WEFTA Trip Report – Honduras
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April – May 2025

23 and 24 April and 1 May 2025 – Las Playas, La Iguala, Lempira

WEFTA first visited this community in August 2024 and completed the design for their project in early 2025. The community has a 30-year-old water transmission pipeline that is undersized and has deteriorated to the point that it frequently breaks and leaves the entire community without water for days at a time.

The purpose of this year's visit was to review the design with the community, inspect the construction materials being delivered during the visit, and kick-off construction.

I walked a few kilometers of recently-dug trench with the Junta and gave recommendations for improvements (e.g. straighten out the trench, make the trench bottom smoother, avoid rocks in the pipe zone, etc. I also managed to hit the existing pipeline with a pickaxe. Oops!

We also measured the flow rate coming into the storage tank, which was 28 gpm, and the pH of the source water. The pH was 7.8 (note, it was 8.2 during the rainy season last August), which probably explains the slightly bitter/ alkaline taste.

The next day the first shipment of pipe and appurtenances arrived, so Martir and I inspected the materials, accepted most of them, and sent a few back that did not meet project specifications.

On May 1, I went back to witness the community trenching in action. It was impressive. Over 110 people working in unison on a line with shovels and pickaxes.

24 April and 1 May 2025 – Santa Ana Las Vegas, La Iguala, Lempira

This project will provide a brand-new water system, since the community of Santa Ana (population 960 people) does not presently have any water system at all. WEFTA visited this community for the first time in August 2024 and completed the design for Phase 1 of their project, consisting of a river diversion and water transmission line, in early 2025.

The purpose of this visit was to present the design to the community and kick-off construction of Phase 1.

The site visit on 24 April started with inspecting progress to date on the river diversion structure, a 1.5 meter tall concrete dam. The community carried rock for the dam construction by hand. Then we walked the pipeline and gave some direction on field adjustments to the pipeline alignment near the river diversion to maintain hydraulic grade lines. I also marked locations needing steel pipe or concrete-encased pipe with GPS and recorded the quantities for purchase of these additional materials. I also field designed a cased road crossing, and recommended the addition of a few extra air valves.

Funding To Date:

- Community: L. 600,000
- Municipality: L. 500,000
- WEFTA: L. 850,000

  Total Funding To Date: L. 1,950,000

Project Costs:

Phase 1 – River Diversion and Transmission Line

- Land purchase for river diversion: L. 600,000
- Topographic survey: L. 82,000
- Materials for river diversion: L. 44,000
- Materials for transmission line: L. 850,000
- Contingencies (10%): L. 170,000

  Phase 1 Cost Total: L. 1,746,000

Phase 2 – Storage Tank and Distribution System

- TBD

25 April 2025 - El Mango, La Iguala, Lempira

WEFTA visited this community of 660 people for the first time in August 2024, at which time WEFTA inspected the community's two spring catchment boxes, water transmission line, and tank. At that time, it appeared there was adequate water supply, but the community still suffers chronic water shortages. Leaks in the distribution system were suspected. The community's water system was built in 2015 and had a design (which may or may not have been followed), but that design did not become available to WEFTA until this visit. After the visit last year, the community had two assignments: (1) to get a copy of the design for WEFTA, and (2) to locate leaks in the distribution system. The community completed both of these tasks.

We started off the day reviewing the original design, which took some time because they only had one printed copy and the print copy was nearly illegible. After ~2 hours of deciphering, we finally had a usable system map of the distribution network. It appears the original design did not include any pressure breaks, in spite of having static pressures of over 270 psi. Small wonder, then, that the system has leaks.

After this initial design review, we went to the field. First we verified the flow rate coming into the storage tank, since the only other time this was measured was during the rainy season (we are at the very end of the dry season now; this is the time of year when all the water sources are at their lowest and thus the most conservative time of year to measure flow rates). During the rainy season last year, the flow rate was around 52 gpm. Today it was 38 gpm, which is still more than enough for a community of 110 families. But the tank was nearly empty. This reinforces our diagnosis that the main problem facing this community is water losses due to leaks in the distribution system.

The transmission line traverses mountainous terrain but does not have a single air valve. When the flow was measured coming into the tank, large quantities of air were observed which caused wide variations in flow rate. Installation of air valves should increase the capacity of the transmission line and make flow more steady.

Then we walked/ drove the entire distribution network and sited five (5) pressure breakers, based on elevations and constructability of sites. Each pressure break site was recorded by GPS, shown to the community, and red-lined onto the existing distribution system map. Prior to construction, Martir and Belarmino will double-check pressures with pressure gauges to verify elevations. Note that most pressure breakers will require additional piping to include homes at similar elevation to each pressure break in the upstream pressure zone.

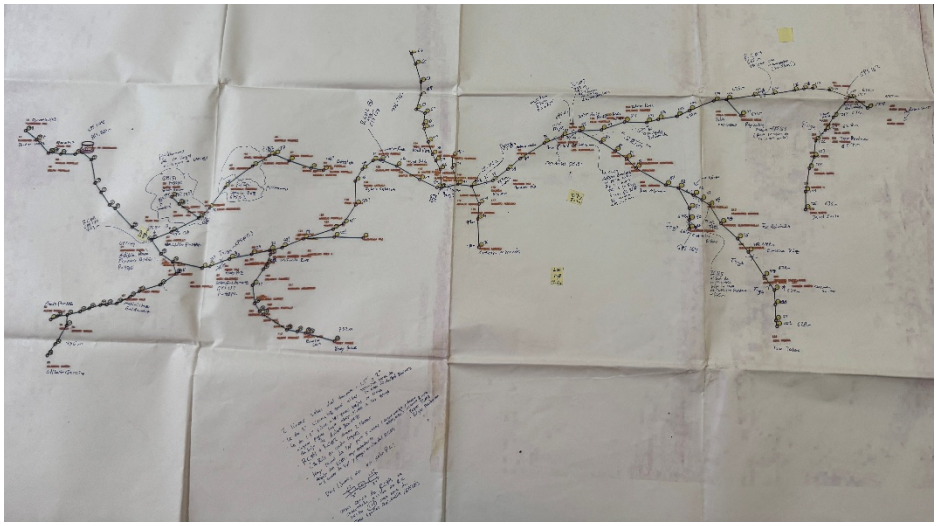
Project Scope and Budget:

WEFTA's proposed solution to El Mango's water crisis consists of 3 phases:

- Phase 1 – Construct 5 pressure breakers.
    - 5 pressure breakers: L. 50,000
    - By-pass piping for high elev. homes: L. 10,000
    - Phase 1 Total: L. 60,000
- Phase 2 – Repair leaks in existing distribution network
    - This will be the community's responsibility
    - Note that this cannot be done until Phase 1 is completed, because if the pressures are too high, the pipes will simply burst again right after they are repaired.
    - Nonetheless, the community will not see any improvements in water service reliability until Phase 2 is completed. So this is important.
- Phase 3 – Install air valves in the supply/ transmission line
    - Approximately 10 air valves with boxes: L. 40,000
- Project Total:
    - Sub-Total: L. 100,000
    - Contingencies (20%): L. 20,000
    - **Total Budget:** **L. 120,000**

Funding Analysis:

- Community: L. 40,000
- Municipality (verbal commitment from Alcalde): L. 40,000
- WEFTA: L. 40,000
- **Total Funding:** **L. 120,000**



26, 28 & 30 April 2025 - La Iguala Centro (Casco Urbano, Carrizales y Colaca), La Iguala, Lempira

This project consists of a completely new water system, with river diversion, central transmission line, three branch transmission lines, three storage tanks, and three distribution networks, for three barrios of La Iguala's central district with a combined population of approximately 1,800 people. Phase 1, consisting of the river diversion and transmission line, was completed in August 2024. Phase 2, consisting of branch transmission lines for each individual barrio, is currently under construction. Phase 3 storage tanks and distribution networks will be constructed after Phase 2 is complete.

The Phase 2 branch transmission lines are currently under construction. This visit focused on inspections and field engineering to resolve current construction problems.

There were a couple of problems with the Carrizales line. Originally the community trenched the wrong alignment. This is because the first alignment surveyed by the Honduran surveyor was not feasible, so WEFTA ordered a second alignment to be surveyed, which became the basis for design. But because the surveyor was not able to schedule construction alignment staking in time to allow trenching to begin before the start of the rainy season, the community had to go ahead and start working, and they initially trenched the alignment they remembered surveying with the surveyor, which was the wrong one. We discussed this and corrected the error. The second issue affecting the same segment of alignment for the Carrizales branch line was that the design had the

pipeline go through an area of hard rock and land slides (landslides have become a major problem in Western Honduras since Hurricane Iota a few years ago). Therefore, Martir directed the community to realign the pipe below the unstable slope and rock outcrop. However, this change increases the pressure in the pipe, which means we will need to change the pressure class of the pipe from DR26 to DR21, which has already been purchased. It's not a problem, though; the unused DR26 pipe will still be used in Phase 3, so nothing will go to waste.

During this visit, we reviewed the aforementioned realignments and field engineered the changes to ensure a feasible alignment and proper pipe pressure classes.

The surveyor arrived on-site during this visit. I gave orders to the surveyor to stake the area downstream, which the community was less familiar with, to prevent any possible confusion or mistakes in advance of the community trenching that area the week after I leave. I also asked him to stake all three tank sites to verify locations and elevations.

Please note an important lesson learned, which has become SOP for WEFTA's technicians in Honduas (Martir and Belarmino). We always build concrete structures last. That is to say, we build pipelines first, and then measure flow rates and end-of-line static pressures with gauges prior to constructing structures like pressure breakers and storage tanks. That way if there's a survey bust, design error, change of field conditions, or any other issue, we can correct it before committing to the final location/ elevation of any concrete work. For example, we've completed the Phase 1 transmission line, but haven't built the flow splitter box yet. We will complete all three branch lines first and make sure flows and pressures are good before building it, just in

case it needs to move up or down a few meters. Similarly, we will build the storage tanks last, or at least after the distribution networks are fully designed and verified.

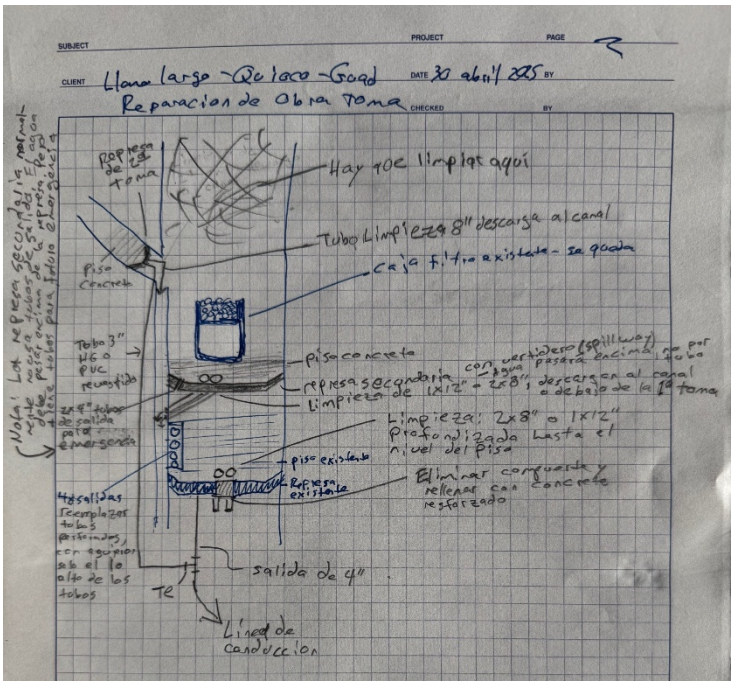
With Phase 2 thus in good shape to continue construction, we turned our attention to the upcoming design for Phase 3. The topographic surveys for the distribution networks had a few areas missing, so we field walked those areas to determine alignments and then gave orders to the surveyor to shoot-in additional points to create topographic surfaces for them.

Finally, Martir and I had a look at the main street through the urban center and Carrizales, which is in the process of being paved with concrete. We designated 3 locations for PVC sleeves to be installed prior to paving, so we can run pipes across the street later. On my next trip down here, we will field walk the entire distribution network to figure out how to reach all the homes along the main street that have concrete road or driveways in front of them.

27 & 30 April 2025 - Llano Largo, Quioco y Guadalupe, La Iguala, Lempira

This project to provide a first-time water service to three villages (combined population: 1,700 people) was completed in 2021. The project includes a river diversion, transmission line, branch lines, 3 storage tanks, 3 distribution networks, 100 household bathrooms and 2 elementary school bathrooms. The project has been working well for the past 4 years; every time I travel to Honduras, I spend most nights in either Guadalupe or Llano Largo and enjoy showering and drinking the water there.

During the rainy season last year, a large landslide destroyed the river diversion structure serving the 3 villages. They rigged a temporary solution that got them through the summer, but a more permanent solution needs to be implemented quickly before the rainy season returns within the next month or two.



We visited the diversion site and, after extensive inspection and Socratic discussion with Martir, Belarmino, and the Junta leaders, devised what we all felt was the best solution to rebuild the river intake. We also walked the transmission line to see areas affected by other landslides (there were many during this single storm event) and determined which sections needed to be replaced with steel pipe, which needed concrete encasement, and which could simply be re-buried.

Prior to this site visit, on Sunday, I attended a meeting with the Junta in Llano Largo after church and discussed with them the communities' responsibility to maintain the water system on their own and pay for the repairs with their own money from monthly water bill revenues. All three villages agreed to this.

Llano Largo is also making good progress on their powerline project. I got to recharge my cell phone and laptop for the first time since I started going there in 2014.

28 April 2025 – Las Crucitas, La Iguala, Lempira

This project consists of an entire new water system for a small community of ~150 people who currently do not have water. The project includes a spring catchment, transmission line, storage tank, and distribution network. The spring catchment and transmission line have been completed. The purpose of this visit was to kick-off construction of the distribution system, and later the storage tank.

We inspected the materials they have on-hand for the tank and distribution system. In terms of quality, all the pipes, valves, and appurtenances look good. However, the bricks for the tank are of variable quality – some are minimally acceptable, others are poor. We recommended dividing the bricks by quality into three categories: good enough for the tank, good enough for pressure breakers, and only fit for valve boxes.

We counted all the materials and determined there are a few missing items: some ½" valves, ½" PVC pipe, and lots of bricks, concrete, and re-bar for the tank. There were more 1.5" valves than we need; that's okay, we will use for clean-outs on the transmission line.

Then we measured flow coming out of the transmission line. It was only 2 gpm. So we hiked up to the spring and found it was overflowing around 14 gpm. This was a relief; it meant the problem was in the pipeline and not that the spring had dried up. After walking the line, we determined the problem was debris or sediment build-up in a low section just below a cliff. We will fix this by installing a clean-out valve at this location, using one of the left-over 1.5" gate valves.

We also reviewed the distribution network design and made a few field adjustments. Then I scheduled the surveyor to come and do the survey staking for 1-2 weeks out. The community will await the survey staking

before starting work on the trenches. Once the trenches are completed and accepted by Martir and Belarmino, they will install the pipes, with funnels at all the pressure breaker sites. I instructed the community not to cover up any of the trenches until the pipes are pressure tested. When the pipes are fully installed and tested, Martir and Belarmino will measure flow rates and pressure to ensure everything is working properly before giving the go-ahead to install the pressure breaks (this will allow for adjustment to pressure break elevations if anything is found to be out-of-kilter).

Follow ups include bringing the surveyor out to do the field staking and informing the alcalde we need more (and better quality) bricks, as well as a concrete worker (albañil) and additional materials for the tank, pressure breakers, and concrete pipe encasement. Martir and the community also need to install the clean-out on the transmission line.

29 April and 2 May 2025 – Quelacasque, Gracias, Lempira

The Quelacasque project includes three villages – El Rodeo, Jicaro, and Ojo de Agua – with a combined population of over 3,400 people. This project is being implemented by World Vision (Vision Mundial). World Vision's scope of work includes a river diversion, 6-inch transmission line, branch lines, and three tanks. Distribution systems for each village will be needed, but are not currently included in World Vision's scope. To date, the river diversion, transmission line, branch lines, and tanks have been constructed.

World Vision contacted WEFTA last year because the transmission pipeline has never been put into service since it was completed and requested our technical assistance to troubleshoot and fix it. Neither the branch lines nor the tanks have been tested yet, because there is no water available to fill them until the transmission line is brought on-line.

After WEFTA's site visit last August, we produced a technical report analyzing the current design and construction, with diagnostics for where the problem areas are and recommendations to get the project working. This technical report noted some gaps in the available data. The purpose of this trip was to review progress in the field and try to fill in some of the gaps in the data to flesh-out the analysis, as well as provide additional recommendations to World Vision and the community. It was also important to provide encouragement to community members who have seen completion of their project delayed by over a year and many of whom have lost faith that the project will ever be completed successfully.

We spent a solid (and exhausting) day hiking the alignment and recording the locations of pipe pressure class transitions by GPS. We also discussed with the Junta members and World Vision technical staff where to install each type of pipe.

We also discussed how to install polyethylene (HDPE) pipe, which World Vision plans to utilize in the high-pressure areas. I went to World Vision's warehouse in Yamaranguila on 2 May 2025 to inspect their PE-PVC adaptors, but was unable to find all the parts, so this inspection remained inconclusive.

Upon return to the USA, I updated last year's technical report based on the new field data from this trip and sent it to World Vision so they can replace the specific sections of pipe that currently do not meet pressure requirements.

4 May 2025 - Colonia Policarpo, Roatan, Islas de la Bahia

Policarpo has been a challenging project. The water system was built about 15 years ago by Living Water 4 Roatan (LW4R), which has been operating the system ever since. The original water system had serious issues with design and construction quality, which have been compounded by lack of proper training for the operations staff and lack of resources for adequate maintenance. The system also has serious financial challenges, due to difficulties to persuade customers to pay their monthly water bills, lack of definitive information as to how many customers there actually are (estimates range between 400 and 800 families), and high power costs. Most importantly, there are social and political challenges. There has been a complete rupture and loss of trust between the community and LW4R, which makes solving the aforementioned problems fiendishly difficult.

WEFTA first got involved a few years ago, and has since then assisted the community to install a central chlorinator and replace the grossly oversized pumps in their three original wells with appropriately-sized pumps to reduce power costs and extend the service lives of the pumps, motors, and wells themselves. While the chlorinator does work when it's used, LW4R rarely allocates resources to buy chlorine tablet, so it sits unused. The power consumption did decrease significantly after the pumps were replaced, but electricity is still very expensive on the island.

The good news is that the long-heralded formation of a Junta Administradora de Agua Potable (Junta) and transfer of system ownership from LWR4 to the Junta at last seems close at-hand. This leaves WEFTA with a few basic decisions to make, and lots of corollary questions to figure out based on those:

1. Do we stay involved with this community, or not?
2. If so, we are committed to drilling a new well at Zapata #2 tank site

    a. Who should drill this well, and when?
    b. Plenty of technical issues to work through in terms of selecting the driller, determining well depth, schedule, budget, etc.
    c. WEFTA will need to select the pump and motor after the well is completed. We should not allow the pump vendor to select the pump, as they may have incentive to over-size it to charge more money.
3. Technical and managerial support for the new Junta
    a. The community has requested help with establishing the Junta, set up bank accounts, etc.
    b. The bank accounts are probably the biggest issue the community will need to assistance with. This assistance is probably best provided by PHA, a separate NGO focused on Policarpo.
4. Technical assistance and training for operators
    a. WEFTA can provide training, as can Reef Alliance and Polos Water, possibly others

During this visit, I met with two members of the current Patronato, who may potentially get elected to the new Junta in May. I also met with Roatan's local well driller, Stephen Garcia, and spoke by phone with his competitor, a driller from Tegucigalpa named Addrubal.

There's a lot more to say about this complex project, much of which is addressed in my report specifically on the Policarpo visit, so I'll refer to that document for more detailed information.