

# **Rotary Foundation Global Grant #25625 Honduras Water Project**

## **Well Installation and Field Report**

**La Urca and Eguerito Villages,  
Santiago, Cortes Honduras**

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## Abbreviations

BGS	below ground surface
Ft	feet/foot
GPM	gallons per minute
MSL	mean sea level

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## **Executive Summary**

In 2012, Primero Agua entered into a Memorandum of Understanding (MOU) with Rotary International funded by the Rotary Foundation Global Grant 25625 that initiated purchase of equipment and supplies necessary to install five drinking water wells in villages where there were no clean sources of drinking water. These were installed as of April 2013 with the fifth well completed solely by Primero Agua's non-profit subsidiary in Honduras, "El Agua Tu Prioridad". As an additional commitment to the grant, Primero Agua tested the water to assure that it was suitable for drinking and conducted community meetings to serve as opportunities to educate the villagers about the importance of clean drinking water and protection and maintenance of their source of water. By May 2013, four such meetings will have been conducted, thus fulfilling the requirements of the MOU between Primero Agua and Rotary International. This report documents these activities. It also provides the opportunity to demonstrate how this effort has sparked much more than the installation of five wells and conducting public meetings. The equipment and materials purchases to fulfill the MOU between Primero Agua and Rotary International have initiated drilling and well rehabilitation efforts conducted solely by El Agua Tu Prioridad. Thus, the fulfilling of the MOU presents an example where "men are taught to be fishermen", or in this case where men are trained to drill wells to help more than can be provided within the terms of the MOU alone. It also serves as an example where the equipment and skills provided by the grant are aiding the goal of a sustainable endeavor.

## **Background**

In 2010, Primero Agua took possession of a Central Mine Equipment (CME) - 75 drill rig donated by Terracon Consulting, an engineering and environmental consulting company in Olathe Kansas. The drill rig is mounted is a 1997 Ford F-750, and the age of the truck was greater than normally allowed for clearance through Honduran customs. Dr. Raul Ugarte, director of Primero Agua's non-profit subsidiary in Honduras called "El Agua Tu Prioridad", spearheaded the procurement of a legal "amendment" for the rig to allow it passage through customs. This amendment was approved by the Honduran Congress and signed into law by President Pepe Lobo. After release of the drill rig in August, 2011, an attempt was made to drill

a well at the compound that houses Primero Agua as well as other Washington Overseas Mission (WOM) missions. The well installation attempt was unsuccessful, but it prepared the way for productive endeavors in 2012 and early 2013.

The Rotary Grant enabled the purchase of a small drill rig – 2012 Hydro Fab Model #IG1600, a 5-ton crane mounted on a 2000 International 4700 truck and a 2002 Kia utility truck to assist with the drilling and well installations. The crane along with an air compressor donated by Ameren UE (St. Louis, Missouri) are utilized to develop wells after the wells have been drilled and set, and also to re-develop wells as a periodic maintenance operation whereby the screened interval is air-lifted to clear sand, silt, and mineral encrustation from the well casing where it has accumulated over time. The demand for well re-development is considered a potential endeavor for El Agua Tu Prioridad to generate income toward independence. In December 2012 and January 2013, El Agua Tu Prioridad completed redevelopment of four community wells in Pimienta which generated enough capital to sustain operations for those two months.

## **Drilling Operations**

The drill rig utilizes mud-rotary techniques for drilling, and the standard bit size is 8 7/8-inch diameter (i.e., a tri-cone bit). The mud-rotary method requires drilling with a slurry of bentonite (referred to as ‘gel’ or ‘driller’s mud’) to coat the borehole to prevent collapse of the open hole, lubricate the drill bit, and entrain the cuttings from the bit to the surface. Thus, there is considerable water consumed during the drilling as necessary to maintain the gel slurry during all drilling. The water was provided by three polyethylene tanks (capacity approximately 285 gallons each), with two stationary at the drill site, and the other inside the bed of a pickup used to transport the water from its source; the source of water to assist the drilling for this project was the Rio Ulua where access was a few minutes away from each of the drilling locations. The water was pumped via a small utility pump up an embankment (approximately 20 vertical feet) and into the transport tank.

Drill Team members (Team) gathered in Honduras during sessions in February and August 2012 to install fresh drinking water wells in the villages of La Urca and Eguerito outside the municipality of Santiago, Pimienta, Cortez, Honduras. There were six US volunteers during each session as well as four Honduran members of El Agua Tu Prioridad. The US members for the February trip included Jay Quattlebaum, Tommy Mouser, Tim Fetterman, Leo Meyer, Dale Lohmeyer and Mark Underwood. The August team included: Jay Quattlebaum, Tommy Mouser, Nathan Mouser, Vance Jordan, Patrick O’Brien and Jeff Albrecht. Tommy, Nathan, Tim, and Vance are experienced well drillers who reside in Texas, Jeff is an environmental engineer who resides in California, and the remainder resides in or near Washington, Missouri. Most of the US Team was returning from previous volunteer efforts associated with WOM. The local assistance was provided by Dr. Raul Ugarte, in the form of logistical support, and El Agua Tu Prioridad Team members Fernando, and Geraldo in the form of drilling assistance.

It should be mentioned that upon arrival at each of the drill sites, the local village men and older boys were quick to jump into action and assist the Team. At each site, they cleared brush and rocks, leveled the site of bumps and ruts, and participated in the various other setup activities as well as drilling activities. They also shared materials that they had available, such as concrete blocks, as well as providing information about the local groundwater to the extent that they had knowledge. In addition, the local people of La Urca shared generously of their harvests of bananas, plantains, corn, papayas, and squash; their embrace of the improvements to their village as provided by the addition of clean sources of water were outward and obvious in their actions and reactions.

## **Goals and Objectives**

There were three goal of the MOU between Primero Agua and Rotary International:

1. Install five drinking water wells and outfit the wells with hand pumps
2. Conduct public meetings associated with the well to promote health and hygiene and proper operation and maintenance of the wells
3. Use the well drilling activities to provide equipment and train local persons to install additional wells and pumps

Toward these goals, four wells were drilled in 2012 during two field sessions (a session in February that installed two wells in La Urca, and a session in August that installed one well in La Urca and a second in Eguerito Central) with El Agua Tu Prioridad members receiving training in all aspects of drilling. Public meetings are scheduled to be held at these two locations (La Urca and Eguerito Central) with two meetings at each location. The first meeting at Eguerito Central was held in August 2012 with the 3 remaining sessions scheduled to be conducted by Engineers with Borders (EWB) teams in May 2013. (Note: these training sessions were delayed due to EWB scheduling conflicts.)

In April 2013, the El Agua Tu Prioridad drill team installed the fifth well (La Urca #4) and pump without direct US volunteer assistance, thus marking a milestone result from the training that occurred during the previous sessions. Earlier this year, the El Agua Tu Prioridad team also undertook re-development of four community wells in Pimienta for fees sufficient to sustain the operations for several months. The following provides a detailed report on the actions undertaken as part of Primero Agua's agreement with Rotary International.

## **Drill Site Locations**

The La Urca area is inhabited by 64 families, and water was previously supplied by four hand dug wells. The village of Eguerito is inhabited by an estimated 12 families who also obtained water from several hand dug wells. The hand dug wells were all located within a sedimentary

flood plain of the Rio Ulua where groundwater could be found at shallow depths (less than 25 ft below ground surface) and somewhat easily dug by hand. The flood plain of the Rio Ulua is subject to periodic inundation by flood waters. Only one of the hand dug wells was covered leaving the remainder completely open to the environment and subject to collection of leaf litter, debris, and insects, while also subject to collection of overland flow from large rain events.

It can be noted that the people of La Urca first occupied this area after the banana company abandoned the property following hurricane Mitch in 1998. For many years they were considered squatters who possessed little and subsisted through simple farming by hand. However, a few years ago they obtained legal title to the land and have recently been awarded a grant from the Government of Honduras to acquire a breeding herd of cattle. The herd is managed in a cooperative. Please note that this grant would not have been possible without the presence of a community well provided by Primero Agua, because a source of clean water was a requirement for the grant.

The people of Eguerito primarily earn their living from working the sugar cane fields. Many of the children at these locations do not attend school.

La Urca lies along an escarpment of limestone rock that raises out of the flood plain of the Rio Ulua, which is a major river transecting Honduras and San Pedro Sula. The escarpment appears to be along the erosional front of the Rio Ulua that was subsequently backfilled by river sediments and flood deposits of the meandering river. Based on available geologic descriptions and field observations, the visible surface rocks forming the escarpment are part of the Cretaceous age Yojoa Group comprised prevalently of limestone rocks. Beneath the Yojoa Group are thick intrusive granodiorites and granites thought to be of the Atima Group also of Cretaceous age. At the western extent of La Urca village lies a fault as identified by a previous geologic study that also appears to direct the flow of the Rio Ulua toward the south. From maps of the area, the Rio Ulua flood plain at the La Urca village appears to lie approximately 120 ft above mean sea level (msl). Thus, from this information, it appears that the drill sites at La Urca were at approximately 10-to-15 ft above the flood plain, or approximately 130-to-135 ft msl. **Figure 1** shows the location of the village of La Urca as well as the drilling locations.

The Eguerito area is located within the vast sedimentary plain of the Rio Ulua where sugar cane production is prevalent. The village was located roughly 6 miles southeast of Pimienta and roughly 1.5 miles due east of the Pan-American Highway. The homes in the village were primarily composed of a combination of sticks, mud, and tin sheets. Most people in the village did not wear shoes and younger children did not wear clothing. Maps of the area indicate that the drill site was at approximately 135 ft msl. **Figure 2** shows the location of the village of Eguerito Central as well as the drilling location.

## Equipment and Methods

In August 2011, Primero Agua took possession of a Central Mine Equipment (CME) - 75 drill rig. The truck on which the CME drill rig is mounted is a 1997 Ford F-750, and the age of the truck was greater than normally allowed clearance through customs. As stated above, Dr. Raul Ugarte spearheaded the effort to obtain a legal 'amendment' for the rig to allow it passage through customs. Thus, the February 2012 endeavor was only the second field session for the Primero Agua Drilling Team. The drill rig utilizes mud-rotary techniques for drilling, and the standard bit size is 8 7/8-inch diameter (i.e., a tri-cone bit). The mud-rotary method requires drilling with a slurry of bentonite (referred to as 'gel' or 'driller's mud') to coat the borehole and entrain the cuttings from the bit to the surface. Thus, there is considerable water consumed during the drilling as necessary to maintain the gel slurry during all drilling. The water was provided by three polyethylene tanks (capacity approximately 285 gallons each), with two stationary at the drill site, and the other inside the bed of a pickup used to transport the water from its source; the source for this project was the Rio Ulua where access was approximately 10-to-15 minutes from the La Urca sites, and less than 5 minutes from the Eguerito site. The water was pumped via a small utility pump up an embankment (approximately 20 vertical feet in regards to the La Urca sites) and into the transport tank.

During drilling, the drill cuttings were collected for general description. Table 1 provides a general description of the geologic materials encountered with depth. Essentially, the La Urca wells #1, #2, and #3 were installed within bedrock materials with La Urca #1 screened in limestone rock, La Urca #2 screened within granodiorite rock, and La Urca #3 screened across the interface between granodiorite and overlying limestone. The well at Eguerito Central was screened within mixed silt, sand, and gravels of the Rio Ulua sedimentary plain.

A description of the well construction is as follows. Upon completion of the drilling, the 4-inch PVC casings (with 10-to-20 ft of slotted interval at the bottom of the length) were lowered into the wells. The annular space was filled with filter pack material composed of local river sediments screened to size between approximately 1/8-inch and 1/4-inch poured into the annular space from the bottom to a height of approximately 5 ft above the slotted interval. A 2-to-5 ft layer of bentonite chips was placed above the filter pack to serve as a sanitary seal within the annular space. The annular space above the sanitary seal was filled with clean sand and gravel materials to within approximately 5-to-10 ft of the ground surface. The upper 5-to-10 ft of annular space was filled with concrete which extended above the ground surface within an approximate 3 ft-by-4 ft form (made with 2x4's) that allowed the concrete surface to seal below ground surface and form a 4-inch thick pad above ground surface. Thus, concrete was mixed onsite to complete the surface seal and pad.

After the concrete pad had set for 24 hours, the casings of the wells were air-lifted to remove sediments and driller's mud that had accumulated within. The air lifting consisted of surges of air pressure released from the lower depths of the well that evacuated the entire column mixture of water, sediments/cuttings, and mud. The surging of air was performed every 5-to-15 minutes

over a period of up to 2 hours, during which time the water gradually cleared of sediments and mud. An indication of the yield could be determined based on sustained air-lift flow from the wells. All but the La Urca #2 well sustained considerable flow; the La Urca #2 well easily sustains enough flow to accommodate the hand pump installed in the well.

A few days after the well is completed, a local Honduran contractor extends the concrete pad area and constructs a run-off platform with drain area.

The pumps (trade name India Mark II Deep Well Hand pump manufactured by Balaji) were lowered to depths considerably below the water table yet generally above the slotted interval. Table 1 also provides the well pump setting depths. The pump resides at the bottom of a riser pipe of 1 ½ - inch galvanized pipe connected to the pump assembly approximately 12-to-18 inches above the well pad. Within the riser pipe is a 3/8-inch rod that connected the pump to the handle. Approximately one-half gallon of weak bleach was dumped into each well prior to closing the pump housing. Once the hand pump was installed, the initial pumping indicated some residual turbidity (i.e., from the driller's mud) that cleared quickly with continued pumping.

## **Water Quality**

Readings were taken to assess water quality at existing La Urca #1, La Urca #2, and La Urca #3 wells using several Hach Company products. At La Urca #1, pH was measured as 7, calcium carbonate as 667 mg/L, and iron as 0 mg/L. At La Urca #2, pH was measured as 7, iron as 2 mg/L, calcium carbonate as 564 mg/L, and nitrate and nitrite as 0 mg/L. It was reported from villagers that the taste of La Urca #1 and #3 are superior to the taste of La Urca #2, likely due to the absence of iron. A simple bacteria test was performed using a Hach kit, and the results were negative for La Urca #1, La Urca #2, and La Urca #3 wells. Water samples for Eguerito Central #1 well were tested for coliform in February 2013 showing negative results.

## **Community Education Presentation**

Community education presentation was made to residents of the village of Eguerito in August 2012 using selected elements of the Water, Hygiene, and Sanitation Presentation produced by the Centre for Affordable Water and Sanitation Technology (CAWST). The presentations were given in English by members of both Primero Agua, and EWB-Gateway then had the presentations translated into Spanish by members of El Agua Tu Prioridad. The presentations targeted water hygiene techniques, well sanitation methods, and hand pump use. After each of the presentations, one UNICEF bucket was provided to each family in attendance. The bucket, complete with lid and spout, was provided to Primero Agua by the Honduran Government; food

and clothing were also provided to each family. Three future community education presentations are planned to be performed by the St. Louis professional EWB chapter in May of 2013.

## Summary

In 2012 and early 2013, volunteers with Primero Agua along with their non-profit Honduran subsidiary El Agua Tu Prioridad successfully installed five drinking water wells to benefit approximately 76 families in rural Honduras villages of La Urca and Eguerito Central. Water supplies at the locations previously consisted of shallow and open hand-dug wells. This program, funded in part by the Rotary Foundation Global Grant 25625, utilized two drilling sessions (one in February 2012, and the other in August 2012) to install four wells and train the El Agua Tu Prioridad drill team. The training was sufficient to witness El Agua Tu Prioridad drill and install the fifth well of the MOU and the first well by El Agua Tu Prioridad unassisted by their American counterparts. In addition, El Agua Tu Prioridad (also without assistance from Primero Agua) performed re-development well cleaning services for fees that sustained two months of operational expenses thereby moving them toward a self-sustaining future. Additional actions performed under the MOU between Primero Agua and Rotary International included presentations in public meetings targeting water hygiene techniques, well sanitation methods, and hand pump use.

This report documents the activities performed under the MOU, and it also provides the opportunity to demonstrate how this effort has sparked much more than the installation of five wells and conducting public meetings. The equipment and materials purchased to fulfill the MOU between Primero Agua and Rotary International have initiated drilling and well rehabilitation efforts conducted solely by El Agua Tu Prioridad. Thus, the fulfilling of the MOU presents an example where “men are taught to be fishermen”, or in this case where men are trained to drill wells, install pumps, and service existing wells aiding the goal of a sustainable endeavor.

**Figure #1**



**Figure #2**

