most nights during the trip, so it is possible that the variability in E. coli levels is due to flooding of the springbox by river water. Also, different results may be due the two bacterials testing methods used, though they are supposed to be equivalent.

The water from Tomas's well tested to be quite dirty.

Water from rainwater was variable, likely reflecting conditions in the pilas it was stored in.

62.5% of households did not show any E. coli in their water supplies. Of the three houses that did show E. coli in their water, two reported using rainwater and one used water from the springbox in the river.

The two households that filtered their water both showed no E. coli growth. The test from Survey House #5, who use a ceramic filter, showed extremely clean water, with no E. coli and very little total coliform. The test from Tomás's house showed no E. coli but lots of total coliform.

5.2 Mapping

A site plan was drawn after the January 2009 trip. It is attached in Appendix B.

6.0 PHOTO DOCUMENTATION



Date: July 3, 2009

Location: Porvenir, conocaste tree

Description: Voting for the ADESCO election in Porvenir



Date: July 5, 2009

Location: Porvenir

Description: Well near Tomas's house



Date: July 5, 2009
Location: Porvenir
Description: Springbox at river



Date: July 17, 2009
Location: Porvenir
Description: Members of the ADESCO. From left: Carlos, Chepe, Jesús Antonio, and Tomás.

7.0 PROJECT FEASIBILITY

7.1 Availability of Local Materials

Tufts EWB has gained a familiarity with local availability of building supplies working on a water supply and filtration project in the village of Arada Vieja, which is located in the same municipality as Porvenir. Most supplies were obtained from the Agroferreteria San Rafael located at the port of La Libertad, about a thirty-minute drive from Porvenir. This store has delivered concrete, galvanized steel pipes, pipe fittings, and tools to Arada Vieja, which is located further from the highway than Porvenir is. The only parts that were difficult to obtain were the large plastic barrels used for the slow-sand filters, since plastic was required that had not been used for petroleum products.

7.2 Availability of Local Labor

During this trip, Tufts EWB hired the services of a local consulting engineer. Luís Carlos Palomo works for Hidrotec, an engineering company that has experience designing and installing wells. Luís provided Tufts EWB with an estimate to drill a well in Porvenir.

Members of the leadership council in Porvenir signed a Memorandum of Understanding with Tufts EWB offering to provide labor if a water project is developed. Porvenir residents have not yet been surveyed for their specific construction skills.

7.3 Property Ownership

Only three families (of the approximately twenty) living in Porvenir are landowners or have the land they live on under lease. The remainder of residents are *quidanderos* or caretakers of the land. Neither renters nor squatters, the people “watch over” the land at the owner’s behest, and may even receive some monetary payment from the landowner.

7.4 Water Rights

It is a concern that an amenity, such as a well, on property not owned by the residents could be seized by the land owner. Residents of Porvenir suggest that the well be located in a “Green Zone”, where legally all people have access.

A set of property plans are kept in the village. The plans were drawn in 1988, approved in 1993 (just after the end of the civil war), and show Porvenir divided into a gridiron of small lots and perpendicular streets. The main road through town is represented and the concrete-paved roads that run perpendicular can be interpreted as being a few of these streets.

Two Green Zones are shown on the map, but neither is quite how Porvenir had understood them. The Green Zone to the north does not start at the road, but rather 90 meters to the west at Tomas’s house and 150 meters to the west of the road at Domingo’s house. This Green Zone, therefore, is composed of steeply sloping land near the Río San Antonio that is not accessible to a well-drilling truck. Perhaps more promising is a second Green Zone to the south of the main road along the San Antonio. This area may be more accessible using the wide path that branches away from the main road. We take photos of the plans and note the document numbers so that perhaps we can obtain copies in the future. We are told that the landowner named on the plans, Ingeniero Francisco Arriaza is dead, but his son now owns the property. We wonder if the phone number on the “For Sale” sign across the street from Domingo’s house belongs to this son of the Engineer.

8.0 LESSONS LEARNED

8.1 Appropriate Water Quality Testing Methods

We used two methods to perform water quality testing for bacteria.

Test	Advantages	Disadvantages	Conclusions
Easygel	Quick to perform No equipment required	Maximum 5 mL sample Can only detect E. coli and coliform bacteria down to 20 units per 100 mL	Appropriate for initial water quality testing for potable sources.

Membrane Filtration	Can detect E. coli and coliform bacteria down to 1 unit per 100 mL	Time consuming to perform Filtration equipment and incubator needed	Appropriate for detailed evaluation of water quality.
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8.2 Advice on controlling bacterial growth in clean water storage tank

We discussed the bacteria problems we have encountered in AV with Luís from Hidrotec. Luís says that the common solution for bacteria growth in tanks is chlorine, added to the tank using an automated feeder. According to Luís, this is a cheap, low-risk method to keep bacteria levels down. Chlorine is very cheap to use. Only two parts per million is needed in a tank, and chlorine only costs \$2 per pound.

8.3 Importance of community organization in a water project

From the presentation given to Porvenir on July 12, 2009:

Since we came to El Salvador eight days ago, our group has had the privilege of meeting many friendly and hospitable people, see the beauty of the mountains and fields, and learned about the history of the nation. The people of Porvenir have told us that they do not own the land they live on and farm, and our fears that the people could lose their land if the owners so choose has been confirmed in our conversation with ACUA. While we are foreigners and do not pretend to understand all the politics of El Salvador, we think that these issues are as important to consider for a potential water supply project as the pipes, pumps, and tanks from which it is built. The importance of considering the rights and organization of the people comes not only from these broad observations, but from examining water projects built in the last few years around San Jose Villanueva and from consultation with the very experienced development organization, ACUA.

In 2007, a well was completed in the catone of Los Lotes by an American group. Hidrotec built the well, some community members were trained in its use, and all was fine for eighteen months. One day some people not trained in the operation of the well left the pump on for too long, emptying the well and breaking the pump. Today the well is broken, perhaps beyond repair, and the people of Los Lotes again have no water. In our opinion, this unfortunate situation is not simply the fault of those who left the pump on for too long, but also of those who constructed the well for not putting sufficient time into educating the public of the use and sensitivity of the well.

Another case that is within our direct experience is the contone of Arada Vieja. Mike and Susie Jenkins introduced us to the people of Arada Vieja in 2005 and EWB has helped design and pay for upgrades of a broken water supply system. Our group has paid for a new pump, new pipes, and a sand filtration system. The community devoted labor to the project and organized a "Water Board" to oversee the construction and operation of the system. EWB and Arada Vieja had an agreement that once completed EWB would continue to give technical assistance, but that the community would own and be in charge of maintaining the water system. Future repairs were to be made from a fund of user's fees collected in the village. This July we have returned to Arada Vieja to visit and to check on the water quality, and we find that this fund has divided the people of the village. Many of the

families claim that they do not have enough money (\$2 per month) to contribute to the maintenance fund. Assigning blame in this situation is not as easy as good and bad, right and wrong. To us, the blame extends to our own group. While extensive meetings were held to organize the Water Board and to establish community interest in the project, we may have concentrated too much on the physical construction of the system and not made sure that sufficient rules and authority were in place to prevent people from renegeing on their promises to pay.

These difficulties have not diminished our desire to partner with the people of El Salvador, helping to improve living conditions and provide educate our students, but it has made us question the methods we have used to organize our water projects. Also convincing us that we needed to be more careful in our planning was our meeting with Elmer from ACUA. The organization ACUA has been helping communities in El Salvador build leadership capacity and complete water supply and agricultural improvement projects for many years. Lessons similar to the ones we have learned through Los Lotes and Arada Vieja have been repeated many times through the years. ACUA has developed strategies to create higher chances of project success and to realize additional benefits for the community. In ACUA's experience, a successful water project requires years of commitment and struggle for all community members, but through this process skills are learned that can be applied to address the many problems and injustices faced by the people. By taking care to include women and the young in planning organizations, voices can be heard and confidence learned that would not otherwise have had the chance. We ask the community of Porvenir to not look upon this project as simply construction, to be completed as quickly as possible, but as part of larger goals for healthier lives, social justice, and improved education.

9.0 MENTOR ASSESSMENT

Tufts Civil and Environmental Engineering Professor John Durant:

Once again the students conducted themselves admirably and were able to accomplish a great deal on the trip despite the problems they encountered in Arada Vieja. I was very impressed with their thoughtfulness in planning how best to move forward with project in El Porvenir. This project will be more of a challenge than working in Arada Vieja for at least two reasons. First, there is less water in Porvenir. We will need to collect as much flow (river, pila) information as possible so as to assess flow variation over the course of the year (rainy season vs. dry season). Rather than designing and building a centralized water treatment system as we did in Arada Vieja, we may need to consider individual household treatment systems in El Porvenir. We may also need to consider designing and building rooftop collection systems to supplement supplies from the pila in the riverbank. We will need to give serious consideration to the installation of a well, this is an

expensive and risky option. The second reason the project will be a challenge is that we have started to run low on funding for EWB projects at Tufts. We will need to put time and effort into developing a secure pot (or dependable annual stream) of funding so that we know what our options are in El Porvenir.