



water for people

A Systems-Based Approach to Climate-Resilient WASH in the municipality of San Bartolomé Jocotenango in Guatemala

Authors: Byron Palacios, Johnny Toledo, Liza Rivera, Kelly Latham, and Anna Libey
Funding was generously provided by the Shockwave Foundation.

Executive Summary

The municipality of San Bartolomé Jocotenango in Quiché is situated in Guatemala's Dry Corridor, one of the regions most affected by climate change. Prolonged droughts, intense rainfall, floods, and landslides increasingly disrupt water and sanitation services, threatening both ecosystems and rural livelihoods. These risks are compounded by steep terrain, deforestation, and fragile infrastructure.

Water For People has been working with the municipality since 2007 to implement the Everyone Forever model, striving for universal and sustainable water, sanitation, and hygiene (WASH) services.

Climate adaptation measures in San Bartolomé Jocotenango are grounded in three aims:

- **Healthy freshwater ecosystems:** identifying land use areas, mapping water recharge areas, reforestation, establishing agroforestry systems, and promoting water conservation and rainwater sowing for groundwater recharge.
- **Dynamic and inclusive service management:** strengthening the Municipal Directorate of Water and Sanitation (DIMAS), improving governance, introducing micro-metering and fair tariffs, and developing the municipal Climate Resilience Plan.
- **Stronger infrastructure:** investing in climate-resilient design, additional water sources with rainwater harvesting, and innovative sanitation technologies such as eco-digesters.

Many of these measures are already underway. The Climate Resilience Plan consolidates ongoing work, builds legitimacy with the community, and provides a roadmap for scaling to other municipalities and the department.

The experience of San Bartolomé Jocotenango shows that local leadership is central to climate resilience. DIMAS and the Water Committees, supported by the mayor and Municipal Council, have built a model of community ownership that ensures solutions are relevant, lasting, and culturally appropriate. Their work demonstrates how municipalities can take the lead in addressing climate challenges while securing the human right to water.



Table of Contents

Executive Summary	2
Background and Rationale	4
Why Climate Resilience is Central to WASH	4
Global Framing for Adapting to Climate Change Through an Area-Wide, Systems-Based Approach.....	6
National Context: Guatemala	9
District Context: San Bartolomé Jocotenango	13
Local impacts of climate change on WASH services in the municipality of San Bartolomé Jocotenango	13
District Climate Risks	14
Climate Risks to WASH Services in San Bartolomé Jocotenango	14
Adaptation Strategies	18
Priority Adaptations that Respond to Climate Risks in San Bartolomé Jocotenango, Guatemala.....	18
Defining potential areas for forest restoration	20
Rainwater harvesting	20
Integrating Climate Into Planning	20
Integrating Climate Risks and Adaptation into Local Policy in San Bartolomé Jocotenango.....	21
Lessons Learned	21
Looking to the Future	21
Conclusion	22
References	23



Background and Rationale

Why Climate Resilience is Central to WASH

Water For People is adapting its approach to sustainable water, sanitation, and hygiene (WASH) services to address the growing challenges of climate change directly. Ensuring equitable, continuous, and safe access to water requires not only expanding infrastructure, but also protecting and managing the ecosystems and institutions that sustain it over time.

Climate variability in Guatemala has already intensified, bringing rising temperatures, prolonged droughts, landslides, and floods. These hazards damage water sources and infrastructure, sometimes leading to the abandonment of entire systems. The majority of the rural population depends on surface water and springs fed by shallow groundwater. Protecting aquifers is therefore critical, as they are the foundation of long-term water security – yet are often overlooked in favor of short-sighted exploitation.


The country's water crisis is compounded by the fact that domestic consumption represents only a small share of total use compared to agriculture and industry. **This makes a climate justice and human rights approach that centers fair and sustainable distribution of resources essential.**

Adapting to climate change is an urgent priority, particularly in rural areas where service levels are lowest and vulnerabilities are highest. Extreme events in recent decades have revealed how unprepared communities and institutions are to manage climate risks. Each new emergency strains public funds and widens existing service gaps, particularly among vulnerable groups, leaving communities less resilient.

Public policies are beginning to address water challenges in more integrated ways. To be effective, stakeholders must coordinate across sectors to embed climate resilience best practices into long-term planning. Projects that are short-term, isolated, or lack sustained funding for operations and maintenance risk deteriorating over time and falling short of their goals.

Climate adaptation is not only an environmental priority – but an essential condition to guarantee Guatemalan communities' water security, public health, and sustainable development.

Climate adaptation is not only an environmental priority – but an essential condition to guarantee Guatemalan communities' water security, public health, and sustainable development. This challenge requires a multisectoral response, led locally and with a long-term strategic vision.



This case study examines how the municipality of San Bartolomé Jocotenango in Quiché is addressing these challenges. By documenting the experiences in this municipality, we will support more sustainable and adaptive models in the WASH sector and systematize and share our lessons learned.

Through this documentation, Water For People aims to foster dialogue with donors, governments, conservation organizations, and productive sectors by integrating soil, forest, water, and biodiversity into WASH. **Because water connects us all, this cross-sector approach enables broader participation in building comprehensive solutions to climate change.**

In addition, since the agricultural and industrial sectors consume significantly more water than domestic users, this case brings more visibility to the limited water resources in rural Guatemala, and why we must search for equitable and sustainable alternatives.

Finally, this case can also raise awareness among the populations vulnerable to climate risk – such as green entrepreneurs and sustainable tourism facilitators – who have a key role in fostering economic practices that contribute to both local economic development and the conservation of water resources.

Global Framing for Adapting to Climate Change Through an Area-Wide, Systems-Based Approach

We found three overarching themes when assessing the climate challenges faced in all countries where Water For People works. Water and sanitation services increasingly face too much, too little, and more polluted water as described in Figure 1.



Figure 1: Physical climate change impacts on WASH services.¹

While these challenges are physical, the solutions are rarely physical. We have found that identifying solutions requires the same systems perspective we have been using for the past 15 years, which considers the building blocks shown in Figure 2.

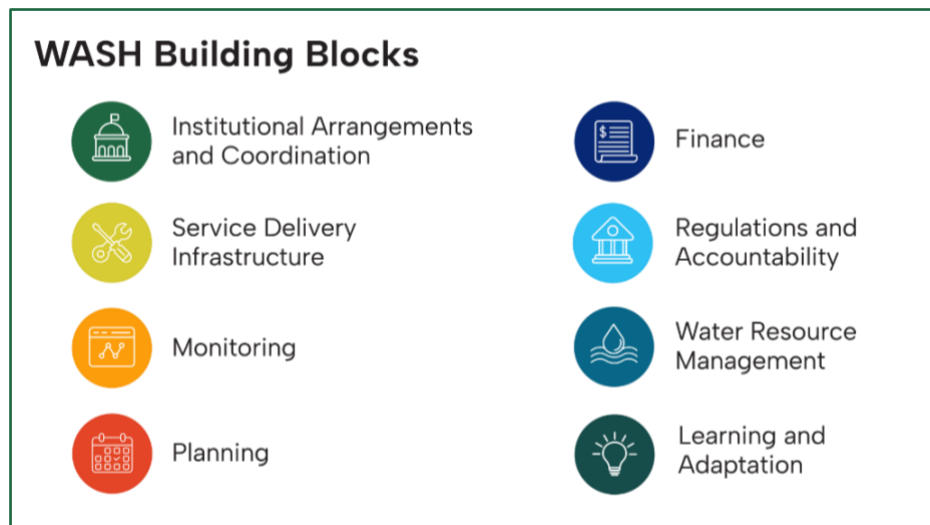


Figure 2: WASH Systems Building Blocks. Adapted from Agenda for Change.

¹ IRC and Water For People, [Climate Change, WRM, and WASH: Working Paper](#), 2021.

Climate challenges and solutions align with building blocks in different ways. For example:

- **Institutional coordination** might need new connection points between various water-related sectors, such as the environment and agriculture.
- **Monitoring** systems might require greater frequency to understand shifting seasonal patterns or service disruptions.
- **Regulations** might need to shift design standards so infrastructure can withstand new and changing risks.




Understanding risks comes from considering the unique hazards, vulnerabilities, and exposures of a WASH system in a specific geography – all of which have proven helpful for identifying the most impactful strategies for adapting to climate resilience.

Three components of risk:



Hazard:	Vulnerability:	Exposure:
A dangerous phenomenon, substance, human activity, or condition that may cause loss of life, injury, or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, and environmental damage.	The characteristics and circumstances of a community, system, or asset that make it susceptible to the damaging effects of a hazard.	People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

Strategies we have identified fall into three categories, or adaptation aims, as defined in the following table.

Table 1: Three aims for adapting WASH services to climate change	
	<p>Healthy freshwater ecosystems that protect and restore freshwater ecosystems, which can strengthen climate defenses and restore a natural balance that benefits WASH services.</p>
	<p>Dynamic and inclusive service management that actively manages risks on a real-time basis to maintain continuity of services with a focus on disproportionately impacted populations. Opportunities to manage more dynamically can be identified across all of the building blocks.</p>
	<p>Strong infrastructure that withstands stress and shock based on climate risk analysis to secure inclusive accessibility, while also recognizing that infrastructure alone will not deliver resilience services.</p>

As described in the adaptation aims table, strategies to adapt WASH services go beyond technology and infrastructure and center more on human and environmental dimensions of resilience.

Water For People’s global approach to climate resilience has evolved over several years as different communities, teams, and partners have faced challenges, and it is a work in progress. Most recently, this approach has been validated by its alignment with the sector-wide definition of climate-resilient WASH:

“Climate-Resilient WASH services anticipate, respond to, cope with, recover from, adapt to or transform based on climate-related events, trends and disturbances, all while striving to achieve and maintain universal and equitable access to safely managed services, even in the face of an unstable and uncertain climate, where possible and appropriate, minimising emissions, and paying special attention to the most exposed vulnerable groups.”²

² Sanitation and Water for All, [Definition of climate-resilient water sanitation and hygiene services](#), 2024.

National Context: Guatemala

The water sector in Guatemala has unique geographic, social, economic, and environmental challenges. High climate variability, loss of forest cover, and lack of infrastructure limit access to drinking water and sanitation – especially in rural and indigenous areas.

According to the 2018 National Population and Housing Census, 89% of the population has access to either water connections inside or outside the house, public taps, or a drilled well.³ However, several rural departments are below this average, including Quiché (85%), where Water For People works. Volunteer-run community water systems also struggle to provide services, with only 20% meeting standards for safe and continuous water supply.⁴ **The lowest water service levels in Guatemala are found in regions with higher structural poverty levels.**

National sanitation coverage is considerably lower at 63% of homes with a toilet connected to a sewer, septic tank, or washable toilet.⁵ Human waste entering the environment untreated is widespread. This shows that sanitation continues to be one of the most urgent challenges in the country's development agenda but has the least dedicated resources.

In addition, approximately 90% of the water sources in the country are contaminated and families state that "water pollution is one of their greatest fears."⁶ Despite the national water abundance, access to safe drinking water that is free from contamination remains limited in the most vulnerable areas – further exacerbating health disparities.

Climate change intensifies floods and droughts, especially in the Dry Corridor, where the territory at risk of aridity is expanding.⁷ Roads, bridges, and buildings have not been designed to withstand extreme and unpredictable precipitation either. Only 6% of rainwater manages to infiltrate the soil, due to both the loss of forest cover and the country's geography, only 6% of rainwater manages to infiltrate the soil. This causes a low recharge of aquifers and spring-fed streams and an alarming loss of fertile soil due to erosion.⁸

Guatemala's National Climate Change Report summarized the following three impacts:⁹

- **Prolonged droughts:** mainly in the Dry Corridor, communities experience reductions in the availability of water for consumption and agriculture, increasing food insecurity and conflicts over the resource.

³ Instituto Nacional de Estadística Guatemala, [Resultados Censo 2018](#), 2019.

⁴ Instituto de Agricultura, Recursos Naturales y Ambiente en la Universidad Rafael Landívar (IARNA), [Agua: Serie Perfil Ambiental de Guatemala](#), 2023.

⁵ JMP, [Household WASH Data in Guatemala](#), 2024.

⁶ World Vision Guatemala, [AGUA, CAMBIO CLIMÁTICO Y CORREDOR SECO](#), 2024.

⁷ IARNA, 2023.

⁸ IARNA, 2023.

⁹ Ministry of the Environment and Natural Resources, [CONTRIBUCIÓN NACIONALMENTE DETERMINADA](#), 2021.

- **Extreme weather events:** Heavy rains cause floods and landslides that damage water infrastructure and increase repair and maintenance costs, causing a lack of service continuity.
- **Reduction of sources and flows:** The decrease in the availability of surface and underground sources, combined with their contamination, limits access to safe water for many communities.

In addition, the high territorial vulnerability aggravates these impacts. Many populations are settled in steep slopes, where the change in land use – including deforestation, forest fires, and annual farming – has increased erosion and reduced water retention capacity. This aggravates the effects of heavy rainfall and weakens the resilience of the ecosystem and communities.

Together, these factors pose a constant threat to the maintenance and improvement of WASH service levels and underscore the urgency of incorporating climate risk into the planning, design, and operation of these systems.

Weaknesses in the WASH system also increase the vulnerability of populations impacted by climate change. In 2021, a national assessment of the eight building blocks of the WASH system was conducted, which made it possible to identify structural strengths and weaknesses (see figure 2).

The main weaknesses detected were:

- **Decentralization without clear national direction:** Although there is a high level of decentralization of planning and budgeting control to the municipalities, there is no effective mechanism from the central government to guide them towards fulfilling development goals. Municipal autonomy makes it difficult to establish common standards or demand results, since no fiscal, budgetary, or results-based management measures oblige them to do so.
- **Institutional fragmentation:** There are overlaps and gaps in institutional functions at the national level, such as how the Ministry of Health oversees drinking water quality but the Ministry of the Environment coordinates water source protection and they do not coordinate sufficiently. No effective governing body regulates or provides technical and normative guidance to municipalities on WASH.
- **Provision of services without a clear regulatory framework:** Most municipalities provide services directly, without differentiating roles between the service authority and the service provider. There are also no mechanisms to evaluate or improve the performance of providers.

- **Absence of sectoral technical instruments:** Apart from the water quality monitoring system, there are no comprehensive monitoring systems or manuals for infrastructure development, asset management, or the exercise of key municipal functions.
- **Weak financial framework:** No national entity to coordinate financing exists, and no specific funds are allocated in the national budget to develop water and sanitation infrastructure. The Development Council system is the main channel for investment, but its bottom-up approach creates fragmentation and makes it difficult to achieve economies of scale. In addition, there is no defined tariff regime or mechanisms to encourage municipal contributions.

These structural weaknesses make the population even more vulnerable to climate change. For example:

- **The lack of centralized planning and clear rules prevents climate-resilient infrastructure** from being designed, especially in areas prone to droughts, floods, or landslides.
- **The absence of monitoring and adaptive management limits the ability to respond to extreme events**, making it difficult to protect water sources or quickly repair damaged systems.
- **Financial and institutional weakness hinders investment in adaptive technologies** such as rainwater harvesting, wastewater treatment, or re-forestation conversion to improve water recharge.
- **The most affected populations, especially in the Dry Corridor, are exposed to water scarcity and outbreaks of gastrointestinal and vector-borne diseases**, the prevalence of which increases in contexts of unsafe water and extreme weather events.

These vulnerabilities highlight the urgency of strengthening the WASH system from a climate resilience perspective, with a national vision, adequate financing, and a strong regulatory base.

Guatemala has defined national plans and priorities to address climate change that have great potential for positive impacts on WASH services, especially in rural and vulnerable contexts. The most relevant elements are highlighted below:

National Climate Change Action Plan (PANCC)

In compliance with Decree 7-2013 (Framework Law on Climate Change), this plan has a cross-cutting approach, applicable to all government institutions and sectors of the State. Its objective is to:

- **Reduce the vulnerability of the population**, especially those living in conditions of greater climate risk.

- **Strengthen the country's capacity to adapt** to increasingly intense and frequent climatic phenomena.
- **Decrease greenhouse gas (GHG) emissions**, although the national contribution to global emissions is low.

Regarding WASH, the PANCC promotes the integration of adaptation actions, such as protecting water recharge areas, efficient water use, rainwater harvesting, and resilient infrastructure planning, all essential to ensure sustainable and climate-resilient services.

Nationally Determined Contributions (NDCs)

According to the Ministry of Environment and Natural Resources (2021), Guatemala has submitted its NDCs as part of its commitment to the Paris Agreement. These explicitly recognize that:

- The country is **highly vulnerable to climate change**, despite its low contribution to global emissions.
- An **increase in average temperature of up to 1 °C (1.8 °F)** and a reduction of **up to 500 mm (20 in)** in annual precipitation are expected by the end of the century.
- Protecting **ecosystems** is key to ensuring **ecosystem services** that provide water in adequate quality and quantity, directly linked to WASH services.

Although the NDCs do not explicitly and in detail mention the WASH sector as a separate category, they do include it implicitly when talking about adaptation, water resource management, vulnerability reduction, and community resilience.

These policies and plans allow:

- Integrating WASH into national climate planning.
- Directing resources (technical and financial) towards climate-resilient projects.
- Promoting nature-based solutions, such as the protection of natural forests, reforestation of recharge areas, and water harvesting – taking advantage of public policies such as forest incentive programs.
- Strengthening the link between health, water, and the environment, which is essential in the context of climate adaptation.

District Context: San Bartolomé Jocotenango

Local impacts of climate change on WASH services in the municipality of San Bartolomé Jocotenango

San Bartolomé Jocotenango is located in the central part of the department of Quiché in the upper part of the Salinas River basin in Guatemala's Dry Corridor.

Water For People has partnered with the San Bartolomé Jocotenango local government to implement the Everyone Forever model since 2007, working to ensure sustainable water, sanitation, and hygiene services for every household, school, and health clinic.

As of 2023, the municipality has reached 90% coverage with improved water services, thanks to the establishment of 32 drinking water systems. The municipality's water supply sources are distributed according to Table 2, where it is observed that 71% are gravity-fed from protected springs and surface water and highly susceptible to drought and landslides.

The community of Los Cimientos, in San Bartolomé Jocotenango, where 65 families benefit from an improved water system, is an example of climate resilience. Following the damage caused by storms Eta and Iota, which interrupted service for more than two weeks, the community committee was able to respond immediately thanks to the existence of micro-metering and a previously established fair tariff. These mechanisms provided them with sufficient resources to build an overhead passage and replace the PVC pipe with a more resistant and durable HG pipe, thus ensuring continuity of service and better preparedness for climate change.



Figure 3. Map of Guatemala and the Municipality of San Bartolomé Jocotenango

Water Supply Sources	Quantity
Gravity-fed systems	34
Wells	5
Single family systems (wells or rainwater harvesting)	3
Communities receiving water from outside the municipality	6

Table 2. Water supply systems in the municipality of San Bartolomé Jocotenango

District Climate Risks

Climate Risks to WASH Services in San Bartolomé Jocotenango

In San Bartolomé Jocotenango, WASH services are highly exposed to hazards and vulnerable to disruptions, elevating the risk to communities. 100% of the water catchments that supply the sources people rely on are facing threats from drought, landslides, or pollution – which are made worse due to climate change as well as local environmental degradation. Water storage and distribution infrastructure is also at risk, as half of distribution tanks are in landslide-prone areas and the other half in drought-prone areas. This elevated risk makes it more likely that increasing climate change will affect the continuity and quality of WASH services.



The following table summarizes the climate hazards, vulnerabilities, and exposure.

Hazards	Vulnerabilities	Exposure
<ul style="list-style-type: none"> • Prolonged droughts • Torrential rainfall in very short periods (poor distribution of rainfall) • Changes in rainfall patterns • Sustained increase in temperature • Chemical and biological water pollution from farms • Fecal contamination of water sources from unsafely managed sanitation 	<ul style="list-style-type: none"> • Weakness in the water and sanitation system infrastructure • Water and sanitation service gaps • Limited access to climate information • Institutional and organizational weakness in responding to emergencies • Lack of funding and a plan to respond to emergencies • Little willingness to use metering and pay fair rates. • Loss of forest cover in water recharge areas • Steeply sloped terrain with high landslide and erosion potential 	<ul style="list-style-type: none"> • Springs and wells that depend on subsurface and underground water recharge • Springs that are located in mountainous areas with high slopes are susceptible to landslides • Water infrastructure is not adequate to the effects of climate change • Sanitation infrastructure is not adequate to the effects of climate change

In the municipality of San Bartolomé Jocotenango, an assessment of the climate resilience of drinking water systems was carried out to identify vulnerabilities and strengthen the capacity to adapt to risks associated with climate change. The 2025 field assessment was conducted using How Tough is WASH?, developed by the University of Bristol and adapted to Water For People’s monitoring system.¹⁰

The assessment used a structured and participatory approach, coordinating with students from the Centro Universitario de Nor Occidente, of the University of San Carlos de Guatemala, the Municipal Directorate of Water and Sanitation (DIMAS), and the community water committees. Teams conducted surveys, community visits, field trips, and meetings with local actors. Water system data was recorded using the mWater mobile application and a Geographic Information Systems (GIS) map used to analyze the exposure of infrastructure and water sources to hazards such as droughts, landslides, and loss of forest cover. With this assessment we can characterize the existing infrastructure, identify vulnerabilities, and advance in the design of climate-resilient improvement strategies.

The climate risks assessment was guided by the principles of Locally Led Adaptation, ensuring that the most affected communities not only participate but also lead the development of culturally relevant, sustainable solutions with direct benefits on their livelihoods.

The findings from the climate resilience study helped the municipality and Water For People to prioritize actions such as detailed characterization of existing infrastructure, assessment of climate vulnerabilities, and the design of improvement plans oriented toward sustainability. The three components of climate exposure evaluated were topography, forest cover, and current land use.

Forest Coverage		
Coverage	Area (hectares)	Percent
Forest	14.5	35.5%
Not Forest	26.4	64.5%
Total	40.9	100%

Forest Cover

60% of the water sources that supply the municipality are outside its administrative limits. For this reason, it is essential to carry out an analysis that considers neighboring municipalities to identify climate risks properly. Forest cover plays a key role as a mitigator of climate change as it acts as a carbon sink, regulates climate, modulates rainfall, prevents erosion, and protects water resources.

¹⁰ University of Bristol, [How Tough is WASH Climate Resilience Framework](#), 2023.

Water For People and the University of San Carlos of Guatemala conducted an analysis of forest cover in the micro-basins with direct influence on the municipal territory, because water flows respond to physiographic criteria, not administrative divisions. Findings show that 35.5% of the territory of San Bartolomé Jocotenango is forested, mainly concentrated in the high areas of the mountainous relief. These forests play a key role in soil protection and water recharge processes, contributing significantly to the regulation of the water cycle in the municipality.

Current Land Use

When humans modify land for different purposes, we affect the climate through the release of greenhouse gases stored in soil and plants and the alteration of natural cycles. Unsustainable agricultural activities generate methane and nitrous oxide emissions, contributing to biodiversity loss and soil degradation.

Figure 4 shows the spatial distribution of water sources according to the land cover type. 61% of the sources that supply the water systems of San Bartolomé Jocotenango are in forested areas, while the remaining 39% are in areas with altered vegetation cover. The sources in altered areas are more exposed to erosion, contamination, and more likely to go dry in times of drought.

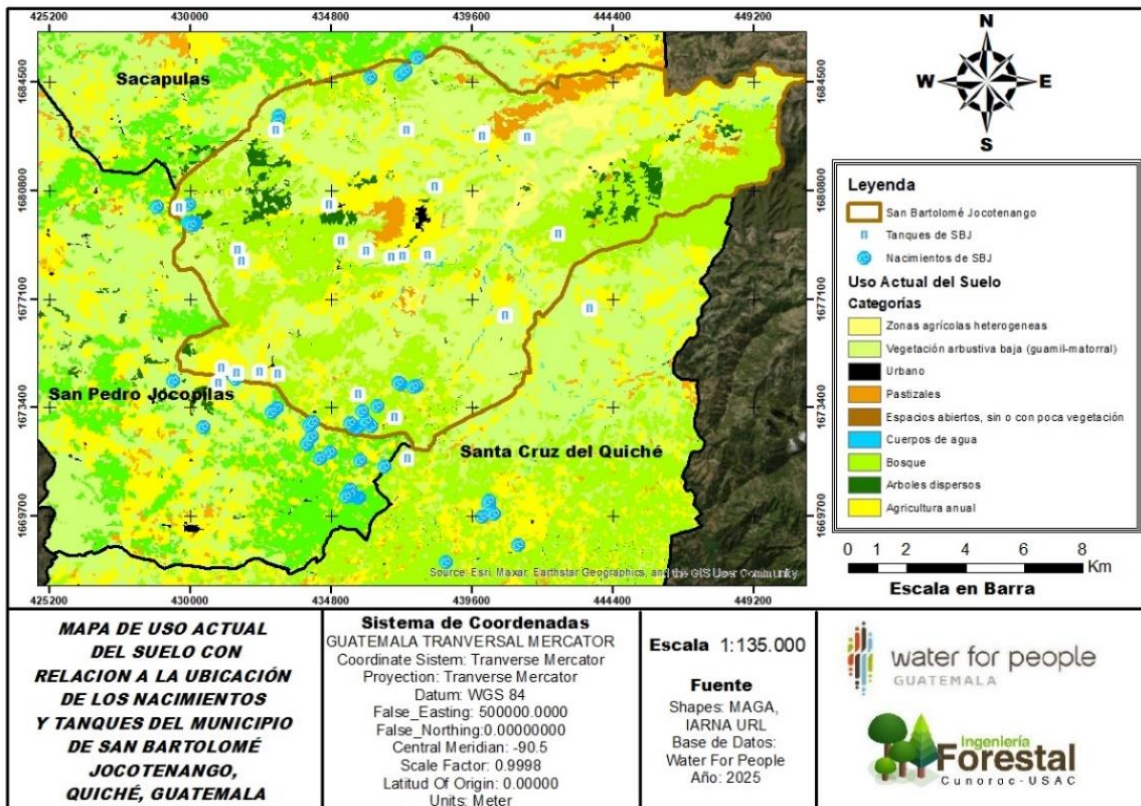


Figure 4. Location of the springs that supply the water systems and the categories of land use in the municipality of San Bartolomé Jocotenango, Guatemala.

Slope of the Terrain

The slope of the terrain is also a determining factor in the resilience of WASH services. Constructing distribution pipelines is more difficult in steep terrain and systems may be harder for operators to reach to perform maintenance and repairs. In San Bartolomé Jocotenango, 100% of the water sources are in areas with slopes between 25% and 75%, classified as “uneven to steep” areas. These topographic conditions significantly increase the risk of erosion, landslides, and soil degradation, compromising water quality and damaging infrastructure.

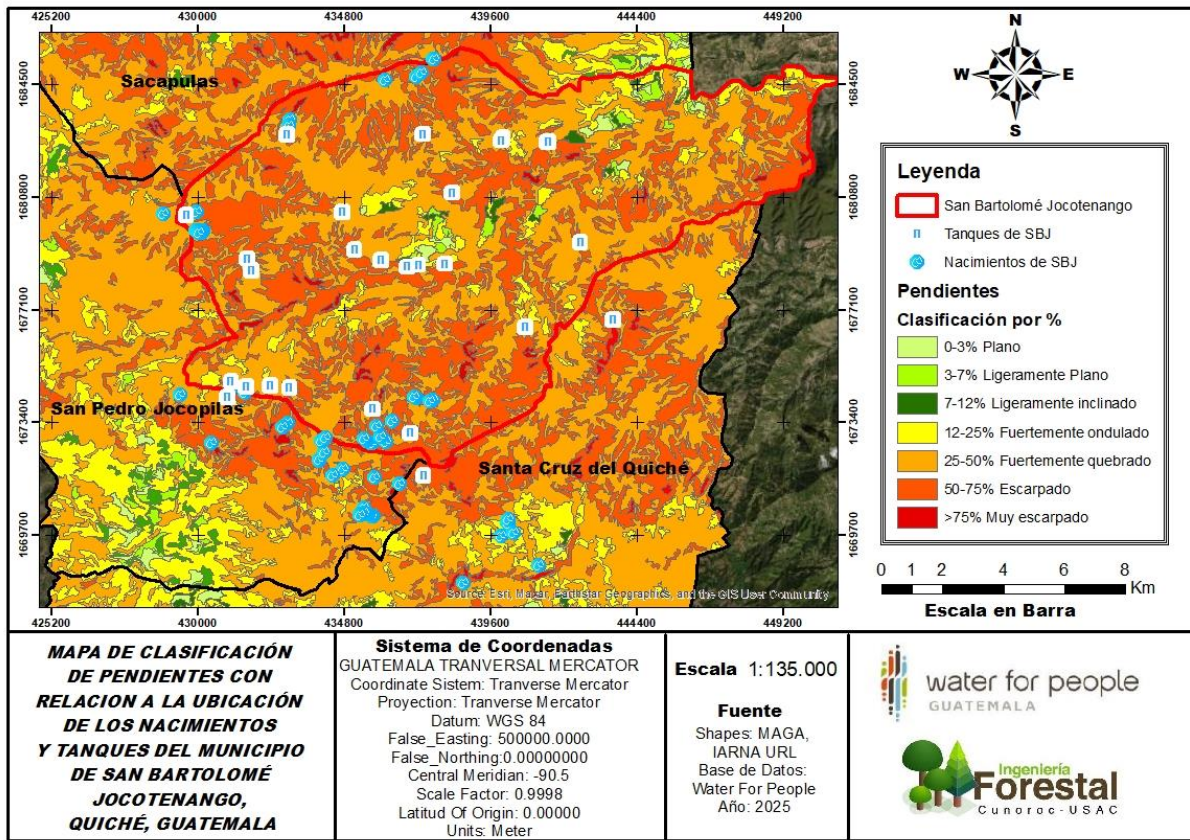


Figure 5. Location of the springs that supply the water systems and the steepness of the terrain in the municipality of San Bartolomé Jocotenango

Adaptation Strategies

Priority Adaptations that Respond to Climate Risks in San Bartolomé Jocotenango, Guatemala

This initiative has facilitated the formulation of a realistic and contextualized Climate Resilience Plan and strengthened the legitimacy of the process and its future sustainability. The following table summarizes key adaptations being implemented and planned to improve the resilience of WASH services.



Adaptation Aim: Healthy Freshwater Ecosystems

Implemented Activity:

- Identification and mapping of high water recharge zones
- Identification and prioritization of areas with potential for forest restoration
- Incentive program implementation for natural forest protection
- Reforestation activities and establishment of agroforestry systems
- Rainwater sowing with ditches and infiltration wells

Future Activity:

- Forest restoration in areas of high water recharge zones
- Strengthening of the forest incentive programs
- Forming a micro-watershed committee



Adaptation Aim: More dynamic and inclusive service management

Implemented Activity:

- Micro metering to manage system demand
- Fair user fees
- Training of water committees in administration, operations, maintenance, and inclusive participation.
- Strengthening the DIMAS with periodic training and the use of new technologies.
- Regular monitoring of service levels and asset analysis
- Development of Climate Resilience Plan

Future Activity:

- Inclusive governance that promotes equal participation of men, women, and young people.
- Identification of system-level vulnerabilities
- Participatory elaboration, socialization, and implementation of the Climate Resilience Plan for the municipality
- Emergency response plan (including an emergency fund and warehouse with tools, accessories, and supplies for immediate response)
- Implementation of the Municipal Water and Sanitation Policy

**Adaptation
Aim: Stronger
infrastructure****Implemented Activity:**

- Assessment of the climate resilience of water system infrastructure in San Bartolomé Jocotenango

Future Activity:

- Technological innovation
- Investment in resilient water infrastructure (physical protection of catchment areas, climate-resilient water systems designs)
- Rainwater harvesting
- Incorporation of the eco-digester (innovative treatment technology for rural sanitation)

Incentivizing forest restoration

The GIS analysis generated maps of water recharge zones, land use capacity, and current land use in order to identify priority areas for forest restoration. This has allowed the municipality to have accurate information on the areas that require greater investment in forest protection, reforestation, agroforestry, and other conservation measures.

This approach, known as the Forest Incentive Program, is an evidence-based approach to improve the efficiency of public and community investment by allowing climate change adaptation actions to be concentrated in the territories with the greatest need and potential for environmental recovery. The Forest Incentive Programs have channeled new resources towards the protection of forests, reforestation where needed, and the establishment of agroforestry systems — facilitating the protection of water recharge areas and the restoration of degraded landscapes. In addition to their environmental impact, these programs have strengthened social sustainability by creating livelihoods and complementary income, while enhancing communities' adaptive capacity and reinforcing their direct role in conserving natural resources.

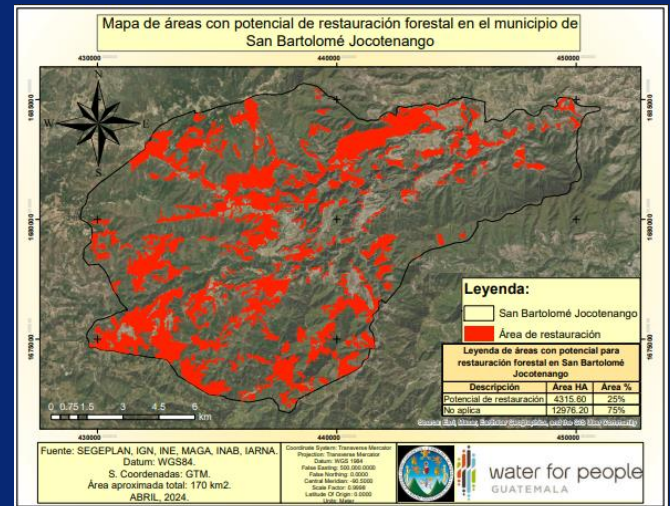


Figure 6. Ferrocement cistern for rainwater harvesting

Rainwater harvesting

In the municipality, there are communities located in the *upper* areas of the basin, which, although they are located in zones of high water recharge, face a paradox: they do not have accessible water sources since the natural discharges of the aquifer occur in the *middle* and *lower* parts of the basin.

In this situation, ferrocement cisterns for rainwater harvesting have been promoted as an alternative source to

improve water security. Although this solution has certain limitations, such as storage capacity or the seasonality of rainfall, it has proven to be a viable and effective option, especially for the communities most vulnerable to water shortages for human consumption.

Integrating Climate Risks and Adaptation into Local Policy in San Bartolomé Jocotenango

Evaluating the climate resilience of drinking water systems forms the basis for developing a Climate Resilience Plan, which is integrated into the Municipal Water and Sanitation Policy as part of the broader IWRM framework. Approved by the Municipal Council and aligned with departmental and national planning, this integration provides the plan with institutional legitimacy, stability, and long-term sustainability.

Water For People strives for activities to be executed under the leadership of the DIMAS, ensuring alignment with the Municipal Water and Sanitation Policy and corresponding plan. Additionally, we promote the involvement of the municipal mayor and their council because their political support encourages the sustainability of these activities.

Mayor Joaquín Xotoy Tum has expressed a firm commitment to the issue of his constituents' water access, considering it one of the central priorities for his municipal management. This vision has been crucial for moving forward with technical processes such as climate resilience planning, IWRM, and the strengthening of WASH services – especially in rural territories with high pressure on their sources.

Lessons Learned

Lessons Learned and Key Challenges in Integrating Resilience

The active involvement of municipal authorities, DIMAS, and Water Committees has been central to analyzing climate risks in drinking water systems. Their leadership has established a model of community and municipal ownership that ensures adaptation measures are culturally appropriate, relevant, and durable. By empowering these actors, the process gains legitimacy and long-term sustainability through strengthened local leadership.

Looking to the Future

The San Bartolomé Jocotenango Climate Resilience Plan will be socialized with local actors, and implementation will begin in 2026. It is important to note that several of the adaptation measures are already being implemented in the municipality; the plan seeks to make them official, give them legitimacy, and ensure their sustainability, while integrating them with new actions defined from the climate resilience analysis of drinking water systems.

Both the adaptation measures in progress and those that are planned must be complementary, contextualized, and adjusted to the local reality, ensuring that they provide

an effective, viable, and relevant response to the adaptation needs of the municipality in the face of the impacts of climate change.

Climate Resilience Plans are also being developed in San Antonio Ilotenango and Santa Cruz del Quiché municipalities. It is expected that these plans can be expanded to other municipalities where work is currently underway. It is feasible to even scale to the department level since the municipalities share similar climatic, social, and structural challenges regarding the resilience of water and sanitation services. This would allow for an efficient and contextualized adaptation of resilience plans in other territories of the department of Quiché.

Conclusion

The Everyone Forever model represents an ambitious and necessary vision to guarantee universal, sustainable, and equitable access to water and sanitation services. However, achieving this goal is only possible if IWRM is decisively incorporated into a climate resilience approach. Prolonged droughts, heavy rains, landslides, and loss of water sources are some direct consequences that already affect infrastructure, water quality, and service continuity in rural and urban communities in Guatemala.

In this context, it is not enough to build water systems; it is imperative to protect and restore ecosystems, engage communities in adaptive water management, and strengthen local and institutional capacities to plan, invest, and respond to uncertain climate scenarios.

Resilience is not achieved with isolated actions, but through participatory, comprehensive, and evidence-based processes, which recognize the particularities of the territory and the voices of those who inhabit and depend on its water sources. Municipal Climate Resilience Plans should not only be technical instruments, but also tools of local governance, promoting climate justice, equity, and sustainability. Building resilience in water and sanitation systems is not only a response to climate change; it is essential for guaranteeing the human right to water in an increasingly vulnerable world.

If you have any questions or feedback, please contact Kelly Latham at klatham@waterforpeople.org.

References

- INDC-UNFCCC. (2015). *Intended and Nationally Determined Contribution of the Republic of Guatemala*. United Nations Framework Convention on Climate Change. Retrieved from <https://unfccc.int/sites/default/files/NDC/2022-06/Gobierno%20de%20Guatemala%20INDC-UNFCCC%20Sept%202015.pdf>
- Institute of Agriculture, Natural Resources and Environment (IA+RNA). (2023). *Environmental Profile of Guatemala*. Retrieved from http://www.infoiarna.org.gt/wp-content/uploads/2025/07/modulo_agua_2025.pdf. Rafael Landívar University.
- Joint Monitoring Programme (JMP). (2024). *Guatemala WASH Data*. Retrieved from <https://washdata.org/data/household#!/GTM>
- Ministry of Environment and Natural Resources (MARN). (2021). *Nationally Determined Contribution, Guatemala 2021*. Government of Guatemala. Retrieved from <https://ailac.org/wp-content/uploads/2023/09/NDC-Guatemala-actualizada.pdf>
- Nijhawan, A., Flint A., Geremew, A., Ghimire, A., Poudel M., & Howard, G. (2023). *How Tough is WASH Climate Resilience Framework: A field guide to assess climate resilience of water supplies*. Retrieved from <https://bpb-eu-w2.wpmucdn.com/blogs.bristol.ac.uk/dist/1/712/files/2023/06/Field-Guide-for-Resilience-Assessment-Water-ENGLISH.pdf> University of Bristol
- Public Square. (2020). *Research on water and human rights in Guatemala*. Retrieved from https://www.plazapublica.com.gt/sites/default/files/investigacion_aguaddhh_padilla_final.pdf
- Viatori Magazine. (2020). *11 of 25 polluting rivers in Guatemala*. Retrieved from <https://revistaviatori.com/notas/11-de-25-rios-contaminantes-guatemala/>
- Sanitation and Water for All (SWA). (2024). *Definition of climate-resilient water, sanitation and hygiene services*. Retrieved from https://www.sanitationandwaterforall.org/sites/default/files/2024-11/ClimateResilientWASH_DefinitionPaper_final_0.pdf
- Water For People. (2021). *Everyone Forever Model: Executive Summary*. The WASH Room. Retrieved from <https://thewashroom.waterforpeople.org/wp-content/uploads/sites/2/2020/07/Modelo-Cobertura-Total-Para-Siempre-Resumen-julio-2021.pdf>
- Water For People & IRC. (2021). *Climate change, water resources management and water, sanitation and hygiene: Working paper*. Retrieved from <https://thewashroom.waterforpeople.org/resources/climate-change-wrm-and-wash-irc-water-for-people-working-position-paper/>
- World Vision Guatemala. (2024). *Water, climate change and the Dry Corridor*. Retrieved from <https://blog.worldvision.org.gt/historias/agua-cambio-climatico-y-corredor-seco>
- National Institute of Statistics (INE). (2019). *Results of the 2018 National Population and Housing Census*. Retrieved from https://censo2018.ine.gob.gt/archivos/resultados_censo2018.pdf
- Water For People. (2023). *Water system monitoring data in San Bartolomé Jocotenango*. Institutional database (not published).