Cantón Quiacquix, Departament of Totonicapán. Guatemala.

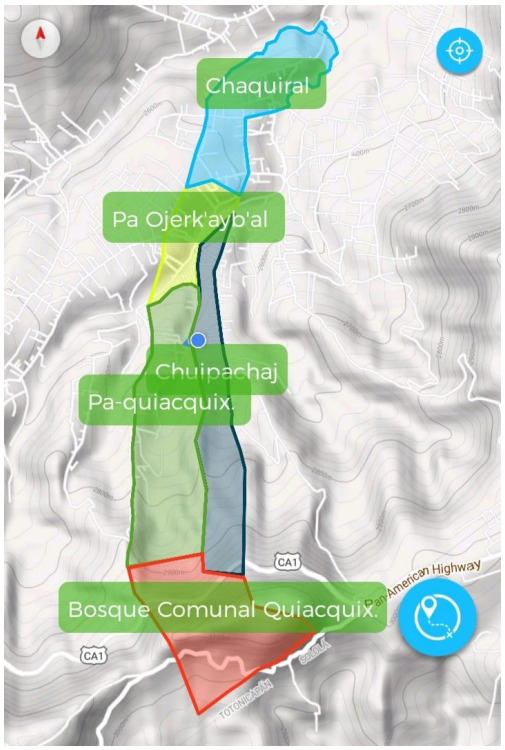
Location: 14° 51´ 33.94”N 91° 23´01.13”
Water Project
September 2022

The present document summarizes information gathered during a field visit made August 8th 2022 at the request of the community to express their need for support with a potable water project.

1. COMMUNITY DESCRIPTION

Quiacquix is a rural community in the Guatemala highlands. It is a *caserío* (hamlet), the department of Totonicapán, Guatemala. Quiacquix is divided in 4 *parajes* (sectors): Chaquiral, Pa Ojerkayb’al, Chuipachaj, and Pa’quiacquix. Current population is approximately from 1,500 to 2,000 persons; about 400 houses.

Most of the community members are K’iché, Maya descendants. Languages spoken are K’iché and Spanish. The main economic activity in the community is textiles, informal commerce, subsistence agriculture, and portion of the community members receive funds from relatives that have had to migrate in search of job opportunities. Most families have low income, under the minimum wage.



Quiacquix community’s four habitable sectors and communal forest sector.

The community has reached out for support, as for years they have not had sufficient water to cover their basic needs. During our visit, we were able to confirm this is the most prioritized need in the community, as expressed by the local authorities that we describe below.

In Quiacquix a strong sense of community is perceived, the population is organized and represented in various work committees. In our visit we were able to meet with:

- Alcaldía Comunal/Communal Mayorship: Main local authorities.

- ASDIMQ: Ancestral authorities in charge of guarding the communal forest, area where mayan religious altars exist and were some of the current water systems springs are found.

- Comité de Agua Tres Parajes/Three *Parajes* Water Committee: in charge of managing one of the two existing water systems, system that serves three of the four *parajes* in the community.

- Comité de Agua Pozo Mecánico/Water Committee for Mechanical Well: in charge of maintenance of the existing infrastructure from an unfinished water project partially built in 2009, and to continue search of support for completing the system; system that the hereby presented proposed project is expected to complete and make functional.

Meeting with different authorities and committees in Quiacquix

2. CURRENT SITUATION: EXISTING WATER SYSTEMS

The community currently has 2 existing water systems:

SYSTEM 1: 3 PARAJES WATER SYSTEM

The system is fed by a group of water springs and distributed by gravity. It serves 3 of the 4 parajes that conform the community: Chaquiral, Pa Ojerkayb'al, and Pa'quiacquix.

Throughout the years, the flowrate from the springs has decreased, as mentioned by the community members, and expressed in socio-economical study done by Universidad Rafael Landívar in 2016.

Flowrate was measured during our visit on the inlet pipe of the distribution tank; it was of 0.014 liters per second. This flowrate makes the system almost useless to supply the population or a fraction of it. Acording to the Guatemalan standards where minimum demand *per cápita* is of 60 liters/person/day, the system would be able to provide for 20 persons each day.

The 3 Parajes Water Committee expressed that they close service for days, to wait for the distribution tank to fill, and then distribute to some families at least a small quantity of water.

Figure : Distribution tank of 3 Parajes System.

Water samples were taken from the inlet pipe of the tank. Results are shown in appendix A. The physicochemical parameters that were tested are appropriate according to the Guatemalan standards. What is of concern, is the significant amount of total coliform presence showing in the bacteriological test, which shows the water is not being treated.

SYSTEM 2: SYSTEM SHARED WITH ALDEA CHIPUAC

The fourth paraje, Chuipachaj, has water service from a system shared by a neighboring village, Aldea Chipuac.

This system has a good flowrate from what he noticed when visiting the distribution tank, but the water committees from Quiacquix can not distribute service to additional houses, as it would affect Aldea Chipuac where the system distributes mainly. We were not able to measure this flowrate as opening the tank hatch could have created conflict or misunderstanding from the community it mainly serves.

3. MECHANICALLY DRILLED WELL SYSTEM DESCRIPTION AND SCOPE OF PROPOSED PROJECT

3.1 EXISTING COMPONENTS IN UNCOMPLETED PROJECT:

Between 2008 and 2009, the community was able to get support from the Ministry of Health through an NGO for part of a system with a mechanical well as source. The intention was to develop an entire water system for the community, but the project was not completed, only the first phases were built. The components that were built are not being used by the community, as these have not been connected by pipes so for now remain as isolated components.

The existing infrastructure is the following:

1. **Mechanical well drilling.**
   The community provided copy of technical specifications from a design with date 2005. It mentions the well to be of about 600 feet deep and 12” in diameter. Pipe casing of 8” in diameter, and that it produced 90 GPM in the pump test.

2. **Pump house and perimeter wall.**
   Next to the well, a pump house was built and a perimeter wall that protects the well head and the pump house, construction with concrete block masonry and a metal gate. Appropriate for keeping safe the pumping equipment.

3. **Pumping equipment: submersible pump, motor, and diesel fed generator.**
   We were not able to verify the horsepower of the submersible pump installed in 2009. For now we know that it works, as the community turns the equipment on every couple of weeks for some minutes, to prevent it from rusting or decay due to lack of use.

   We were able to get some information from the specification plates in the other equipment.

4. **Distribution tank.**
   A robust distribution tank of good size was built in one of the highest points in the community. It is a semi-buried tank with stone masonry walls and reinforced concrete slabs. Its internal dimensions are 6.0 x 8.0 x 1.9 m, with a total volume of 91.20 m^3.

Wellhead

Diesel power equipment

Inside of pumphouse

Distribution tank, empty for now

The community turned on the pumping equipment during our visit, PVC pipes were used to conduct the water a few meters away from the wellhead, to discharge in a natural ditch just outside of the perimeter wall from the well site.

The flowrate was measured and water samples were taken.
The flowrate was of 8.15 liters per second, and water quality tests show very good quality of water as shown in Appendix 1.

Well/pump flowrate measurement and water sampling

3.2 SCOPE OF PROPOSED PROJECT

For 13 years the community has not been able to distribute and use the water produced by the well. To complete the project, the following works are needed:

Planning and design:

- Topographic survey of the community, to obtain the exact location and altitude of the different system components, and the houses in the community. Survey to be done with total station
- Well cleaning

- Design: hydraulic design of impulsion line, water treatment and distribution network. Check if the existing pumping equipment is sufficient according to demand and field conditions.

Construction works:

Conduction line:
Approximately 1.4 kilometers of pipe installation to conduct water from the well to the distribution tank.

Water treatment:
The Guatemalan government requires specifically chlorination to be installed in all water systems. A tablet chlorinator is recommended.

Distribution network:
Piping to distribute water from the distribution tank to all sectors by gravity. Including house connections with water meters, one tap at each home. Number of kilometers included in cost estimate is a very raw estimate, for preliminary planning purposes. Exact quantities should be obtained

Well cleaning:
As the well was drilled 13 years ago, it is recommended to schedule cleaning it before the system is put to work.

Possible additional scope, to be determined during preliminary design phase:

Pumping equipment:
It is necessary to verify if the existing equipment can efficiently impulse water to the distribution tank. The needed horsepower should be estimated according to the demand and altitude differences between the pump and distribution tank, and compared to the installed equipment. An estimate of cost of this type of equipment is added separately in the preliminary cost estimate table, in case change is needed.

Electrical connection:
We verified on field that the community has a diesel fed power generator for the pumping equipment that seems well maintained. The equipment is turned on for some minutes every two weeks to prevent damage. However, we suggest to change the diesel generator to electrical grid power, as electricity would cost less. This change can contribute to the sustainability of the project, as observed in other projects in Guatemala.

Community trainings

A series of 7 community trainings is required, the proposed topics are listed below:

1. Community organization and its environment.
• SWOT, action plan
• Mapping of actors
• Risk and hazard matrix for the project

2. Comprehensive Management of Water Resources (sustainability)
• Ecological sustainability (Sanitation: disposing of gray and black water, protection of basins and water sources).
• Economic sustainability (The costs of construction, operation, maintenance, safe and clean water, use of meters and fees.)
• Social sustainability (types of organization, relationships with organizations). Vulnerable families. Project impacts. The participation of the community and organized groups. Organized management, regulated, consensual decision making.

3. Creation of Community Regulations for Water System I
• Administrator group and accountability.
• Technical staff
• Estimating service fees
• Fines and penalties for defaulters

4. Creation of Community Regulations for Water System II
• Receipts to use
• Control of income and expenses
• New beneficiaries of the project
• Chlorination

5. Assembly
• Socialization of the water system regulations
• General assembly for approving the regulations

6. Post Assembly
• Necessary clarifications
• Practice using tools

7. Operation and Maintenance Session

4 PRELIMINARY COST ESTIMATES

COST ESTIMATION OF PLANNING AND DESIGN

PROJECT	**CONSTRUCTION OF POTABLE WATER SYSTEM, QUIACQUIX, TOTONICAPAN**
DATE	**SEPTEMBER OF 2022**

No.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL in Q	Total in US$
1	FIRST GRADE TOPOGRAPHIC SURVEY	ML	9500.00	Q 5.00	Q 47,500.00	$ 6,168.83
2	HYDRAULIC DESIGN	KM	9.50	Q 1,800.00	Q 17,100.00	$ 2,220.78
3	CONSTRUCTION DRAWINGS	UNIDAD	1.00	Q 6,000.00	Q 6,000.00	$ 779.22
4	BILL OF QUANTITIES/CONSTRUCTOIN BUDGET	UNIDAD	1.00	Q 4,000.00	Q 4,000.00	$ 519.48
				TOTAL BUDGET	**Q 74,600.00**	**$ 9,688.31**

PRELIMINARY BUDGET OF CONSTRUCTION WORKS
For preliminary project evaluation purposes, to be confirmed after design phase

PROJECT	**CONSTRUCTION OF POTABLE WATER SYSTEM, QUIACQUIX, TOTONICAPAN**
DATE	**SEPTEMBER OF 2022**

No.	DESCRIPTION	UNIT	CANTIDAD	UNIT PRICE	TOTAL Q	TOTAL US$
	REQUIRED WORKS					
1	IMPULSION LINE (1355 m aprox.)	METER	1355.00	Q 95.00	Q 128,725.00	$ 16,717.53
2	DISTRIBUTION LINES, (6635 m (aprox)	METER	6635.00	Q 65.00	Q 431,275.00	$ 6,009.74
3	HOUSE CONNECTIONS	UNIDAD	400.00	Q 850.00	Q 340,000.00	$ 44,155.84
4	CHLORINATOR	UNIDAD	1.00	Q 4,600.00	Q 4,600.00	$ 597.40
5	CHECK VALVES	UNIDAD	3.00	Q 4,200.00	Q 12,600.00	$ 1,636.36
6	AIR VALVE, INCLUDING CONCRETE BOX	UNIDAD	2.00	Q 4,200.00	Q 8,400.00	$ 1,090.91
7	CLEANOUT VALVES	UNIDAD	2.00	Q 4,200.00	Q 8,400.00	$ 1,090.91
8	DITCH CROSSINGS	UNIDAD	3.00	Q 2,500.00	Q 7,500.00	$ 974.03
9	PRELIMINARY WORKS AND FINAL CLEANING	UNIDAD	1.00	Q 4,900.00	Q 4,900.00	$ 636.36
	WORKS TO CONFIRM IF NEEDED AFTER DESIGN PHASE					

10	PUMPING EQUIPMENT (70 HP)	UNIDAD	1.00	Q 250,000.00	Q 250,000.00	$ 32,467.53
11	THREE PHASE ELECTRICAL CONNECTION (700 M aprox.)	UNIDAD	1.00	Q 70,000.00	Q 70,000.00	$ 9,090.91
1	COORDINATION, PROCURING, FINANCIAL MANAGEMENT, COMMUNITY TRAININGS	UNIDAD	1.00	Q 126,640.00	Q 126,640.00	$ 16,446.75
2	CONTINGENCY (25%)	UNIDAD	1.00	Q 316,600.00	Q 316,600.00	$ 41,116.88
				TOTAL PRELIMINARY BUDGET, Q:	**Q 1,709,640.00**	**$ 222,031.17**

GENERAL OBSERVATIONS

- Water meters will be installed in all houses, to ensure as much as possible the sustainability of the project.

- Each family (user) will contribute a connection service payment, that should cover the house connection cost. This is required to promote community's sense of ownership. The funds will be collected and managed by the community based organization, who should also be in charge of procuring specific materials as indicated by the constructor.

- The community members will provide unskilled labor, which has been considered in the preliminary budget presented in this document.

- It is still to be discussed with the municipal government, if they can partner on the project by providing construction materials.

APPENDIX 1
WATER QUALITY TESTS

A. Existing system: 3 Parajes Water System

Project: 3 Parajes water system, Quiacquix

Sample number: 1

Date of sample: August 8th, 2022.

Parameter	Result		Equipment/method
pH	7.2		Hach 5 in 1 stips
Conductivity	211	ms	Multi Tester, Hach 9532800
Total Disolved Solids, TDS	150	ppm	Multi Tester, Hach 9532800
Salinity	0.11	ppt	Multi Tester, Hach 9532800
Alcalinity	40	ppm CaCO3	Hach 5 in 1 stips
Color, apparent	45	Pt-Co	Colorimeter, Hach DR 900
Turbidity	0	FAU	Colorimeter, Hach DR 900
Total Chlorine	0	mg/l Cl2	Colorimeter, Hach DR 900
Free Chlorine	0	mg/l Cl2	Colorimeter, Hach DR 900
Iron	0.14	mg/l Fe	Colorimeter, Hach DR 900
Copper	0	mg/l Cu	Colorimeter, Hach DR 900
Manganese	0	mg/l Mn	Colorimeter, Hach DR 900
Sulfates	0	mg/l SO4	Colorimeter, Hach DR 900
Total hardness	50	ppm CaCO3	Total hardness kit, titration. Hach 145401
Arsenic	0	ppb	Arsenic test strip kit, Hach 2800000
Total coliforms	150 colonies/100 ml		Membrane filtration method with field kit and ColiBlue reagent. Hach product 2586400
E-coli	0 colonies/100 ml		

Bacteriological test, 3 Parajes Water System

Physicochemical parameters tested are within national quality standards.
Bacteriological test shows high presence of coliform bacteria.

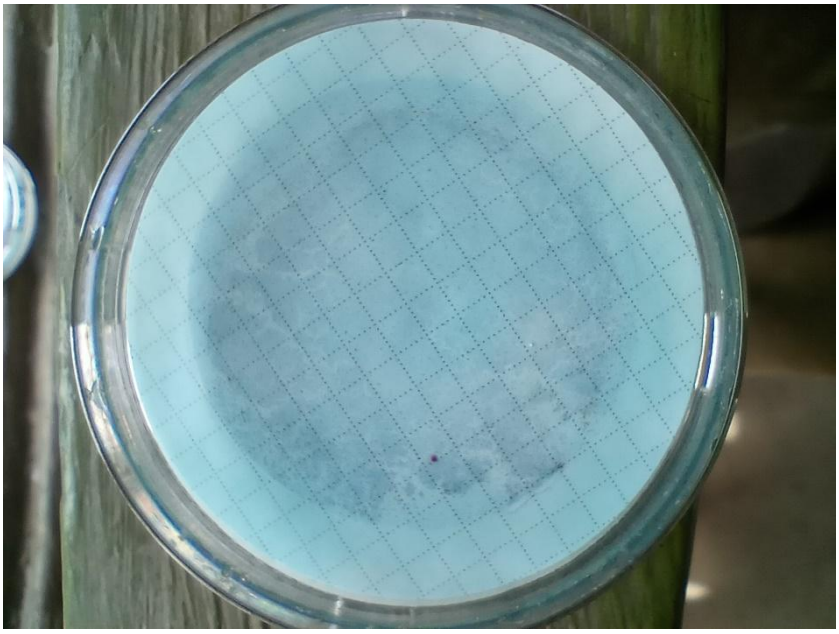
B. Drilled well water sample, water source of proposed project

Project: Mechanically Drilled Well. Quiacquix

Sample number: 1

Date of sample: August 8th, 2022.

Parameter	Result		Equipment/method
pH	7.2		Hach 5 in 1 stips
Conductivity	196	ms	Multi Tester, Hach 9532800
Total Disolved Solids, TDS	140	ppm	Multi Tester, Hach 9532800
Salinity	0.10	ppt	Multi Tester, Hach 9532800
Alcalinity	80	ppm CaCO3	Hach 5 in 1 stips
Color, apparent	13	Pt-Co	Colorimeter, Hach DR 900
Turbidity	5	FAU	Colorimeter, Hach DR 900
Total Chlorine	0	mg/l Cl2	Colorimeter, Hach DR 900
Free Chlorine	0	mg/l Cl2	Colorimeter, Hach DR 900
Iron	0.02	mg/l Fe	Colorimeter, Hach DR 900
Copper	0.02	mg/l Cu	Colorimeter, Hach DR 900
Manganese	0	mg/l Mn	Colorimeter, Hach DR 900
Sulfates	0	mg/l SO4	Colorimeter, Hach DR 900
Total hardness	50	ppm CaCO3	Total hardness kit, titration. Hach 145401
Arsenic	0	ppb	Arsenic test strip kit, Hach 2800000
Total coliforms	1 colony/100 ml		Membrane filtration method with field kit and ColiBlue reagent. Hach product 2586400
E-coli	0 colonies/100 ml		



Bacteriological test, Drilled Well

Physicochemical parameters tested are all within national water quality standards.
Bacteriological test shows water cleanliness, as expected from a well source.