

# WEFTA Trip Report Honduras 23 July to 6 August 2021

# By Andrew Robertson, P.E.

#### 23 July 2021 – La Iguala

Community water operators reported that the 16-mile long water transmission line for Llano Largo, Quioco and Guadalupe villages was not delivering its full flow rate. Total flow rate should be at least 72 gallons per minute (gpm) – and is generally above 85 gpm – but only 61 gpm was reaching the villages. Andrew inspected the waterline with water operators, measuring flow rates at each pressure breaker box along the way to isolation the location of the apparent flow blockage or water loss.





The upper reaches of the pipeline were flowing at 93 gpm, which dropped to 86 gpm

a few kilometers down the line at the flow splitter box (roughly halfway down the line). We observed a local coffee farmer taking water from the pipeline at one of the air valves. The volume of water he was taking was not that much, but the process of tapping the line damaged the system. Unfortunately, this individual is a local bigwig, so the community will have to tread carefully.

The problem appears to be water thieves stealing water from the air valve connections, then leaving the air valve isolation valves closed after they leave. This causes air locking in the pipeline, which reduces its capacity. Community doesn't mind so much people taking water, as long as they don't mistreat the pipeline or close the valves.

In the afternoon/ evening, Andrew gave a training session at the Guadalupe Tank in chlorination and chlorine measurement and monitoring to the water operators from all three villages. Everyone present took turns using the chlorine probe, and everyone seemed to get it. The only problem was that when we did the cls, there was no water flow at the Guadalupe Tank... more on that in tomorrow's post.





#### 24 July 2021 – La Iguala

The Achille's Heel of this project has always been the galvanized steel to PVC transitions before and after the Rio Guadalupe crossing. The only parts available in Honduras to make this type of transition is a PVC threaded fitting that screws into a steel threaded coupling. But threaded PVC is notoriously fragile. Martir reports that these PVC fittings have to be replaced roughly every 1-2 weeks because they only last that long before they develop stress fractures, start to leak, and eventually break completely.



Core and Main of the USA donated 4 mechanical joint sleeves that will

make the steel-to-PVC transition without threaded PVC parts and without putting undue stress on the PVC pipe. This morning we installed the MJ sleeve and conducted a training for operators from all 3 villages to learn how to do the installation.



Upon removing the old broken fitting, we inspected the interior of the steel pipe. Perfectly clean: no scaling, no corrosion. We measured the pH of the water in the pipe. pH = 7.2

We also repaired a 3" PVC DR 17 pipe that had been vandalized.

In the afternoon, Andrew met with the Junta of Quioco. Discussion mainly centered water rate structure. Currently all 3 villages have different water rates. Llano Largo has a flat rate of L.90/ month. Quioco charges only by volume at L.13/ cu. mt., with no fixed rate. Guadalupe has a fixed base rate plus additional cost per cu. mt. Quioco residents are concerned because their water bills are currently too high at the current rate. At this meeting we started the process to resolve this into a single water rate that everyone can live with.

#### 25 July 2021 – Chusquín

Chusquin's water project got hit hard by the landslides that resulted from Hurricanes Eta and Iota in November 2020. The water catchment dam and sand removal chamber were completely wiped out, as were large sections of transmission pipeline. The river itself was also greatly deforested by the landslides. What was once lush jungle is now a lunar landscape of bare red dirt. We hiked the transmission line to see where landslides have carved up to 100 ft deep scars. The municipal government has rebuilt the pipeline on a temporary basis, but this consists simply of PVC pipes hanging in the air; they are not durable. The community requested WEFTA's assistance to rebuild the catchment, grit chamber, and aerial pipe crossings.

The other need expressed by Chusquín is that the last 3 km of their transmission line was never finished and their water tank is too low, leaving many community members above the tank and unable to get service. The community will get a topographic survey done by Hector Olivera and send it to WEFTA to design this last 3 km of pipe. It will probably be high pressure, similar to the Llano Largo pipeline.

Project scope (in order of priority):

- 1. New river catchment and grit chamber
- 2. Bury or encase in concrete all PVC pipes exposed by landslides
- 3. Replace aerial river crossing over Rio Conchagual (8 joints of 6" pipe) destroyed by hurricane

- Currently using temporary fix of 6" PVC DR26 without sleeve, with cable and tree branches for support.
  But this is only temporary solution, installed shortly after hurricane; need long-term solution.
- b. Options include:
  - i. 6" steel pipe
  - ii. 6" PVC inside 8" or 10" sleeve
  - iii. 4" PVC inside 6" or 8" sleeve
  - iv. 6" PVC with protective tape coating
- c. All options will required concrete pillars and suspension cables
- 4. Finish remaining transmission pipeline below last rompecarga (i.e. last 3 km of transmission line which was never built)
  - a. Need topo survey first
- 5. Concrete encasement of 6 joints of 4" PVC pipe in large landslide area near GPS Pt. #092. Will need to dig deep to set pillars on firm ground.
- 6. Put valve boxes on all gate valves and air valves. Add isolation ball valves to all air valve installations.

Pending Tasks:

- 1. Measure flow rates in all rompecargas and intertie between new and old pipelines. This includes flow measurements of all overflows, especially at rompecarga #3.
- 2. Analyze the impact of reducing the pipe size at the Rio Conchagual from 6" to 4". If feasible, this will reduce cost and potential construction problems.
  - a. Result: Increases headloss by ~0.7 psi
- 3. Talk to Ing. Sonia or re-do the survey and hydraulic analysis for last 3 km of pipeline.
  - a. New engineer is named Amín. He has his own engineering firm in La Iguala, and seems pretty good (I have not met him). He might have study on latest alignment, but need to check.
  - b. Community ended up getting new topo survey. Done by Hector Olivera and reviewed remotely by John Rocha.
- 4. Research existing air valves on transmission line. Are the 1-, 2-, or 3-event valves?

#### 26 July 2021 – Quioco and Guadalupe

Morning - Formal inauguration of water project, with local political bigwigs, etc. Andrew gave a speech. It was fun.

#### Afternoon – Come to Jesus meeting with Llano Largo Water Board

For a few years, Llano Largo has not been pulling their weight with the other villages. Quioco and Guadalupe work together well, but complain consistently that Llano Largo doesn't do their fair share. I had some other concerns about Llano Largo's internal administration, as well. This meeting was intended to address these issues head-on and plot a course to resolution.

Llano Largo Board Mtg Topics:

- 1. Parable of the three servants.
- 2. Review finances and make sure no funny business with the money. Andrew estimated revenues and expenses independently, then checked those against the Water Board's bank statement. Everything looks about right. So it appears all the money is there and no one is stealing anything.



- 3. Responsibilities of each village water board
  - a. Chlorination
  - b. Distribution network
  - c. Transmission line for that village
  - d. Share responsibility for upstream facilities
    - i. Catchment dam
    - ii. Primary transmission line above splitter box
  - e. Share materials that belong to entire project
- 4. Announce WEFTA's commitment of L. 1.000.000 to upcoming bathroom project, with conditions:
  - a. Water Boards
    - i. Get paid-up with Committee
    - ii. Get current on labor debt for work on shared upstream infrastructure
    - iii. Share common materials with other villages
    - iv. Enforce rules on community members
    - v. Decide which families will participate in Phase 1, if more families want to join than there are funds available
  - b. Individual community members
    - i. Must be paid-up on current project
    - ii. Must have completed all labor requirement for current project
    - iii. Must be current on monthly water bills
    - iv. Commit to labor for bathroom project
    - v. Pay L. 2.000 toward bathroom project

#### 27 July 2021 – Meeting of All Three Water Boards (Llano Largo, Quioco & Guadalupe)

Topics of Discussion:

- 1. Bathroom Project
  - a. WEFTA will donate L. 1.000.000
  - b. World Vision will donate an amount to be determined in October 2021, and will provide project administration and management at no charge
  - c. Municipal government will donate between L. 200.000 and L. 400.000
  - d. Each participating family will contribute L. 2.000
  - e. Each Water Board will provide needs assessment of all families by 15 August 2021
  - f. Participating families must
    - i. Be fully solvent with water project, both in terms of money and labor
    - ii. Be current on monthly water bills
    - iii. Pay L. 2.000 toward bathroom project
    - iv. Contribute labor toward bathroom project
- 2. Monthly Water Rate
  - a. Llano Largo charging only fixed rate of L. 90/ month. No surcharge based on consumption, which does not incentivize water conservation.
  - b. Quioco charges almost entirely based on consumption, but is too high and is scaring people off because water bills are exorbitant.
  - c. Guadalupe's rate structure, a combination of base rate and consumption surcharge, seems to be working pretty well.
  - d. Based on everyone's expenses up to now, an average bill of ~L. 90/ month seems like a good target to meet expenses and generate a little savings for the Water Boards. But how to meet this target while also encouraging water conservation?
  - e. With World Visions's help, all three Boards agreed to a new rate of L. 75/ month for up to 15 cu mt of water usage. Consumption in excess of 15 cu mt would cost an additional L. \_\_ per cu mt.

- f. It was agreed to hold a follow up meeting on 19 December 2021 to review finances and see if this water is working, needs to be increased, etc.
- 3. Commitments and Responsibilities of Each Water Board (with unspoken agenda to get Llano Largo to commit to this stuff in front of Quioco and Guadalupe)
  - a. Contribute labor for maintenance of shared infrastructure, like dam and pipeline upstream of splitter box.
    - i. Llano Largo publicly acknowledged they are delinquent in this regard and pledged to get caught up.
  - b. Pay toward Central Project Committee in amount of L. 3 per beneficiary per month.
    - i. Llano Largo publicly recognized they are in arears and promised to pay up.
  - c. Share jointly-owned materials.
    - i. Materials purchased by a Board belong to the Board. But materials purchased for the whole project (by WEFTA or WV) belong to all three Boards and need to be shared with whichever village needs them.
  - d. Enforce rules on their own community members, without exception or favoritism.
    - This means the Boards must go after individual families to get current on labor and cash contribution requirements, which can help the Board meet their responsibilities under Items a & b, above.
- 4. Sale of New Water Service Taps
  - a. This turns out to be a big source of controversy, and with good reason. Everyone who wants water now had to pay L. 3.500 and work for 180 days. But what about people who show up next year, or in 5 years or 10 years? Should they get a free ride, or should they have to match the original sacrifices of the first generation of water users? Easy to say "make them pay", but since there won't be labor to, that would all be cash and would come out to around L. 40.000, which is a king's ransom. Again, easy to say that, say, a gringo from Albuquerque who wants to move there should pay this amount. But what about the children of the original project beneficiaries? The current project participants will want their children to have access to water for an affordable price.
  - b. The exact terms of this were not resolved at this meeting, but Andrew will do some follow up to see what policies other communities (Yamaranguila) have in place.
  - c. Could have different prices for children of original project participants vs. outsiders.

Afternoon – Meeting with Guadalupe Water Board

- 1. Discussed water rates
- 2. Discussed general concerns from project participants

#### 29 July 2021 - Mejocote

Andrew had heard this was a project in trouble, similar to Ojojona. We considered there might be a need for WEFTA to provide design assistance. We went to meet with a community leader, and it turned out this is not the case. Apparently there was a problem with the original design, but the government has since paid for a new topo survey and design, and will have a private design-build contractor construct the new project.

No need for WEFTA to work on this project.

#### 30 July 2021 – Consolacion

Consolacion is a community of ~95 families in Western Honduras. World Vision Honduras (WVH) is in the process of constructing a water project to serve the community, consisting of 2 spring catchments (total flow = 11 gpm in summer and 17 gpm in winter). Because the community is located above the springs, WVH is constructing the system using solar pumps.

WVH solicited WEFTA's technical assistance to provide design recommendations regarding:

- 1. Pump forebay tank volume
  - a. Recommend 15kgal for now, with room to expand in future
- 2. Pump forebay tank and pump inlet configuration
  - a. Recommend building a small pump sump outside the tank perimeter and just below the tank floor elevation, with the submersible pump installed in this sump for ease of access.
  - b. The outlet pipe should protrude 10-15 cm above the tank floor to act as a silt stop.
- 3. Transmission line diameter and pressure class
  - a. 3-inch, with pressure class varying from DR26 PVC all the way to Schedule 40 galvanized steel.
- 4. One check valve should be provided at the pump outlet.

# 31 July 2021 – Monquecagua

Monquecagua was hit really hard by the hurricanes last year, with many huge landslides that wiped out long stretches of pipeline. The fact that they got the project back on-line is amazing. What's even more amazing is nobody plummeted to their death working on the pipeline. Basically, the experience of inspecting the pipeline is a steep, strenuous hike through dense jungle, periodically interrupted by sudden sheer drop-offs of up to 60 ft. There is no warning; the jungle just ends in mid-air. I rock climb for fun, and this was way scarier than any climb I've done.

The community requested a project consisting of 3 elements:

- 1. Watershed protection: The watershed feeding the stream is mostly pristine jungle, but there is one potato farm just upstream of the dam. Potato farming is chemical-intensive, using a large concentration of fertilizers and pesticides, so this is a problem. The community identified two possible solutions:
  - a. Negotiate with the farmer either to buy the land and retire it, or pay him to stop farming it.
  - b. Build a ditch to channel storm run-off from the farm around the dam, forming a confluence with the stream downstream of the community's water intake.
- 2. Sand remover: The stream carries a lot of sediment after rain events. The community would like to build a grit chamber to remove some of this sediment before the water is piped to the community. There are two options for building this without interfering with the existing system hydraulics:
  - a. Build the grit chamber above the dam. This is similar to what Llano Largo did. The idea would be to strain out sediment in the stream itself before water enters the reservoir.
  - b. Build the grit chamber on the pipeline below the dam. To the right of the dam is a decent site for the grit chamber, almost at the same level as the dam. We could raise up the dam by about 0.50 mts to get more head, then run the water to the clarifier just below. This option seems more feasible, and would probably require ~7 cu mt of concrete to raise the dam (0.50 mt tall x 1.20 mt wide x 12 mts long), plus the concrete to build the sand remover itself.
    - i. 7 cu mt concrete x 5 bags cement per cu mt x L. 200/ bag cement = ~L. 10.000 for concrete to raise dam (including re-bar, etc.)
    - ii. Assume another L. 50.000 for sand remover itself
    - iii. So, ~L. 60.000 for total project
- 3. Hurricane damage repairs to pipeline: Many long sections of pipeline are literally just hanging in mid-air, with no protection of the PVC pipe from the sun and no structural support. WEFTA cataloged these free-hanging pipe segments; there are roughly 25-30 of them. Most need to be encased in concrete with concrete support pillars, while some may be direct buried. There are also several air valves that need valve boxes.

Action Items:

- 1. Estimate costs for all three projects
- 2. Create grant agreement
- 3. Ideally start work in summer winters in Monquecagua are extreme

#### Late Afternoon – Pueblo Viejo

Community leaders from Pueblo Viejo, a village neighboring Monquecagua, approached WEFTA and requested financial assistance to drill a new well. The new well was needed, they said, because there was not enough water supply for their population of 122 families. And reviewed some basic statistics:

- Flow rate from linea principal to three communities Chiligatoro, Paisal, and Pueblo Viejo was measured at 44 gpm, but this measurement is highly suspect due to non-steady-state conditions at the time the flow was measured.
- Flow rate allocated to Pueblo Viejo 15 gpm, but not sure how much of this water the village actually sees
- 15 gpm = 21,600 gpd supply
- 122 families
- 6-7 people per household
- Assume 15 cu mt/ home/ month = 130 gphd
- 130 gphd x 122 homes = 16,000 gpd demand
- Therefore, it appears there is already ~5,000 gpd more supply available than demand

Furthermore, the transmission line and distribution network are both 30 yrs old. There are no water meters. So it's not difficult to imagine 5,000 gpd of water losses through leaks in the system or excessive water use by residents.

By the way, the transmission line has no rompecargas. No idea if any are needed or not.

After analyzing all the foregoing facts, Andrew told the community leaders he was not convinced a new well was necessary. Maybe, but not enough evidence to support that conclusion. More importantly, a well is very expensive to operate and maintain, not to mention construct. And there's no guarantee they would find good water underground. Therefore, Andrew recommended looking into other options first, before committing to a well with big monthly electric bills. Alternatives include:

- 1. Repair or replace distribution network
- 2. Install water meters
- 3. Leak study to figure out where water is going

The community leaders weren't too happy about this recommendation. I think they just want the well because that's what they've convinced themselves they need, and believe WEFTA is trying to get out of helping them get it. But I stand by my recommendation.

BTW, the community has L. 300.000 saved up to contribute toward a new water project.

# 1 August 2021 – Ojojona

Andrew went to visit the community after VM completed the pipeline modifications designed by WEFTA last year. The project is now delivering water. Flow rate is only 32 gpm which is lower than design flow, but VM engineers state this is due to two leaking air valves that they plan to repair.

The community will have a project inauguration ceremony on 21 September 2021.

We met a community leader, Jesus, who expressed appreciation for the project and the re-design. They have had water now for three months.

The pipeline feeds 6 communities – 3 large villages and 3 smaller ones. Some of these villages had no water at all before, others were partially served before the project.

The large villages volunteered 70 days of labor per family, while the smaller villages (that needed more infrastructure) donated 300 work days per family.

#### 2 August 2021 – Las Uvitas

Andrew went to visit project with VM. Project will provide water supply to four (4) villages from small dam near large and impressive waterfall. VM has a transmission line design that is not feasible and not affordable. Villages have been working for 12 years to try to get a water project approved.



We drove/ walked the entire line and picked up GPS points, then marked points on possible alternative routes. I noticed the design did not seem to match what we were seeing in the field. After the site visit, I plotted out SANAA's horizontal survey alignment and it did not match the GPS points at all, nor did it make any sense. There appears to be a massive survey bust in SANAA's topo survey. Also, the alignment itself is not feasible, but there appears to be a possible alternative. I analyzed the problems with the survey and followed up via email to VM with a proposed re-alignment. VM said they would work with SANAA to have the new alignment surveyed and send to me for review and hydraulic design.

The excitement of the day came with a torrential rainstorm that turned the dirt road into soup. We had to walk alongside the truck in the mud on the way back and continually push it sideways to keep it on the road. We got back to town around 11pm.

#### 3 August 2021 – El Tamarindo



El Tamarindo is in one of the most dire situations we've seen. The village is located on the banks of the Choluteca River about 25 miles downstream of Tegucigalpa. Teguc does not treat its sewage, instead dumping raw effluent into the river. As a result, the river is highly contaminated, and village residents have a very high incidence of hepatitis and other water-borne diseases. Community leaders have been fighting for over 14 years to get a clean, safe water supply.



The project will bring water supply to three villages – Guanacastillo, El Rodeo, and El Tamarindo – serving approximately 282 families in total. The water supply will come from a stream up in the Yuscaran Biological Reserve and require ~15 km of gravity transmission line to reach all three villages. We measured flow rate at the stream. It was not possible to capture all the water in the flow measurement, but it appears flow rate is on the order of 200 gpm. Note that this

measurement was taken downstream of existing water intakes for other villages, so this represents the water available. Estimated average flow rate required for population is ~71 gpm (based on 282 families x 6 per family x 30 gpcd x growth factor of 2.0).



We applied to Loyola Foundation for this project, in partnership with VM. Andrew provided preliminary hydraulic design and cost estimate as part of the Loyola proposal.



### 4 – 5 August 2021 – Roatan

For much more detailed information on this project, please refer to "Living Water for Roatan Community Water System Evaluation and Project Summary", dated September 2021.

The Colonia of Policarpo Galindo is home to 400-600 families (depending who you ask). Water service is provided by a missionary group called Living Water for Roatan (LW4R), who built an entire water supply and distribution system from scratch about 12 years ago. It's an impressive achievement. LW4R still operates the water system and collects monthly water bills from residents to finance operations.

Water service is infrequent, with residents receiving water once every 10 to 22 days (again, depends on who you ask). Residents complain about water quality, although that could be coming from the containers residents use to store water between deliveries. Operation costs are high – residents pay L 250 per month per family (compare with L 90 per month in Llano Largo, where they get water 24/7). The majority of this cost is for electricity; the entire system runs on pumps, and power is very expensive on the island.

I spent a couple days with LW4R's two operators, Carlos and Benjamin, and evaluated the entire system as much as I could. I was not able to observe the pumps down the wells. Overall, it appears the wells are in need of maintenance and likely the pumps could be optimized, which would improve water production and reduce costs.

Chlorination consisted of dropping a chlorine tablet in one of the tanks every few days, and residual chlorine was not measured. I gave the operators a chlorine tester and showed them how to use it.

Phase 1 of the project will entail cleaning/ maintaining the wells and pumps, replacing well drop pipes, installing meters on all three wells, and installing a continuous-flow dosing chlorinator.

Future work will include analyzing water production and energy consumption, as well as comparing pump curves to observed hydraulic conditions, to determine if the pumps could be replaced with more efficient units. Some policy changes might also help: Because water deliver is so infrequent, residents store large volumes of water within their homes. But because everyone takes and stores so much water when they receive it, there is less water to go around, resulting in more infrequent deliveries. It's a vicious cycle. Breaking it will take concerted, persistent social and political work at the grassroots level.



Thanks to LW4R and Dr. Alice Neuman for their commitment to improving the lives and health of colonia residents.

# 6 August 2021 – Return to USA



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