

## 2012 WEFTA Site Visits in Peru

Site Visits by Lou Harrington  
March 13 to March 22, 2012



Valley of Coruca, Peru

### ***Introduction***

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The trip was to consist of two geographic areas of Peru, Urubamba and Tacna. The first stop would be Urubamba.

In Urubamba the plan was to meet with the local Habitat for Humanity community where WEFTA has assisted with the construction of a wastewater collection and septic system, and potable water reservoir. I also planned on meeting with Urubamba provincial government officials and town officials from communities up and down the valley to discuss the ways in which WEFTA could help with a regional approach to wastewater treatment. All the small urban centers up and down the river have historically dumped their raw sewage directly into the Urubamba River, and the once majestic river has become dangerously polluted and is an eyesore with filth lined shores and decimated fish population. With the expertise offered by some key supporters of WEFTA, clearly we could provide important insights into what treatment alternatives might be feasible.

In Tacna I intended to follow up on the initial conversations we had had with school officials at the Jesuit high school 'Colegio Cristo Rey'. The previous administrator, Hermano Cardona, is no longer at the school but the new administrator had made it clear that he would like to follow up on the idea of Hermano Cardona to use 'scalped' wastewater from the City of Tacna's municipal wastewater system and use it for irrigation of green areas after treatment. Also, during the last trip a couple years ago, locals had shared with us the desperate situation at a remote village, in an adjacent watershed above Tacna whose only 'potable' water source had excessive levels of arsenic and other heavy metals. I was to meet with representatives from the community to discuss how some of our volunteer engineers could perhaps prepare an assessment of what alternative treatment systems and technologies exist that we could help them install.

*Wednesday, March 14, 2012*

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Arrived to Lima at 6:00 am after all-night flight from JFK and continued on to Cusco and then Urubamba arriving at Linda Ochoa's home mid afternoon.

In the late afternoon I met with representatives of the Urubamba municipality who shared with me what has been done recently and what is in the works related to treatment of wastewater in the valley, and also the problems they've experienced recently with their potable water system. I presented in broad terms what it is that WEFTA can offer and where we might be of help with efforts being made in the valley regarding wastewater treatment, especially in the evaluation of available treatment technologies and systems. One of the more senior engineers seemed a bit defensive at first, insisting that they have capable people and understand these things. I was quick to clarify that we certainly were not here to attempt to impose our will or that we felt we were working with people who didn't understand the issues. I shared with him and the others present the fact that within the group of engineers that support the work of WEFTA we are fortunate to have some that have an extraordinary in-depth knowledge of the topic of wastewater treatment and decades of experience evaluating and designing just such systems in North America. After a good discussion it seemed like we had reached an understanding and that we had developed a good foundation on which to build our collaboration, all in favor of the health of the Urubamba River Valley, especially of course the residents of the valley.

After meeting with the Urubamba staff, I met with Habitat board members in town (Guillermo Atayupanqui and Zacharias Perez), and they shared with me the situation at the community with regards to both the water and wastewater projects. I knew just before making the trip that the wastewater system had recently failed. It was initially suspected that the percolation pits had become clogged due to lack of proper maintenance and cleaning of the septic tank. We discussed various alternatives available to the community, some as presented by the municipal engineer, Pedro Sullca, who had recently made a site visit to assess both projects. The engineer concluded that the septic system had failed because the percolation pits had become fouled with solids due to lack of proper maintenance of the septic tanks, and suggested that both the water and wastewater systems be transferred to the municipality who would then take charge of making sure that both were properly maintained. The community members would then pay a relatively small monthly fee for the service. This would seem to be the best option according to the board members present, but would be something that would need to be discussed with the other community members the next day during the site visit.



Zacharias Perez, President of the community association (left) and Guillermo Atayupanqui, board member (right)

***Thursday, March 15, 2012***

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Met with Beverly Elder, an American ex-pat who has lived in the Urubamba Valley for about 30 years, to discuss the Pumahuanca water and wastewater projects. Beverly is very involved in the projects and one of the key promoters. The JASS de Pumahuanca is the first JASS (community water association - roughly equivalent to an MDWCA in New Mexico) in the valley to make any serious effort to clean the wastewater prior to dumping into the river. The community has obtained financing from the Regional Government for the cost of labor and materials to build the wastewater collection and treatment systems, with the condition that that community provide all of the land needed for construction.



The 'maestro de obra' (in vest), along with Simion Gonzales and Beverly Elder (members of the Pumahuanca JASS) explaining the system to Linda Ochoa (in red jacket) and Lou Harrington of WEFTA (not pictured)

Beverly shared with me that the community has had trouble coming up with the funds needed to purchase the land required to complete the collection system. She asked if WEFTA could assist them with funds for that purpose and I explained that our funds couldn't be used for the purchase of land but we could consider assisting in some capacity with materials or perhaps technical review, but it seems like that part is already being provided by the Regional Government. She asked if we might be able to assist with the needed improvements to their water system which the local and regional governments have indicated they could not fund. She will prepare a proposal and submit it for review. If it seems like something that WEFTA could support, we can follow up with the initial questionnaire and go from there.

Visited each Pumahuanca wastewater treatment site (three), relatively simple primary treatment systems each consisting of 22 inch diameter inlet, cámara de excedentes, cámara de rejillas, desarenador (with 4" valves), cámara de grasas, cámara decantadora (largest tank at end) with six large diameter vents, and sludge drying beds with pump system. Each of the three sites are currently under construction. I visited with several locals representing the Pumahuanca JASS: Simion Gonzales Nuñez, Benedicto Loayza Nuñez, Celestino Bustamante (Presidente de Pumahuanca JASS), among others.



Pumahuanca wastewater treatment system under construction

The wastewater system serves several hundred homes and is completely gravity fed, including the 'treatment' system, except for the pump used to extract solids to be spread on the sludge drying beds, which is projected to be done approximately once every six months. The effluent is to be fed directly into the river. Mr. Celestino Bustamante, president of the JASS, indicated that they hope to one day be able to provide additional treatment but that this is what the budget allowed for at this time. The most impressive thing about this effort is that they're doing anything at all. Not even the provincial capital of Urubamba is doing as much.

Upon completing visits to the Pumahuanca facilities, Linda and I went to the Habitat community to meet with the locals on site. They explained what they had recently experienced with one of the two septic systems failing. They had pumped out the percolation pits and much of the septic tank with as much of the solids as they could, but within just a couple days the system was backing up again. It was obvious very quickly that the percolation pits were completely clogged and this is what was causing the septic system to back up. They'll need to construct a new percolation



Pumahuanca treatment site with sludge drying beds

pit and remove the solids from the septic tank as soon as possible so that it could again function as it did before. The system had essentially worked perfectly well for almost eight years; so there is no reason to think that, with proper maintenance, the system should not function for many years to come.

We visited the other smaller septic system that serves a smaller portion of the community. It is working properly but the sludge level in the septic tank is reaching dangerously high levels. Also, the percolation pit for this other system seems to be disintegrating due to the fact that they had used inappropriate, poorly consolidated stones to construct it. This pit would also need to be reconstructed with proper material.

They will contact a local engineer to help with evaluating what material would be required to construct the new percolation pits and piping to connect. Once a budget is established we can discuss how to assist them. The cost of materials should be minimal and the non-skilled labor will be provided of course by the locals at no cost.

I brought with me the complete file for this project including a set of plans of the original system. This was fortuitous because theirs had been lost at some point in the transitions from one board to the next over the years. I left our set of drawings and specifications with them and they'll copy them and return ours to Linda.



Site of failed septic system where new percolation pits will be constructed



Guillermo and Zacharias inspecting septic tank at lower site

Linda and I later visited the school bathroom projects that Linda helped coordinate. We had a chance to speak with Tania who was the school's director when the bathrooms were constructed, and she shared with us that they continue to function well. She introduced us to the physical education teacher who made a plea for assistance with construction of shower facilities since many of the kids that attend the school do not have showers at their homes, and that after a vigorous session of sports and other PE activities they really have a need to shower. I told her that if this is something they feel that strongly about to see if they could get some support locally

with the design and layout of the facilities, which she felt was feasible. Then, once a budget is developed we could let Linda do her magic with leveraging funds and getting multiple parties involved, including the municipality and others. With funds left over from the initial bathrooms project, Linda helped organize another bathroom project for the local kindergarten which we visited. The project turned out really well and is obviously being properly maintained. She also was able to help with another preschool bathroom project in the Chicon valley, and she still has \$800 left from the original grant! She insists that these projects are important because it's the best chance to expose some of these children from rural settings to such bathroom facilities and to instruct them on how to use and maintain them properly. I encouraged her to continue to work with other schools in the valley with a need for new bathroom facilities or repairs.



Completed bathrooms at grade school (left) and later at kindergarten (right) with Linda

Met with entire Habitat community in evening to discuss status of water and wastewater systems, need for O&M manual for wastewater system, discussed broad themes related to septic system maintenance, such as need for all community members to be careful about what gets into the system. The board members made a point of talking about the things they pulled out of the septic tank and percolation pits which should never have been there, so that was very helpful. I shared with those present the basic rules that anyone with a septic system knows about, at least in the U.S. It was all clearly new to them, and in fact would probably be new to just about everyone within the valley considering the fact that such systems simply don't exist except at hotels or some of the homes of the most wealthy.

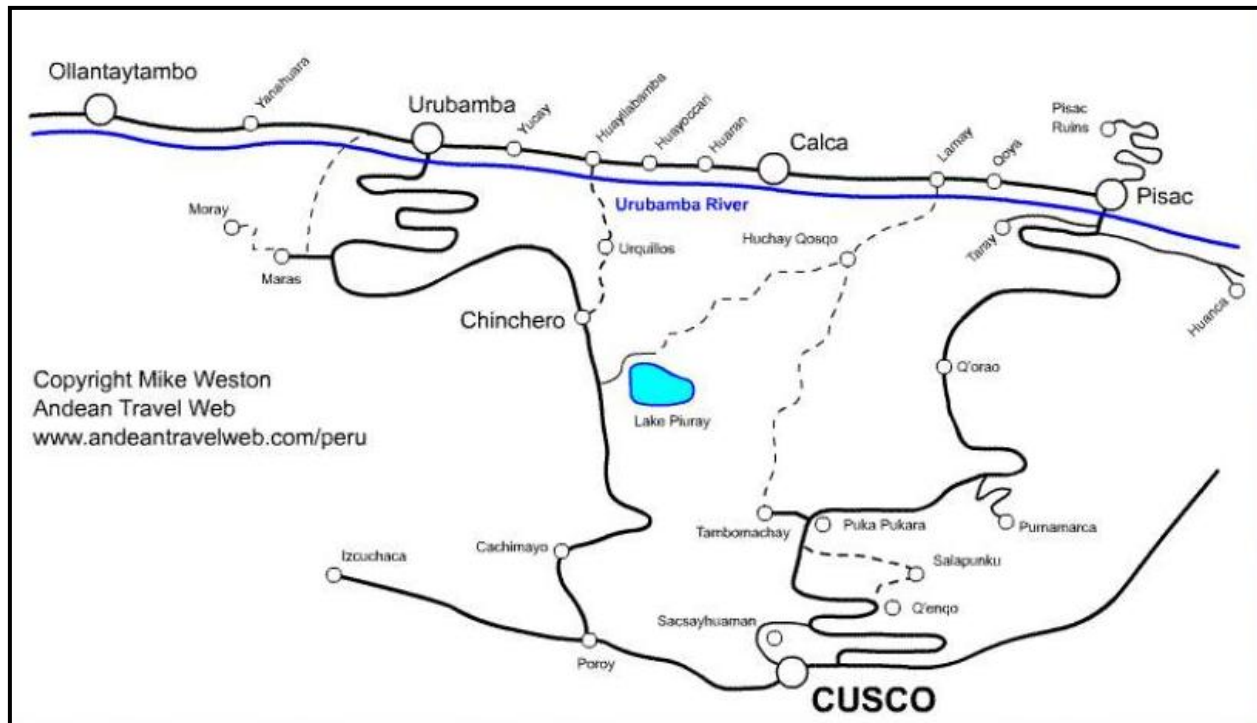
There is \$1,700 left from the \$2,500 transfer made in December of last year (\$800 used to purchase pump to clean septic tanks). These funds could be used to purchase materials needed to construct the new percolation pits.

*Friday, March 16, 2012*

Attended meeting held at municipality all morning and into afternoon. The event was a strategic planning session at the provincial level. It was only by luck that my trip coincided with this event. Representatives from the various districts that make up the Province of Urubamba were present. Several topics were covered, all of which were divided up into four major themes and work groups: health, education, environment, and economic development.

I participated in the discussion group dedicated to environmental issues, facilitated by Derling Palacios, the Director of the Environment Department for the province. This is a relatively new department that did not exist the last time we had made a site visit. Linda was named to the committee that would follow up with the action points identified. It's obvious how much she is respected and loved within the community. She could have sat in on any of the four groups and I'm sure she would have been named to the corresponding committee.

The topics covered by our group included: basic sanitation, environmental health, natural and manmade disaster risk management, land use/zoning, solid waste, and environmental education.



Map of Urubamba River Valley, the subject of regional wastewater study initiative

A great deal of time was dedicated to the topic of wastewater treatment and the state of the Urubamba River. Some of the elder locals talked about their memories of bathing and playing in the river in their youth, as well as a river teeming with large trout. It was clear that it has been a long time since the river was thought of in that way, and the desire to clean it up was clearly evident. Needless to say, this was very encouraging. Another promising sign was when the very engineer from the municipality who a couple days earlier seemed on the defensive during the discussion of how WEFTA might be able to work with them, took the initiative of introducing me and asked that I share with the group what we were proposing in terms of a collaborative

effort. I shared with those present how we felt that WEFTA could prove to be an important ally for the local government(s) as alternative treatment technologies were evaluated and ultimately developed. The concept was well received and several people approached Linda and me afterward to express their support.

Among those we met with individually after the planning session was Señora Dora Cruz Tello (telephone 237095, cell 974272749), email: cusco\_patrimonio555@hotmail.com, representative of the community of Urquillos. She explained that a wastewater collection system is planned for her community and is to be tied into the larger, existing Huayllabamba system that dumps directly into the river. She is hoping that since her community is so small that perhaps we could do something similar to what was done at the Habitat community (septic system).

I met separately with the mayor of Yanahuara, Eriberto Acurio Chullo, and later with the mayor of Yucay, Leoncio Hilario Espinoza Hinojosa, and discussed what kind of basic information would be needed from each community along the river to help evaluate which treatment alternatives are the most feasible. I explained that we would be following up with them and the other communities within the valley with a formal list of the data needed.

We later met with Ing. Pedro Sulcca of the municipality who performed the assessment of the water and wastewater systems for the Habitat community, and we discussed what is being done, or not being done, regarding wastewater treatment in the valley. It was clear that this person had a lot of hands-on experience with the subject, not just in the valley but over the years elsewhere in Peru. He shared with us what he was involved with in Puno in efforts to clean up Lake Titicaca. As we discussed the situation at the Habitat community, he explained the advantages to passing the operation and maintenance of the water and sanitation systems to the municipality.

We also met briefly with a representative of Chichubamba, where WEFTA assisted with the installation of a major trunk line that carries potable water to the community members. The line is in and functioning. They are now in need of assistance with upgrades to the irrigation system. They will prepare a request explaining the situation and share it with us via email. I explained that WEFTA can not help with financial resources for such an effort but that we could perhaps share the request with other NGO's or foundations that may be able to help.

The last meeting of the day, late in the afternoon, was a formal follow-up meeting with Urubamba provincial government representatives. It was decided that a convenio (a sort of MOU) should be prepared which will establish the general relationship between WEFTA and the Provincia de Urubamba with activities/deliverables and corresponding completion dates. WEFTA's role will focus on working with the municipality on the identification of the best and most appropriate treatment technology, and perhaps later in the preparation and presentation of proposals for the project to international funding sources.

The representatives of Urubamba will begin the process of developing an official 'letter of interest' renewing their commitment to the collaboration. WEFTA will follow up with a list of the basic data that will be required to begin the process of assessing which available wastewater treatment technologies exist that can and should be evaluated as viable options for Urubamba.

It was decided that it makes the most sense to use the Municipality of Urubamba as the pilot project due to the fact that it is the provincial capital, and also because they are the best funded and have the greatest exposure, even though the corresponding facility will be the largest.



Representatives from Province of Urubamba:

- Derling Palacios Cano, derpaca@yahoo.es, derlingpalacios@yahoo.es
- Ivonne Quispe Vargas, ivonneqv@hotmail.com
- Martha Ivonne Serna Munoz, ivanser27@yahoo.es
- Raul Otazu Moralesw, jrom77@hotmail.com

It was agreed that any correspondence between WEFTA and Urubamba should be made via copies to all four representatives.

Preliminary observations:

- We'll need to develop and promote an appropriate technology for treatment of wastewater that will be economical to construct and later to operate and maintain, as well as efficient but perhaps not necessarily to the standards required in the U.S. The equipment used must be very sturdy and, if possible, something available in-country. Ideally the majority of the equipment to be used can be fabricated in Peru, and we'll want to limit as much as is feasible components that will necessarily have to come from foreign sources. Where unavoidable, we will want to be sure that such components tend to last a long time and are capable of enduring less than ideal O&M and working environment. Also, any such parts that would need to be imported must be readily available for export/import. We could (and should) consider having spare equipment on-site for quick fixes.
- We'll need to consider how preliminary and ongoing training for the personnel in charge of operations and maintenance can take place, as well as long term oversight by those most familiar with the selected treatment system(s). It will also be imperative to make sure a very good, comprehensive O&M manual is provided, in Spanish of course, that will be shared with the system operators.
- Derling Palacios asked if we could perhaps offer some insights on alternatives available for dealing with solid waste. They are considering incorporating a large incinerator facility and wondered if WEFTA could provide some guidance. Evidently the existing landfill is reaching capacity and is probably not a feasible alternative anymore due to lack of land within the valley.

***Saturday, March 17, 2012***

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Visited the wastewater treatment plant at the very exclusive hotel 'Tambo del Inca' in Urubamba. This completely independent self-contained system treats all the wastewater from the hotel and after disinfection stores the treated effluent in a large underground tank from which it is reused in the irrigation of the extensive landscaped grounds of the hotel. None of the treated effluent goes to the river. This system is fully automated and seems to be functioning very well. If nothing else, it is a great existing and accessible example for communities up and down the river valley of what can be done.



Hotel 'Tambo del Inca' wastewater treatment plant

## Sunday, March 18, 2012

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Travel day from Cusco to Lima and then on to Tacna

## Monday, March 19, 2012

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I met in the morning with representatives of Coruca:

- Reiy Mamani Marquina - Agente Municipal / Teniente Gobernador de Coruca, born in Coruca in 1949 and has lived there his whole life
- Gertrudis Victoria Laqui Marquina - Pobladora

We could communicate with the people of Coruca via email with the son of Señora Gerutdis: Javier Victor Ticona Laqui via [draquion\\_123@hotmail.com](mailto:draquion_123@hotmail.com)

Two buses come and go each day from Coruca. One leaves at 2:00 am, which is the one the people from Coruca took to meet with me in Tacna in the morning. The situation has to do with high levels of arsenic and other heavy metals in the drinking water. The community is made up of about 70 homes with a total population of approximately 400. Local economy is based on agriculture and small amount of dairy (milk). There is a small primary school, up to 6<sup>th</sup> grade. The representatives mentioned that there seemed to be more cases cancer than was common before, or perhaps was not properly diagnosed.

There is a spring source in the mountains above Coruca but it is too far away to be a feasible source of water for the community. In the mid 1980's there was an outbreak of cholera in the area and this is when they constructed the simple pit latrines that most have now. Most houses are made of woven reed mats or adobe. On average the homes are about 50 meters from the river. It was clear that I needed to make a site visit, so we agreed that we would meet at the consejo building of Inclan at 9:00 am the next morning and they would take me up the canyon to Coruca to visit the community.

Later in the day I met with representatives of Colegio Cristo Rey:

- Gonzalo Alvarez - Administrador del colegio
- Pedro Zuniga - Subadministrador

The school is still interested in creating a wastewater reuse project but nothing has been done since the last visit. It was agreed that the school should contract with a local engineer, preferably a sanitation or civil engineer, and ideally an alum of the school, with some knowledge of wastewater treatment and reuse, who could design the system for the school as originally conceived by Hermano Cardona. We could then coordinate directly with that person in the development of the best, most cost effective treatment system for the school. It was clear that the proposal prepared by the Mexican firm that initially designed the proposed treatment system, with an estimated cost of \$250K, was outside the reach of the school. Whatever technology is implemented would have to be much simpler and less costly to be considered feasible.

The school has plans for the tie-in to the municipal wastewater system and a small subterranean tank complete with small pump house on top. The estimated cost of this infrastructure is S/.41,620 (US\$15,650).

I went uptown in the afternoon with representatives from Colegio Cristo Rey to pick up the water quality analyses results performed at Coruca by the provincial Department of Health.

***Tuesday, March 20, 2012***

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Traveled to Coruca by bus to meet with representatives of the community, about a 2 hour trip from Tacna up the canyon along the Sama River.

Electricity arrived to Coruca about 12 years ago and is the only service provided. There is no telephone service (no land lines nor cell coverage), and no water. All homes have latrines. Community has a very basic medical post where nurses attend to the public on a part-time basis during the week; small one-room school with about 15 students from primary grades 1 through 6; community center for gatherings; and an albergue (constructed by students from Colegio Cristo Rey in Tacna) where migrant workers, or any visitors to the community can stay the night.



Don Reiy Mamani Marquani of Coruca overlooking the Coruca Valley along the Sama River.

Community members buy water that is brought in via tanker trucks from Tacna with assistance from the local district government in Sama/Inclan. But when the truck doesn't come, or their water supply doesn't make it to the date of the next delivery, the locals are compelled to use water from the canal to drink and prepare their food. Community members pay S/.5.00 (about \$1.90) for 200 liters of what is called potable water brought in via tanker trucks, or can buy 20 liters for S/.1.00 (about \$0.40) if they don't have the storage capacity.

Another community about 8 km above Coruca is called Sambalai which is especially isolated now since the road up the canyon was washed out a couple months ago. The only way in or out is on foot, horseback or motorcycle. They are worried because their onion harvest is underway now and with no way to bring their crops to market except in small quantities by horseback or motorcycle.



Typical latrine at each home

As far as the water system goes, there are two potential solutions that occur to the community ... one is to develop a spring source several kilometers up the canyon but of course the water would have to be piped in and this would require a tremendous amount of trenching (much through rock) and pipe material, and other appurtenances such as air/vac valves, pressure break tanks, etc. Also, the quality of the water from that spring source has not been tested for year-round flows nor for water quality.

Another alternative is to capture the heavy metal laden water from the canal used to divert water from the river for irrigation, treat it, pump it to a tank on a hill above town and install a distribution system to the homes. There are multiple sites where this could be feasible, where there is ready access to the water from the canal, electricity nearby, and hills high enough to achieve the water pressure needed to feed the distribution system via gravity.

The idea is to have the engineers from Sama/Inclan prepare a design of the water system and then we can review it and provide feedback, concerns, etc. Probably WEFTA's most significant role will be in providing guidance and insights on the different treatment technologies that exist for removing the heavy metals present in the water now.

After a lunch where I was treated to two delicious guinea pigs, we met with mayor of Sama/Inclan (the district to which Coruca belongs). The mayor, Tito Chocano, Jr., explained that the municipality is drilling wells that are showing promising results, but that to drill a well in Coruca is not feasible due to the extreme depth of the groundwater there. He will send us the results of the water analyses of the water from the new wells in Inclan and the results of the test at the spring source above Coruca where he has committed to testing water quality and flows.

The mayor is asking for assistance with the development of water treatment alternatives if development of the spring source proves to be impractical and/or the water unsafe. This is consistent with what we had discussed earlier with representatives of Coruca.

Preliminary water quality tests have shown that the water from the well they recently drilled and completed in Sama/Inclan is not contaminated with excessive levels of heavy metals and the

pumping tests have shown that the well can produce a high volume of water consistently over an extended period which they believe will be adequate to serve the entire community of Sama/Inclan. With this source, the community will not need the expensive treatment equipment that was originally considered that would have had an estimated cost of several hundred thousand dollars and about \$10K/month to maintain in perpetuity.

The mayor intends to find the funding necessary to construct the water project in Coruca via the central or regional government. Considering the fact that his father is the Presidente de la Region (something like a state governor in the U.S.), he may find it easier to find the funding necessary than other mayors. He said that he has received very preliminary estimates that the treatment system for removal of arsenic and other metals for the community of Coruca should be between \$15K and \$30K.

The challenge will be to develop some treatment alternatives that are cost effective, i.e.: don't have a large upfront infrastructure cost and will require relatively simple and inexpensive O&M that ideally can be performed by the locals themselves as much as possible, and with minimal reliance on materials that need to be purchased and brought in from afar.

Ultimately the system may not meet U.S. standards for maximum contaminant levels for the constituents of concern, but anything we can help get done will certainly be better than nothing.



One of the simple homes of Coruca

***Wednesday, March 21, 2012***

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Began long trip back to the U.S. arriving back home about noon on Thursday.