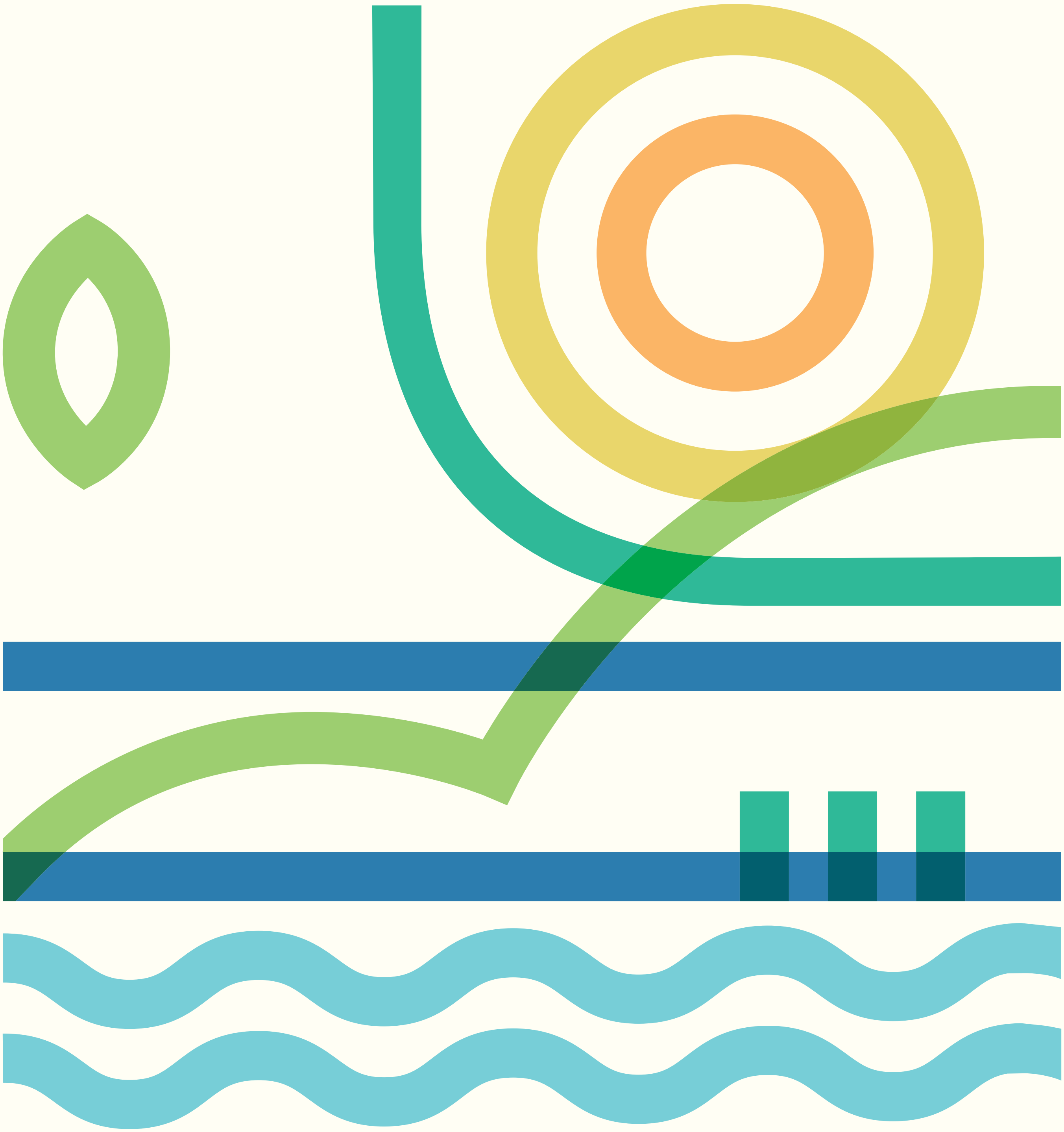

ACCESS TO WATER AND SANITATION SERVICES IN DISPERSED RURAL SETTLEMENTS:

THE PATH TO UNIVERSALIZATION

IDB
Inter-American Development Bank

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

State Secretariat for
Economic Affairs SECO

Swiss Agency for Development
and Cooperation SDC

PEPSICO
FOUNDATION
We Feed Potential

Federal Ministry
Republic of Austria
Finance

Spanish
Cooperation

This report has been prepared by Lourdes Álvarez, consultant to the Water and Sanitation Division at the Inter-American Development Bank, after analyzing the reports and documents issued by the executing agencies responsible for the pilot projects, as well as most recent bibliographical references in the sector.

Washington D.C., June 2019.

With the financing of the multi-donor fund AquaFund:

IDB Inter-American Development Bank

Spanish Cooperation

Federal Ministry Republic of Austria Finance

PEPSICO FOUNDATION We Feed Potential

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

State Secretariat for Economic Affairs SECO

Swiss Agency for Development and Cooperation SDC

And the cooperation of executing agencies responsible for the pilot projects:

GIVE TO COLOMBIA®

water for people

IRC

World Vision

care

This document has been developed with support from AquaFund. The AquaFund is an IDB thematic fund for water and sanitation, being the main financing mechanism to support the Bank's investments in the sector since its creation in 2008. The AquaFund has contributed to the achievement of the Millennium Development Goals in water and sanitation in Latin America and the Caribbean, and will play a crucial role in supporting the governments of the region in achieving the new Sustainable Development Goals. It does so by facilitating investments to increase water supply and sanitation, water resources management, solid waste management and wastewater treatment. It also contributes to the sustainability and accessibility of these services for low income populations. It also supports the Bank's client countries to face the new challenges of climate change, the rapid degradation of freshwater ecosystems, and an increasing water insecurity. The AquaFund is funded with the IDB's own resources and with donor partner resources, being these the Government of Austria, the Spanish Agency for International Development Cooperation AECID, the PepsiCo Foundation and the Swiss Cooperation through its Agency for Development and Cooperation SDC and the State Secretariat for Economic Affairs SECO.

FOREWORD

The world is facing a growing water crisis – one in nine people do not have access to safe and clean water, and it is projected that 25 percent of the global population will suffer recurring water shortages by 2025. In Latin America and the Caribbean, water scarcity affects nearly 230 million people, threatening the health and safety of communities, profoundly impacting hygiene and contributing to waterborne diseases, famine, migration and violence.

This is an urgent global issue that will only be solved with the coordinated action of many. PepsiCo believes that access to safe water is a fundamental human right regardless of where you live or whether you have means. Our aim is to increase water availability and the dignity, health, economic prosperity, and gender equality it provides. It is this aspiration that guided the creation of our partnership with the Inter-American Development Bank (IDB) nine years ago and has since enabled us together to improve access to safe, clean water for 765,000 people in rural and remote communities in Latin America that typically receive less support than more densely populated areas.

We were proud to provide $7 million as the first and only private sector investor in IDB's Aquafund to pilot programs in Colombia, Honduras, Mexico and Peru. With IDB's expertise and a strong partnership, the pilots effectively reached residents with water and helped catalyze $547 million in additional funding for continued support in these communities.

This is the type of public-private partnership PepsiCo will continue to invest in and what is required to address and overcome the shared global challenges summarized in the United Nations' Sustainable Development Goals. The water crisis has never been more urgent and as IDB's work and our partnership demonstrate, public-private partnerships can make measurable, impactful and lasting change.

On behalf of 250,000 PepsiCo team members, I thank IDB for their leadership and the incredible difference they make for families across Latin America, which is described in the following pages of this report.

JON BANNER
Executive Vice President, Global Communications and President, PepsiCo Foundation

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We Feed Potential

ACKNOWLEDGMENTS

This report describes the main achievements and lessons learned from the design and implementation of four pilot projects that provide access to drinking water and sanitation services in dispersed rural settlements in Colombia, Honduras, Mexico and Peru.

Special thanks to the executing agencies of the projects in Colombia (Give to Colombia), Honduras (Water for People and IRC), Mexico (World Vision México) and Peru (Care Perú) for their commitment and leadership throughout the design and execution of such initiatives, while gathering insights and systematizing learned lessons. This document is based on the reports and material prepared by the executing agencies, considering literal data and conclusions drawn on the main findings and results of each program, with the prior authorization of the authors.

The funding for these pilot projects came from AquaFund, a thematic multi-donor fund managed by the Inter-American Development Bank (IDB). Such fund was also financed with IDB's own resources and the following donor partners: the Spanish Agency for International Development Cooperation (AECID), the Government of Switzerland through the Swiss Agency for Development and Cooperation (SDC) and the State Secretariat for Economic Affairs (SECO), the Government of Austria, and the PepsiCo Foundation. Additionally, executing agencies, local governments, as well as other local partners, have provided counterpart financing and support for the successful implementation of the projects.

We are also grateful to all the report reviewers, especially the IDB specialists responsible for overseeing the projects in Colombia, Honduras, Mexico and Peru, as well as other Bank specialists in the rural sector. It is also important to note the contribution of specialists from the executing agencies that reviewed each of the study cases, as well as donor representatives of AquaFund for their suggestions and comments to this report.

SUMMARY

.7

SUMMARY

The universalization of access to drinking water and sanitation services, mentioned in the Human Right to Water (HRW), the Human Right to Sanitation (HRS) and the Sustainable Development Goals (SDG) involves working in dispersed rural communities, far away from the centers of population. Among other features, dispersed rural communities comprise distant nucleated villages with low population density; they are also hard to access, and their population lives on low income and has low educational levels. These communities enjoy great cultural diversity and the presence of public institutions is quite limited; they also have limited access to basic services and credit services.

Although there is no specific data on access to drinking water and sanitation services in dispersed rural settlements, several studies indicate that the levels of coverage and quality of service (availability, accessibility, and quality) are lower than such levels in clustered rural settlements, which -in turn- are much lower than in urban and peri-urban areas throughout Latin America and the Caribbean.

With the goal of developing intervention models to yield further information about the clean water and sanitation sector in dispersed rural settlements, the Inter-American Development Bank (IDB) financed four pilot projects for a total of US$3,825,000. The funding came from the multi-donor fund AquaFund, managed by the IDB and financed with IDB's own resources and donor partners: the Spanish Cooperation Agency (AECID), the Government of Switzerland through the Swiss Agency for Development and Co-

operation (SDC) and the State Secretariat for Economic Affairs (SECO), the Government of Austria, and the PepsiCo Foundation.

Projects developed in Colombia, Honduras, Mexico and Peru benefited 3,342 people with new access to clean water services and 204 people with improved access, while 2,546 people benefited from improved access to sanitation services and 272 people with improved access, with different levels of service, but with at least basic services. Even though lessons learned from the pilot projects cannot be applied likewise to all the dispersed rural settlements in the region due to their heterogeneous nature, all these insights will be used to define different intervention models for each country so that the goals towards universal access for this population segment can be met.

The development of intervention models to serve dispersed rural settlements must go beyond infrastructure and technical aspects. On the one hand, it is vital to integrate social aspects (training, hygiene education, strengthening of supply and demand) and those related to behavior change (payment of fees, hand washing, menstrual hygiene, use of facilities, consumption, protection of the source) so that people embrace their respective projects and results can be sustained over time, with special attention to the role of women and cultural diversity in the areas of intervention. In dispersed rural settlements, cultural aspects cannot be overlooked in the approach to the population, and training local social promoters, preferably from the same community, is a success factor for community development activities.

On the other hand, the definition of a service delivery model, generally carried out by boards, committees or other voluntary community organizations must favor previous organization rules, home location, and cultural characteristics of the inhabitants in such communities, among other aspects. It is important to adapt management models to the reality of dispersed communities while simplifying procedures and defining efficient systems to maintain the systems. Training these organizations at an administrative and technical level is also crucial along with strengthening the municipalities as support institutions for the system operation and maintenance. To develop efficient support models and to create economies of scale with continuous learning systems, this strengthening has to take into account budgetary limitations and available staff, along with high job rotation levels. Some post-construction plans may include shared technical support among several communities, paid for with community fees or with total or partial grants from their municipalities to create economies of scale and reduce costs.

In general terms, intervention costs in dispersed rural settlements are higher than those in clustered settlements in rural or urban areas, especially when dealing with collective solutions. In consequence, it is necessary to consider municipal grants and aids, especially for the most vulnerable families. The cost analysis of the proposed solutions, which largely define whether a certain intervention model is feasible or not, must include construction costs (freight, materials, qualified and unqualified staff, and administrative costs, among others), as well as operation and maintenance costs, including spare parts and expenses related to training and community development.

Also, when defining suitable technologies for dispersed settlements in rural contexts (based on geographical conditions, availability of the source and distance to the community, among others), costs should not be the only variable to assess. Market supply in the areas of intervention i.e. availability of contractors, spare parts, plumbers and other water and sanitation professionals should also be considered, as they have a decisive impact on the construction, operation, maintenance and repair of the installed systems. Due to the heterogeneous nature of dispersed rural settlements, it is possible to find more than one intervention model or system coexisting in one community, involving different technologies, management systems or post-construction support models. Implementing low-complexity systems is vital to simplify their management and ensure sustainability.

The numerous and diverse limitations of working in dispersed rural settlements require the combined work of the health, education, energy or housing sectors, under a comprehensive intervention framework, to create economies of scale that will result in more significant impacts and overall community improvement.

INTRODUCTION

.11

INTRODUCTION

Within the framework of the Human Right to Water (HRW), the Human Right to Sanitation (HRS), and the Sustainable Development Goals (SDGs), the universalization of access to Water Supply and Sanitation (WSS) services seems to be one of the most complex challenges in the Latin America and the Caribbean (LAC).

In 2010, the United Nations General Assembly explicitly recognized **the human right to water supply and sanitation** as an essential right for the full enjoyment of life and all human rights (UN, 2010). In 2015, the United Nations Human Rights Council explicitly acknowledged HRW and HRS as two distinct and interrelated rights (UN, 2015). The Human Right to Water states that everyone is entitled to a sufficient, acceptable, physically

TABLE 1. Service Ladders for Water.

Level of service	Definition
SAFELY MANAGED	Water for consumption from an improved source located at the house or plot of the land, available upon demand and free from fecal contamination or priority chemicals
BASIC	Water for consumption from an improved source, as long as the round trip to collect water is ! 30 minutes
LIMITED	Water for consumption from an improved source, as long as the round trip and wait to collect water is > 30 minutes
UNIMPROVED	Water for consumption from an unprotected drilled well or from an unprotected spring
SURFACE WATER	Water for consumption from rivers, dams, lakes, ponds, streams, channels or irrigation trenches

Improved sources include piped water, bored or tubed wells, protected drilled wells, protected springs, rainwater and bottled or distributed water.

accessible and affordable amount of water for personal and domestic uses, including water needs for sanitation systems. The Human Right to Sanitation states that every person, without any type of discrimination, has the right to physical and affordable access to sanitation services, in all spheres of life. Such services must be safe, hygienic, socially and culturally acceptable, provide privacy and ensure dignity (Mateo et al., 2017).

The Sustainable Development Goals adopted in 2015 by the United Nations General Assembly include the human right to water and the human right to sanitation in the section about goals on universal access to basic services (SDG 1.4), universal access to safely managed WSS services (SDG 6.1 and 6.2), including an end to open defecation (SDG 6.2). The SDGs take a step beyond classifying types of facilities (improved or unimproved) as presented in the Millennium Development Goals (MDGs) and incorporate additional criteria related to the level of service provided (JMP, 2017).

In both contexts, normative criteria beyond coverage are presented to achieve adequate **quality and level of service** and to accomplish positive impacts on health, productivity and school attendance conditions of the population, among others, widely reported by international literature (IDB, 2017; WHO, 2018). Thus, priority is given to ensuring availability criteria (sufficient water for personal and domestic use -including laundry, food preparation, personal and domestic hygiene and sanita-

TABLE 2. Service Ladders for Sanitation.

Level of service	Definition
SAFELY MANAGED	Use of an improved facility that is exclusive for each household and where excreta is safely disposed onsite or transported and treated somewhere else
BASIC	Use of improved facilities that are exclusive for each household
LIMITED	Use of improved facilities shared by two or more households
UNIMPROVED	Use of single pit latrines without slabs or platforms, hanging latrines and bucket latrines
OPEN DEFECATION	Accumulation of human feces in open fields, forests, shrubs, open water bodies, beaches or other open spaces, or next to solid waste

Source: JMP, 2017

Improved facilities include siphon toilets/low-flush siphon toilets connected to sewage networks, septic tanks or pit latrines, improved ventilated latrines, composting latrines or single pit latrines with a slab.

tion- at home and in all those places where the population spends most of their time); accessibility (physical access for everyone); continuity (at all times of need); quality (for human consumption); affordability (taking into account the population's payment capacity, without limiting the payment of other services and basic needs); equality (non-discrimination in access to WSS services); security; acceptability; privacy (non-shared facilities), among others.

To track and monitor the progress of the goals put forward in SDGs, the so-called "service ladders" were defined. These ladders classify the level of service according to several criteria and help define the management system of WSS services in a secure manner to ensure access to improved, available, accessible, affordable and quality facilities (JMP, 2017).

While the WSS **service levels** in Latin America and the Caribbean have improved in recent decades, the gaps between urban and rural areas are still significant. By 2015, 24.1 million people in rural areas in Latin America and the Caribbean did not have access to a basic level of water supply; out of which 7.9 million obtained water from surface water sources. As to sanitation, more than 40.2 million people in rural areas did not have access to a basic level of sanitation services, and more than 14.1 million people practiced open defecation (JMP, 2017).

Providing universal access to WSS services implies much more than investing in clustered settlements in urban, peri-urban and rural areas. It involves entering the **dispersed communities** farthest from the populated centers. Such communities consist of dispersed homes, distant from nucleated populations, where the density of population is low, located in difficult-to-access locations, whose population has low income and low educational levels. They also reveal great ethnic diversity, little presence of public institutions, and limited access to basic health and education services, among other characteristics.

Although there is no specific solid data on access to WSS services in the most dispersed rural settlements (data refers to rural areas, without differentiating type of rural area), several studies indicate that service levels in dispersed communities are lower than those in clustered rural settlements and more expensive (Care, 2015b; Mejía et al., 2016; Smits, 2017; Hernández, 2018). Indeed, the intervention models required to provide access to WSS services in dispersed rural settlements pose specific challenges at an institutional, technical, social and financial level. Defining suitable management mechanisms and post-construction support based on the inherent features of these communities is also essential to ensure sustainable systems. Also, due to the low population density, the technological complexities, among others, traditional solutions involving conventional networks (water, sewerage) and treatment systems (for example, use of activated sludge plants in rural systems) are not efficient or effective.

Except for some specific studies, the systematization of programs and experiences of the WSS sector in dispersed rural settlements is scarce or lost amid general studies of the rural sector. In this context, the Inter-American Development Bank (IDB) financed **four pilot projects to create intervention models in dispersed**

rural settlements. These pilot projects were funded by the **multi-donor fund AquaFund**, managed by the IDB, and financed with IDB's own resources and the following donor partners during the initial stages of the projects: the Spanish Agency for International Development Cooperation (AECID), the Government of Switzerland through the Swiss Agency for Development and Cooperation (SDC) and the State Secretariat for Economic Affairs (SECO), the Government of Austria, and the PepsiCo Foundation.

Projects were developed in Colombia (IDB, 2011), Honduras (IDB, 2015a), Mexico (IDB, 2013) and Peru (IDB, 2015b), and included the review of previous experiences in dispersed rural settlements in such countries, the definition of intervention models and technological alternatives; the implementation of pilot projects in several dispersed rural communities; and, also, the systematization of lessons learned. In some cases, public policy guidelines were proposed for the development of regulations for the WSS sector in dispersed rural settlements.

Altogether, 3,546 people benefited with new or improved access to water supply services and 2,818 people with new or improved access to sanitation services, with different service levels, at least basic.

This report is a learning exercise about the challenges faced when it comes to serving the most dispersed rural communities and providing universal access to WSS services. This report presents the results and findings of the implementation of the four pilot projects in Colombia, Honduras, Mexico and Peru. This does not intend to be a comparison between experiences as each one has a specific context (institutional, social, environmental, economic and cultural), but a presentation of the main results and lessons learned from each of these experiences, some common to all and others specific to each pilot project.

MAIN FEATURES OF DISPERSED RURAL SETTLEMENTS

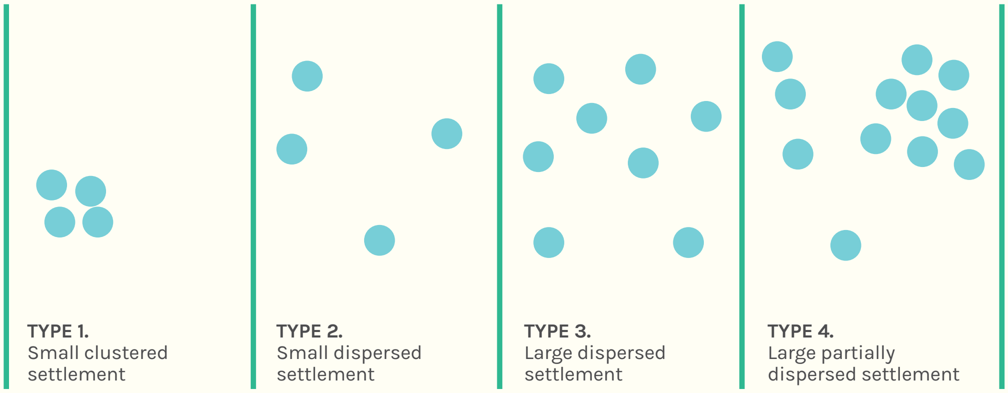
.16

MAIN FEATURES OF DISPERSED RURAL SETTLEMENTS

There is no standardized definition of **dispersed rural population** in the WSS sector. Different approaches coexist and, in some cases, different criteria are used to define them (ECLA, 2011). Thus, for example, in Honduras, the regulatory authority uses size criteria (< 200 inhabitants) to differentiate the dispersed rural population from the clustered one (Smits, 2017). In Mexico, although there is no official definition of dispersed rural population, the National Institute of Statistics (INEGI) uses the size criterion (< 250 families) while including distance between homes (> 150 meters), distance to urban centers (> 10 kilometers) and population density (< 2,500 inhabitants per square kilometer) as criteria, as well as other unquantified criteria (interrelated by kinship, need, historical factors and/or customs) (Hernández et al., 2018).

Martínez et al. (2017) categorize dispersed settlements into four types, discriminating the size of the population and the pattern of concentration (population density), as well as the distance to another population center, without having to meet all the criteria. Thus, for example,

FIGURE 1. Categorization of Dispersed Settlement Types



settlements of > 200 inhabitants with high population density and some homes or groups of remote homes, although they would not be defined as dispersed rural settlements from the demographic point of view, they do have the characteristics of a dispersed settlement in a rural area (distant from the main population center and low density within the group of houses) (type 4 in the following figure). Some isolated homes (type 2 or 3 in the figure) may not be part of any settlement and behave as independent isolated units, although they would formally be part of some type of political-geographical organization (canton, settlement, community, etc.).

Regardless of how populations are characterized, within the framework of the Sustainable Development Goals, the Human Right to Water and the Human Right to Sanitation, and in order to offer safely managed WSS services to the entire population under the universalization and non-discrimination criteria, it is important that regulatory definitions do not leave out any type of settlements, and that there are technological and management alternatives for the entire population.

However, the lack of a standardized definition limits the existence of information at regional domain on differentiated differentiated **access levels** in clustered and dispersed rural settlements. The latest data on access to WSS services in rural Latin American and the Caribbean areas show access levels to at least improved basic WSS services of 85.9% and 68.4%, respectively (JMP, 2017). This data reflects that by 2015 more than 8.1 million people were consuming water from unimproved sources and almost 7.1 million people were drinking surface water. In relation to sanitation, more than 19.6 million people were using unimproved facilities and more than 14.1 million people were practicing open defecation. Some studies indicate that improved sanitation is practically non-existent in rural areas, with geographical and technical limitations, in the case of excreta and greywater treatment (Lampoglia et al., 2008). While it is true that coverage in water supply and sanitation is relatively low in dispersed rural settlements compared to urban or clustered rural settlements, people there have been self-sufficient, even though solutions considered unimproved, since access to water, especially, is essential for life. In this sense, when analyzing access to WSS services, it is important to differentiate between collective/community systems and individual systems; the latter is common in dispersed rural settlements due to the high costs of collective/community systems.

Regarding hygiene, limiting aspects of the achievement of SDGs have been identified. Thus, for example, there is no solid information on the behavior of population regarding hand washing at key moments, the use of sanitary facilities, or adequate habits of menstrual hygiene, among others. The lack of sanitation facilities and access to water supply and soap, low educational levels, lack of rigorous information in families and schools on hygiene and its consequences for health, the distance of homes to healthcare facilities to access information on sanitary aspects and resources, as well as cultural aspects especially decisive in indigenous communities in dispersed rural settlements, among others, are some of the limitations that must be overcome to make progress towards the goals related to hygiene and access to WSS services.

Taking into account that the access levels to WSS services in dispersed rural settlements reported by the few existing studies indicate that the percentages of access in such areas are lower than in clustered rural settlements, the challenge to achieve the universalization of WSS services is colossal.

Access to WSS services in dispersed rural settlements, including aspects related to proper hygiene practices, not only has positive impacts on health, productivity levels and school attendance of people living in these areas (IDB, 2017; WHO, 2018), but comprise aspects related to personal safety, dignity or privacy; not only at home, but also in educational or healthcare facilities.

According to an IDB report on the Human Right to Water and the Human Right to Sanitation, in the dispersed rural settlements of Latin America and the Caribbean, there has been no progress in any of the regulatory criteria related to availability, quality, acceptability, dignity and privacy, physical accessibility and affordability of services. Neither has there been progress in the transversal principles of human rights (non-discrimination and equality, information and transparency, participation, accountability, and sustainability) (Mateo et al., 2017).

Dispersed rural settlements share some **characteristics** with clustered rural settlements, reduced to a small scale. As it has been previously mentioned, dispersed rural populations consist of a few households, in some countries of indigenous majority, and, in many cases, in unfit conditions to be inhabited, that are distributed in the territory with different degrees of dispersion; are distant from populated centers (whether clustered rural settlements or urban areas) and in many cases in difficult-to-access geographical areas (especially during rainy seasons). These populations are often distant from improved water sources, generally live on low-income levels, have no access to electricity services and new technologies and are far away from healthcare and educational centers, in locations where the presence of state institutions is limited or non-existent. The number of products and services' suppliers associated with the WSS sector is limited in these dispersed areas, including people or companies trained for construction and operation, maintenance and repair of the systems or facilities. The points of sale of spare parts for such systems are scarce. Finally, access to financial services to obtain credit support for the improvement of sanitary facilities at the community or individual level is almost non-existent and, when they exist, most families cannot afford them due to their socio-economic conditions (De la Peña et al., 2018).

These differentiating aspects are key in the definition of **intervention** models of WSS programs in dispersed rural settlements, especially when analyzing the feasibility of technological options and post-operation support and management models of the systems. In this sense, the diagnosis of the communities in the early stages of intervention should not only consider the levels of coverage and WSS service in the area, but also socio-economic (willingness and payment capacity), cultural (water value), environmental (accessibility and quality of water sources), organizational (experiences and predisposition for community management), institutional (relationship with public institutions in the area) aspects, among others. Demand and supply mapping are phases of the intervention model that will provide key information for the selection of technology and its implementation (Smits, 2017). For example, on many occasions, the transfer of technologies proposed for clustered rural settlements and even for urban and peri-urban areas to dispersed rural settlements, both for access to water supply (aqueducts) and to sanitation services (sewerage networks), is unsuitable. In most cases, this is due to the high construction and operating costs.

It is worth mentioning that, in some countries of the region, such as Chile, Argentina or Uruguay, dispersed rural settlements also comprise rural settlements in the form of gated communities (second homes), which belong to populations with high economic resources and different characteristics from those indicated in the preceding paragraph. It should be noted that none of the pilot projects were developed in these gated communities as they are not prevalent in the region. However, although they are not the purpose of this technical report, they should be considered due to the potential pressure on existing rural systems as a result of significant reductions in poverty in some countries of the region and the emergence of the middle and upper-middle classes in those countries.

Finally, the supply of WSS services to dispersed rural settlements should be part of more comprehensive intervention strategies, including health, education and housing sectors, among others, to create economies of scale that improve the living conditions of the population in dispersed rural settlements, taking into account their levels of poverty and vulnerability. Even though all the studies reviewed mention this recommendation, the implementation of such services is complex. It is necessary to analyze the roles of the different institutions involved and the specific challenges in each program to successfully achieve the intended goals.

In the section “Lessons Learned” in this report, we will analyze the characteristics of the intervention models, the main findings and the lessons learned at institutional, technological, cost, sustainability, and political incidence levels, among others, derived from the pilot projects to provide WSS services in Colombia, Honduras, Mexico and Peru.

Dispersed Rural Settlements in Colombia
Innovative Sustainability Tools

Players: Give to Colombia and Propal Foundation (execution), Municipality of Guachené, and the Association of Community Action Boards

8,624,000 Dispersed rural population

Open defecation **13.6%**

Intervention Model

Preparation	Pre-implementation	Construction	Post-construction
1. Political support 2. Definition of the Program Committee 3. Diagnosis 4. Identification of standard problems 5. Design of standard solutions **6. Inventory, offer**	7. Intervention conditions **8. Standard solutions building** 9. Social promotion 10. Operational plan	11. Hiring of builders **12. District committees** 13. Intervention agreement with families 14. Construction 15. Improvement of capacities	**16. Families' and government contributions** 17. Post-construction support
List of suppliers to organize, strengthen and regulate local offer Selection of companies for post-construction works Public-private alliances	Definition of **standard solutions** for water and sanitation, including costs and conditions Technology fairs and guided visits Adequacy per family	Municipal, community and family representatives **Decision-making** process, agreements and supervision Organization of help to vulnerable families	**Demand** focused Expression of interest per family, technological solutions and economic contribution Agreement between each family and the municipality

Key innovative sustainability tools

Results

372 people benefited with water access and sanitation services

US$ fee/month /family
3.9 for aqueduct
3.6 for cistern – individual solution
2.4 for cistern – collective solution

+ 50% municipal grant

DISPERSED RURAL SETTLEMENTS IN COLOMBIA INNOVATIVE SUSTAINABILITY TOOLS

.22

DISPERSED RURAL SETTLEMENTS IN COLOMBIA INNOVATIVE SUSTAINABILITY TOOLS

In Colombia, almost a quarter of its population (23.8%) lives in rural areas, with more than 11.2 million people in 2015 (National Economic and Social Council, 2015) inhabiting populated centers, known as nucleated population (clustered in villages or groups of at least 20 houses separated by panels, walls, fences or orchards), and on farms and dispersed houses (dispersed population), among others, separated by cultivated areas, meadows, forests, pastures, roads or paths (National Administrative Department of Statistics, 2015).

Dispersed rural population totals 8,624,000 people and account for 77% of the rural population, (National Economic and Social Council, 2015). This population lives mostly (78%) in category-6 municipalities, with fewer inhabitants and/or lower current income for free destination. By 2010, income per capita in rural areas was about US$53 per month, while the average income per capita in townships was US$157. Regarding living conditions, the probability for a child in a rural area to be extremely poor was four times higher than that of a resident in an urban area and the incidence of extreme child poverty was 37.3% versus 7% in urban areas (United Nations Development Program, 2011).

The official information on the **coverage of WSS services does not refer to** dispersed rural settlements but to the rural area in aggregate form, mainly considering clustered rural settlements. According to the National Economic and Social Council (2014), the percentage of areas supplied with aqueducts in rural areas was 73% (compared to 97% in urban areas). However, this percentage measures coverage levels, not service levels that are generally poor in terms of water quality, availability and accessibility. Regarding sanitation, the percentage of rural sewerage networks was 68%, with a high percentage of dispersed rural population practicing open defecation (National Economic and Social Council, 2015).

According to the *Policy for Water Supply and Basic Sanitation for Rural Areas* (National Economic and Social Council, 2014), the main threats to the sustainability of WSS solutions in dispersed rural communities were associated with the low capacity of the municipalities -responsible for the provision of WSS services–, the limited population information for the management of individual solutions, and the difficulties in structuring, executing and implementing WSS projects in rural areas (high costs, limited population participation, low level of title documents to prove land ownership, inappropriate technologies, etc.).

In 2011, the IDB approved the non-reimbursable technical cooperation **Demonstration Projects for the Sustainability of Supply and Sanitation Systems in Areas of Extreme Poverty in Colombia**, for an amount of US$1,300,000 financed by the multi-donor fund AquaFund, and US$850,000 matching funds by the executor and other institutions involved in the project. This project was executed by the NGO Give to Colombia. During the implementation of the technical cooperation, a new component was included for execution in the municipality of Guachené, district of Cauca and a new pilot model was tested for the provision of WSS services in dispersed rural settlements for US$192,000. This report refers to the results and lessons learned of this specific model for dispersed rural settlements. Give to Colombia, with the support of the Propal Foundation, was responsible for this technical cooperation that executed the pilot project in dispersed rural settlements.

In 2015, Guachené's estimated population was 19,815, the majority (14,748 inhabitants) lived in rural areas and were mostly Afro-descendant (99%). The housing conditions in rural areas (National Administrative Department of Statistics [DANE], 2012) were critical, with more than 46% of the population living in overcrowded conditions, and 29% of the homes were poorly structured. In relation to sanitation, 73% of the households did not have access to a toilet with connection to sewerage networks, and 60% had no garbage collection service.

The **dispersed rural area of Guachené** had a discontinuous water supply service, with poor water quality, and less than half of the population was connected to the regional aqueduct of Northern Cauca, with no micromedition mechanisms. The connection to the aqueduct did not ensure continuous service, neither did it ensure sufficient nor quality water. The charged fee was US$1.8 per month, 50% subsidized by the municipality, and collection levels were quite low. The non-connected population collected water from two public fountains, from their own cisterns (wells) or from neighbors' cisterns filled with groundwater sources, or directly from surface water sources. In none of these cases was potability, continuity, and disposition of the service ensured. In relation to the disposal of excreta, two-thirds of the population practiced open defecation and 8% used latrines. The remaining one third used flush toilets, half of them connected to absorbing wells found too close to cisterns, with potential contamination risk. Education and healthcare facilities in the area did not offer adequate WSS services.

The selection of families that participated in the pilot project in the dispersed rural settlement (WSS infrastructure building, training, and community work) was based on the nature of the community, the poverty level, the presence of women as heads of household, with kids below 5 years of age, senior people, and the general conditions of access to water, sanitation and hygiene services. Also, the presence of the executing agency in the region was crucial to facilitate access to institutions and communities. Ninety-three families were selected from applicants to the program, with four members on average per family. The heads of household averaged 5 years of education and, in nearly two-thirds of the homes, were women.

The **access conditions to WSS services** before the pilot program deployment in Guachiné were inadequate. The aqueducts in the piped service showed uncovered pipes exposed to contamination, lack of maintenance, low water pressure, leak and drainage failures, insufficient amount and poor water quality, and discontinuous service. Reported payments were between US$1.6 and US$1.9 per month, with low collection rates by the supplier (EARPA) due to an almost unexisting payment culture and the poor service offered. Piping to cisterns showed gaps, uncovered areas, lack of maintenance, and cleanliness. Also, quality levels were poor due to contamination from the source and inadequate transportation and storage in buckets and pails.

No management model had been implemented, even though the community informally serviced the community installations and systems. Average water collection took 20-30 minutes a day. There were two public water collection sites in the area that had been built by water suppliers. Both were poorly serviced but offered good quality water (treated groundwater), although transportation and storage contamination issues were identified, in addition to the lack of continuity in one of such sites, far away from most of the inhabitants in this dispersed population. Service was free at these two sites due to an agreement between the municipality and both sponsor companies. Finally, water hauled from open sources (river, irrigation trench or gully) showed contamination in the source and during transportation and storage, with an average distance to the homes of one kilometer, in a journey that lasted 30-60 minutes per day. The chore of hauling water was mainly assigned to women or kids who walked all the way carrying 20-liter uncovered plastic containers. Bicycles, horses or wheelbarrows were also used. Some neighbors charged for the wheelbarrow transportation service (US$4.8 per month) or sold water (US$0.3 per 20 liters). Most families consumed untreated water, including surface water. Ten percent of the families boiled water, and only 3% of them chlorinated it because they disliked the taste and odor of chlorinated water.

Regarding sanitation, almost 50% of the families said they practiced open defecation due to the lack or poor conditions of sanitary facilities. One-third of the families had a toilet with water connected to an absorbing well, and only two families were connected to a septic tank. Some wells were located in plots of land with high phreatic levels and a high potential for groundwater contamination. Most families with water facilities had to resort to open field areas when water source failed, which was frequent in the dry season. Structural issues were observed in outhouses and sanitary facilities, as well as strong odor and presence of insects. In general, families preferred flush toilets, despite they represented a higher investment of time and resources. In most homes, there were no hand washing facilities near the toilets. Lastly, the use of human feces as fertilizer was rejected, unlike urine waste.

Water discontinuity and insufficiency hindered personal hygiene. Additionally, high levels of open defecation and an inadequate operation of excreta management increased the risk of disease transmission via the fecal-oral route. Inappropriate water transportation and storage worsened bad hygiene habits associated with hand washing at critical times, food protection, the presence of animals near food areas, etc., which absolutely required to incorporate hygiene education topics in the intervention model.

The **intervention model** of the pilot project developed by the executing agency comprised four phases: i) Preparation (visibility and problem description); ii) Pre-implementation (supply and demand structuring); iii) Construction (venture infrastructure and consolidation); and iv) Post-construction (system management and sustainability). The table below shows the 17 steps distributed in the model four phases.

Upon consideration of the conditions required for successful results, the implementation of the intervention model was left for the future. If the initiative is assumed by an external agent, either private or public, such agents are expected to act as a facilitator and to create the required conditions for the municipality to lead the process as the ultimate responsible party for the supply of public utilities and to ensure systems will be maintained over time.

The intervention model included four innovative tools for its execution:

- Inventory of local suppliers
- Implementation of “standard solutions”
- Family support application procedure
- Creation of district committees

The municipality was responsible for the inventory of local suppliers so that it could organize, strengthen and regulate the local supply of WSS services while giving visibility and promoting the ventures of local suppliers and workers in the water, sanitation and hygiene sector. Based on this information, a group of ventures was selected. These were invited to participate in the creation of standard solutions, and based on their productivity, in the execution of works in the corresponding homes. This set the basis for the municipality to create a road map to qualify its supply in WSS services; through the National Training Service (SENA), for example, and, with the companies that had their main office within the municipality area, sought public-private alliances to obtain resources for the training programs.

In connection with the definition of standard solutions, technology fairs and visits with host families were organized to introduce the technological alternatives available to access WSS services by the hosting families, and to announce costs and conditions required for their construction and maintenance. The project offered specific designs to improve existing facilities and customized them to each family.The **family support application** helped categorize families by demand, based on the interest expressed to the municipal entity responsible for WSS services, along with needs, preferred options regarding standard solutions and their contribution to the solution implementation. As to agreements between the municipality and the family, other terms regarding contribution to financial sustainability after construction might be included. The application form provided basic information about the families (income, housing conditions, current access to WSS) and the support application for each service (water, sanitation, and hygiene). According to the socio-economic conditions, the municipality defined the family contribution in salaries and wages and/or in cash, based on the costs of the improvements foreseen, as agreed with families.

TABLE 2. Intervention Model. Colombia.

Phase / Expected Deliverables	Steps
Phase 1. Preparation ▪ Description of rural and dispersed rural population ▪ Design of standard solutions to detected problems ▪ Inventory of local builders and suppliers	1. Political endorsement to the process
	2. Definition and preparation of the Program Committee and teamwork
	3. Analysis of WSS and hygiene situation based on the existing information
	4. Identification of WSS and hygiene standard problems
	5. Design of WSS and hygiene standard solutions
	6. Inventory of local builders and suppliers
Phase 2: Pre-implementation ▪ Lessons learned from standard solutions for the rest of the works ▪ Program socialization and family prioritization ▪ Operational plan for works	7. Tuning-up of intervention conditions
	8. Standard solutions building
	9. Program promotion in the community and distribution of family support application forms
	10. Operational plan for the set of works
Phase 3: Construction ▪ Agreed and terms of payment for operation, maintenance and spare parts ▪ Strengthened local players ▪ Works built	11. Hiring builders and suppliers
	12. Organization and training of district committees
	13. Intervention agreement with families
	14. Construction and construction supervision
	15. Strengthening of operational and maintenance capacities, and hygiene habits
Phase 4: Post-construction ▪ Implementation of post-construction support structure	16. Family and government contributions for operation, maintenance and spare parts
	17. Post-construction support

Source: Give to Colombia, 2015.

As regards the municipal organization and the actual community participation, **district committee integration** was established, with formal representatives from the community, program beneficiary families and a delegate from the water and rural sanitation municipal entity. This resulted in a decision-making scenario that integrated various players, consolidated the agreement under technical criteria and improved the management conditions of WSS systems, for the families in greatest need. The main functions of district committees included: i) promotion of the fulfillment of payments with families; ii) reporting of construction issues to the municipality; iii) proposing a list of families whose needs require their neighbors' support; iv) organization of assistance to families that require support; and v) participation in the decision-making process when collective solutions were involved, for groups of more than one household.

Standard solutions were implemented for safe water supply through small-diameter cisterns with manual and electric pumps, supplemented, if necessary, with homemade water treatment by improved traditional practices, such as boiling or chlorinating water, and sanitation through grease traps and absorbing wells.

As part of the project **results**, 93 families benefited with improved water solutions within the framework of current regulations, half of them with new small-diameter cisterns (25 with individual solutions and 17 families that lived in 4 small groups of dwelling facilities, with robust community cisterns) and the rest with improved conditions of existing cisterns or connections. Water availability, quantity, continuity, and quality improved in the homes. By the end of the program, one year after construction on average, there was soap available to wash hands at 86% of the homes along with an infor-

TABLE 3. Technological Alternatives

System	Individual Homes	Groups of Homes
Water	▪ Connection to a regional aqueduct ▪ Construction of a small-diameter cistern ▪ Improvement of a large-diameter cistern ▪ Construction of an elevated tank ▪ Water pumping (electric pump)	▪ Construction of a small-diameter cistern for collective use, but located in one of the homes ▪ Cistern improvement ▪ Construction of an intermediate tank for each home ▪ Manual extraction of water with rope pump and hauling to the storage tank
	▪ Ultrafiltration with UF membrane (three-year useful life) ▪ Ultrafiltration with UF membrane (five-year useful life) ▪ Disinfection	
Sanitation	▪ Grease traps and infiltration trenches for greywater ▪ Toilet with water flushing and absorbing well ▪ Urinal and urine use	

Source: Give to Colombia, 2015.

mation sign reminding key actions for good use and maintenance of facilities and the proper practice of washing hands with water and soap. Also, 93 families benefited from enhanced sanitation solutions (grease traps, absorbing wells, urinals) within the framework of current regulations.

Regarding **costs**, the following table provides a cost breakdown by solution type, considering construction, operation, maintenance, and spare parts. The families connected to the aqueduct, either from urban or rural areas, pay a monthly fee of US$1.7 (Colombian pesos 5,500), per aqueduct and drainage, including the 50% grant, and excluding spare parts.

In this scenario, where families only pay for operation and maintenance and receive the same 50% grant, the highest monthly fee would be US$2.4 (Colombian pesos 7,375) and the lowest monthly fee, US$1.6 (Colombian pesos 5,000), with an average monthly fee of US$2 (Colombian pesos 6,347); i.e., these amounts are not far from those currently paid by them. The cost of spare parts is paid by families, including current grants, costs would rise to US$3.2 per month Colombian pesos 9,862).

Considering the lowest limit of 3% of family income as a reference, the payment capacity of a family in the dispersed rural settlement of Guachené (2015) would be US$4.5 (Colombian pesos 11,365). In consequence, they would be able to afford the cost of operation, maintenance and spare parts of the implemented technology with government grants of 50%.

Regarding operation, maintenance and spare parts, a study was conducted on payment capacity, as part of the pilot project framework in Guachené. The study concluded that the population could pay US$1.5 (Colombian pesos 4,788), minimum, and US$2.1 (Colombian pesos 6,902), maximum, i.e. between 41% to 61% of its payment capacity (values almost reach pretended fees). This confirms that the critical issue for most families is collection effectiveness rather than the cost itself. After the exercise made with the facilitators' focus group, it was concluded that people could afford US$1.3 per month (Colombian pesos 4,000) and US$3.2 per month (Colombian pesos 10,000). The pilot project financed the construction of the systems.

TABLE 4. Costs per Solution Type

Type	Construction (Colombian pesos / US$)	Scenarios (Colombian pesos / US$)					
		Operation and Maintenance (O&M) at families' expense			O&M and spare parts at families' expense		
		Annual O&M	Monthly O&M w/o grant	Monthly O&M w/grant	Annual O&M and replacement w/o grant	Monthly O&M and replacement w/o grant	Monthly O&M and replacement w/grant
Individual enhanced solution							
Connection to aqueduct + elevated tank + outhouse [1] + grease trap + absorbing well	5,575,570 / 1,693.4	242,000 / 73.5	20,167 / 6.1	10,083 / 3.1	291,344 / 88.5	24,279 / 7.4	12,139 / 3.7
Individual small-diameter cistern + electric pump + elevated tank + outhouse + grease trap + absorbing well	7,188,983 / 2,183.4	176,992 / 53.8	14,749 / 4.5	7,375 / 2.2	278,836 / 84.7	23,236 / 7.1	11,618 / 3.5
Small-diameter cistern + individual manual pumping + intermediate tank [2] + outhouse + grease trap + absorbing well	5,973,753 / 1,814.5	160,000 / 48.6	13,333 / 4.1	6,667 / 2.0	252,761 / 76.8	21,063 / 6.4	10,532 / 3.2
Enhanced collective solution (cost per family)							
For everybody: Small-diameter cistern + collective manual pumping /In each house: intermediate tank + outhouse + grease trap + absorbing well	4,731,207 / 1,437.1	120,000 / 36.4	10,000 / 3.0	5,000 / 1.5	178,461 / 54.2	14,872 / 4.5	7,436 / 2.3

[1] Outhouses include a shower, a bathroom sink, a urinal, a toilet, and a basin
[2] Bathroom sink and toilet flushing only
Note. W/grant: With a 50% grant; w/o: without grant
Source: Give to Colombia, 2015

At present, the municipal company is responsible for the management and maintenance of water systems for families connected to the aqueduct. Families pay a fixed monthly fee of US$1.7 (Colombian pesos 5,500) (including the municipality´s grant of 50%). In the case of the families connected to a community aqueduct, the system is managed by a community organization (Community Action Board). Families make a monthly payment agreed on an individual basis. The supply in public fountains is free and managed by entrepreneurs and Community Action Boards. Some people collect water there and sell it door-to-door. When the main source is a cistern, families bear the cost of pumping water. Families bear the maintenance costs of sanitation facilities.

The **lessons learned** from this intervention model initially showed that working exclusively in a dispersed rural settlement was highly restricted as no economies of scales are created.

During the **preparation phase**, the municipality´s commitment and the identification of standard problems were critical to the program success. The activities took longer than expected in the proposal due to the pilot nature of this initiative. In addition, further guidelines for the involvement of the environmental authority and every player of the project were required. Whenever possible, a limited number of field visits and contacts with families could streamline this phase of the project, by simplifying and integrating formats (inventory survey, capacity survey and willingness to pay, and family support application). For socio-economic categorization, the use of target data from the Identification System of Social Program Potential Beneficiaries in Colombia (SISBEN) is suggested, This data ranks population according to their socio-economic situation based on a score. This is supplemented by the social control performed by district committees.

The introduction of standard solutions in the **pre-implementation phase** allowed to develop a successful learning and marketing strategy. The information supplied by families in their requests for support including their needs, commitments and contributions, as well as the creation of district committees were valuable experiences for the project. The executing agency had difficulty in hiring local builders (all male) due to the poor construction capacity available and the legal obstacles to hiring. The creation of an inventory with descriptions and the empowerment of local entrepreneurs in WSS by the municipality contributed to their involvement in the project. Promoting women’s participation and relaxing hiring conditions would help to implement this phase. With regard to district committees, although they contributed to the project’s processes by controlling local players, it is necessary to limit their number of projected tasks and train participants in the use of adequate tools for control and support.

The **construction phase** comprised the development and implementation of adequate instruments for the municipality, the district committees and the executing agency to track work progress, as well as its completion and reception. In order to improve the available offer, the capabilities of local builders and young entrepreneurs were strengthened. The relationship with the municipality was smooth as work regarding task progress and follow-up was shared. It is important to complete the model solutions before starting construction to leverage the opportunity of learning and avoiding mistakes.

On the other hand, although district committees were adequate and helped the program, the members did not visit the sites often. For district committees to be more motivated to participate, it is necessary to raise awareness about their role among the community and the government. Due to the limited construction techniques of small-sized cisterns, some of them were not deep enough to ensure water availability during the summer season. With regard to access to sanitary services, purchasing most of the urinals at the beginning limited the possibility of promoting construction by local manufacturers. Lastly, members of the benefited families participated as unskilled labor and this may have slowed down the progress of the construction. However, considering that they came from very low-income families, the days they spent working on the project may have prevented them from getting paid, so finance compensation should be considered for them.

Establishing a work team with representatives from the municipality helped to manage and monitor the project, and also improved the relationship between the community and the municipality. Although it is necessary to formalize the procedures that were put into practice (model solutions, family requests for support), these helped to organize the demand and guided the decision-making process. It is also important to keep improving the capacities not only of the municipality technicians but also of the community.

It is essential to improve the water quality analysis of some cisterns, as well as their maintenance. A specific project is being developed to excavate a rocky terrain and increase cistern depth so that more water is available during critical summer seasons (increase in availability). In the case of homes connected to the regional aqueduct, a substantial increase in volume, continuity and quality is expected due to the construction in the intervention area. With regard to sanitation infrastructure, systems maintenance levels need to be improved, as well as the community's willingness to pay for them. It is also critical to reinforce hygiene and security aspects of domestic water storage.

Finally, it is important that the family support applications determine their post-construction contributions in relation to systems maintenance and payment during the **post-construction phase**. Facilitators' efforts on the promotion of good use of technology and good practices of healthy habits have been positive. It was also concluded that the technologies introduced in rural areas produce operation, maintenance and spare parts costs similar to those paid by the inhabitants connected to the regional aqueduct.

Some of the main **conclusions** of the project included the need to consolidate interventions in dispersed rural settlements with those in clustered rural settlements, to establish economies of scale and contribute to sustainability —especially in small municipalities that are unable to subsidize system operation or maintenance cost or to offer adequate post-construction support—, and the need to establish links with urban settlements.

With regard to systems **sustainability**, it is essential to get families, representatives from the community and the municipality involved in decision-making processes, and to promote women participation. It is also important that projects integrate water access, sanitation and hygiene aspects and that technologies are chosen based on efficacy (costs, operating times) to address sanitary risks, reduce the potential of environmental impact, and facilitate implementation in the area (simple models with low operation, maintenance and replacement costs; spare parts and workforce can be sourced locally). There are sustainability challenges associated to the municipality's ability to support all phases of the implementation model, and to the possibility of recovering the investment in operation, maintenance and spare parts through fees or grants to implement mechanisms to provide WSS services in dispersed rural settlements, collect fees, and ensure post-construction technical support.

As to **innovation**, small-sized cisterns are preferred over big storage tanks (which cost more, are more difficult to shelter, and usually lack filter tubes). The installation of urinals is recommended because they consume less water, cause less soil and water contamination, and are more productive. Another good solution, especially for low-income families, would be to repair disused or broken manual bombs and use them. In cases when water is hauled, it is important to place intermediate tanks at low altitude so that sanitary equipment with low water consumption can work better. The organization of the offer of local entrepreneurs in the WSS sector faces some challenges, including the lack of knowledge on technological alternatives, the lack of financing to improve business, the lack of associative networks among entrepreneurs, and the lack of conditions that enable and improve business with a social welfare perspective.

There is a high potential to **replicate** this project across families and increase its **scalability** due to the simplicity of the technological options implemented, although the municipality must be able to ensure its own resources and provide for additional ones in order to escalate the intervention model. From the families' perspective, in a context of offer and in a more adequate social and institutional context, they can continue to improve their levels of WSS service with their own resources, since conditions were improved with this project.

PROGRAM DOCUMENTS USED AS REFERENCE
Give to Colombia, 2015. Proyecto piloto de agua, saneamiento e higiene para la zona rural dispersa. Informe final. Modelo propuesto y caso Guachené. Bogotá: Colombia.

Intervention Models in Honduras
Adapted and Effective Solutions

Players: Give to Colombia and Propal Foundation (execution), Municipality of Guachené, and the Association of Community Action Boards

1,270,000 Dispersed rural population

13.3% Open defecation

Intervention Phases

1. Determination of dispersed settlements
2. Supply and demand mapping
3. Classification of previous situation
4. Pre-selection of intervention models
5. Use per intervention model

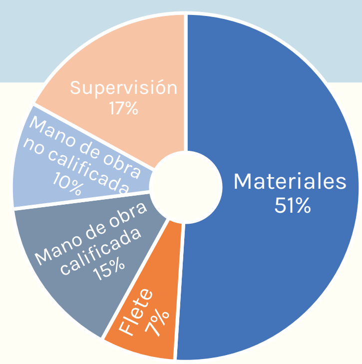
Intervention Models

WATER

Aqueduct densification and expansion	Aqueduct construction	Micro aqueduct construction	Implementation of public stopcocks	Individual and multifamily systems
US$233 per capita	US$166 per capita	US$234 per capita	US$ N/A	US$531 per capita

SANITATION

Promotion of self - sufficiency	Response to the demand	Filters for individual systems
N/A	US$137 per capita	US$14 per capita



Relative weight per item

1,072 people benefited with access to water

680 people benefited with access to sanitation

Sustainability conditions

Community participation
Post-construction support
Training to the municipality
Normative adequacy
Role of the plumber in the management model (Water Supply Community Board, committee or family management)

INTERVENTION MODELS IN HONDURAS ADAPTED AND EFFECTIVE SOLUTIONS

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INTERVENTION MODELS IN HONDURAS ADAPTED AND EFFECTIVE SOLUTIONS

In Honduras, there is no specific demographic definition for **dispersed rural settlements**. The National Institute of Statistics (INE) defines rural areas as places populated by < 2,000 inhabitants, but it does not distinguish between clustered and dispersed rural settlements. In the WSS sector, the most popular definition is the one by the Sanitation and Clean Water Services Regulatory Body (ERSAPS), which draws on criteria such as population size to define dispersed rural population (< 200 inhabitants). This definition does not include two relevant criteria for the WSS sector: population density and distance between dispersed rural settlements and the next settlement.

According to Smits (2017), the population of settlements with < 200 inhabitants represents 15.3% of the total population of Honduras (1.27 million inhabitants) and is distributed in more than 23,500 small villages. The population of settlements between 200 and 2,000 inhabitants represents 34.1% (2.83 million people) of the total population and is distributed in 6,100 small villages. Based on the definition by the Sanitation and Clean Water Services Regulatory Body, dispersed rural settlements would represent 30% of the total rural population. Half of the settlements in dispersed rural settlements have < 30 inhabitants (around 6 homes), and the average is 53 inhabitants per settlement (12 homes).

With regard to **WSS coverage**, 73% of rural homes with access to clean water are connected to a collective system, 4% have an improved individual system, and 13 % have an unimproved individual system. While there are good access levels to aqueducts (within the area, although sometimes a neighbor or a community site act as points of access), issues of continuity and quality are often reported. Aqueduct's connectivity problems are usually associated with socio-economic causes (payment of connectivity fees), technical causes (the system cannot host more users) or perception (fear of running out of water). Superficial sources like streams and creeks are the second source of water supply for the vast majority of Honduran families in rural areas, from which they carry water through a hose (self-sufficiency). This is something intermediate: it has a high level of accessibility, but moderate levels of service quantity, continuity, and quality. Lastly, the third source of water supply comprises open, superficial sources (21% of total), especially in more dispersed settlements. Wells (improved or unimproved) are not very common, and most of them are in poor conditions (issues related to cladding, the bomb's base, and dirtiness, among others). They also present problems of quantity and accessibility (bombing times, even though they are within the area).

With regard to sanitation, 5% of the rural population is connected to a collective system; 65% is connected to an improved individual system (44% has a toilet connected to a septic tank, 11% has a latrine with hydraulic closing, and 10% has a latrine connected to a simple tank); 10% is connected to an unimproved individual system (latrine with simple tank); and 19% does not have access to sanitation and defecates out in the open (National Institute of Statistics, 2013). Information about excreta management, an additional aspect required by the SDGs, is lacking, although it is common practice to excavate a new tank next to the old one once the first is full (alternate tank system).

The National Water and Sanitation Policy highlights the importance of assisting dispersed rural settlements in making services universally available, as well as the need to establish specific intervention models for these areas with lowest levels of coverage. Intervention models aim to support the creation of water boards and improving the municipalities' capacities. Today, however, there is only one national program assisting dispersed rural settlements, with mixed results.

It was in this context that in 2015, the Government of Honduras and the IDB agreed a technical, non-refundable cooperation known as I**ntervention Models in Water and Sanitation for dispersed rural settlements in Honduras**. This initiative was financed by the multi-donor fund AquaFund that donatedUS$525,000, and was executed by the NGO Water for People, with the support of IRC.

The goal of this effort was to establish guidelines for WSS intervention models in dispersed rural settlements (with < 200 inhabitants), based on previous experiences and lessons learned from executing pilot projects of technological alternatives and sustainable approaches. Four components were financed: i) systematization of experiences in Honduras (Martínez et al., 2017); ii) market mapping (Smits et al., 2017); iii) definition of intervention models (Smits, 2017) and execution of pilot projects (Gil et al., 2018); and iv) definition of guidelines (Water for People, 2018).

From the **systematization of experiences** in dispersed rural settlements in Honduras, it is concluded that most programs were applied to clustered and dispersed rural settlements, as well, without differentiation in their intervention model. In addition, water system technology was the differentiating factor of the intervention model between clustered and dispersed rural settlements (wells and filters). In dispersed rural settlements, aqueducts were predominant technology—as in clustered rural areas—on several occasions, technical or financial feasibility have been quite limited. The management of the project cycle between the clustered and the dispersed rural settlements did not have many variations, the differences were observed in certain criteria in terms of feasibility. Thus, it is important to reinforce the pre-feasibility stage in dispersed rural settlements programs. In general, while there is not much information, it is noted that the unit costs of different technologies in dispersed rural settlements were higher, although cost-efficient alternatives existed. Few cases of supported self-sufficiency were reported (where users pay for the total cost of the water or sanitation system). Almost all models followed a co-financing model, although no formal rules were defined on co-financing levels and roles (contribution from communities and municipalities.) However, after more than 30 years of experience in the rural sector, some rules have been consolidated: All programs rely on community contribution (from 10% to 30% of the total cost); communities provide materials, unskilled labor and/or make cash contributions; the Healthy School and Home (ESCASAL) model is implemented as a model of promotion methodology; development of community training activities; among others. Finally, for operation and maintenance, the main model was the water board, with post-construction support. However, this support has evolved in recent decades from Health Technicians, Operation and Maintenance Technicians (TOM) and Water and Sanitation Technicians (TAS) of the State Water and Sewerage Company (SANAA) and today municipalities (municipal promoters), although there are limitations in support due to financial and capacity issues.

Four main intervention models were developed:

- Drinking water, sanitation and hygiene programs in clustered and dispersed rural settlements, differentiated by the selection of technology, based on criteria of financial and technical feasibility. They are the ones with the highest reach.

- Drinking water, sanitation and hygiene programs in clustered rural settlements with non-systematic or explicit actions in the dispersed rural settlements, called models by accident.

- Multisector programs in clustered and dispersed rural settlements, including not only activities in drinking water, sanitation and hygiene, but also housing improvement or links to production aspects of communities.

- Drinking water, sanitation and hygiene programs in dispersed rural settlements with the promotion of certain types of technologies, focused on technical assistance and promotion. These have had little reach.

Intervention processes include several phases: (i) size determination of the dispersed rural settlement; (ii) demand and supply mapping; (iii) classification of the previous situation (context); (iv) pre-selection of intervention models; (v) implementation of the intervention model (including feasibility validation), which includes support interventions at the municipal and national levels.

This systematization and conceptualization phase has been significant in establishing a common definition of the dispersed rural sector. The decision to formally adopt the definition of dispersed rural settlements of the Regulatory Entity for Water and Sanitation Services (ERSAPS) has been remarkable, as it comes from an industry authority. In addition, the inventory of previous programs was a valuable exercise for both local players and international cooperation, with many experiences in the country in clustered and dispersed rural settlements.

The **supply and demand study** presented an analysis of met and unmet demands of the dispersed rural population, and the supply available to meet the demand in 8 municipalities of Honduras. Data on access and unmet needs for both water and sanitation services were complemented by an analysis of the supply, focused on product suppliers (pumps and filters and their spare parts, aqueduct materials, slabs and outhouses). Local suppliers were suitable for obtaining aqueduct materials and products (pipes and fittings), usually for construction companies. Individual clients used suppliers for sanitation products, for example, for the so-called outhouses. In relation to construction services (excavation and drilling of wells, installation of pumps, construction of latrines), the study concluded that there were few local suppliers, and only a few masons or master builders were found as local suppliers of latrine installation services. Financial services (credits for latrines and water systems) were and are almost non-existent in dispersed rural settlements.

For the implementation of pilot projects, five i**ntervention models** were defined for the water sector and two for the sanitation sector, most of which were subsequently piloted in 11 communities in three Honduran municipalities: Chinda, El Negrito and San Antonio de Cortés.

The intervention models in the water sector were selected considering the type of technology developed, and were as follows:

- Densification and expansion of the aqueduct: There was an aqueduct, but families were not connected due to technical, environmental, financial, social or institutional barriers.

- Aqueduct construction: It includes the establishment of a provider; it was also implemented in the communities where aqueduct existed, but such structure required full reconstruction.

- Micro aqueduct construction, mainly to improve unimproved systems (hoses) towards a micro aqueduct; it resembles the construction of the aqueduct (capture, storage tank, distribution boxes), but on a smaller scale, up to 20 homes.

- Implementation of public stopcock: Associated with an aqueduct, but instead of home connections, with public stopcocks for a part or the entire population of the community. This model was not tested as it did not apply to communities with this need.

- Technical assistance and support to improve individual systems (improved or unimproved), in order to achieve more efficiency in service conditions.

In addition, a supplementary action that had been taken in previous intervention models was included. It involved the supply of filters and/or home storage tanks. Filters improve water purification and quality at home. Tanks are relevant in systems with intermittent service to improve continuity. This action was developed in all communities with micro aqueducts and/or individual systems.

In the case of sanitation, technology was not a key factor in the definition of the intervention models, and models were selected according to demand generation and responsiveness. Thus, the two proposed models were:

- Promotion of self-sufficiency: Demand is generated, and supply is facilitated, through the investment in one toilet by the benefited family. This model was not tested due to the inability of families to finance 100% of the facilities.

- Demand response: Sanitation is promoted, and demand is generated through various methods to reach an agreement on the facilities and payment of financial responsibilities (shared financing, including grants).

Insights were gained at each step of the intervention once the implementation of pilot projects had been systematized. Lessons were also learned regarding the differentiating factors of proposed intervention models and the supporting actions required at the municipal level.

While the **situation prior** to intervention in the communities involved in the program showed relatively high levels of coverage in rural areas, such service levels had deficiencies. The levels of coverage in the municipality of Chinda (4,800 inhabitants in the rural area) were 90% and 91% for sanitation. In El Negrito (28,000 inhabitants in rural areas), water and sanitation levels reached 87%; and in the municipality of San Antonio de Cortés (15,000 inhabitants in the rural area), 80% of the inhabitants reported access to both water and sanitation (National Institute of Statistics, 2013). Communities showed mainly unimproved access to water, using mostly water directly from open sources (gathering and hauling) or through hoses. This situation posed contamination risks for the unprotected source (water spring), as well as high operating costs (time) in the case of hoses, which, in many cases, were punctured and leaked, were decoupled and shared between homes. Also, neither the continuity nor availability of the source were ensured. Regarding sanitation, 102 families did not have sanitation facilities, and 170 families had inadequate facilities.

Thanks to the pilot project, 268 families benefited with new or improved access to water services, and 170 families gained new or improved access to sanitation services. The difference between families benefiting from water and sanitation services arises from the fact that several families already had adequate sanitation facilities.

TABLE 5. Beneficiaries by Community

Municipality	Community	Intervention in Families (Number of families)	
		Access to Improved Water	Access to Improved Sanitation
Chinda	El Zapotal	19	14
	Los Arbolitos	8	8
	La Cuchilla	8	5
El Negrito	Guaymón Arriba	16	14
	Rivera de las Minas	31	22
	Sinaí	14	8
	Yuguela	39	21
	Zacate Te	22	14
San Antonio de Cortés	Colonia Jarry	47	23
	Nueva Esperanza	22	19
	Tapiquilares	42	21
Total number of families		268	170
Total number of people		1 072	680

Source: Gil et al., 2018

The main factors that influenced the implementation of the project were associated with the underestimation of individuals per family (the original proposal provided for an average of 6 persons per family, when the final number was 4); the unit cost estimated in the proposal (US$650 per family versus the actual average cost of US$940 per family [US$235 per person] in water and US$548 per family

[US$137 per person] in sanitation) due to increased freight costs, building materials and execution time, mainly; and the remoteness and difficulty access communities (higher costs and the need to spend time in the transport of staff and materials). This is just one example of the difficulties of working in areas with little basic information and in implementing development programs for the population.

The experience of the executing agency in the intervention area, with long-term presence and projects, gave way to a comfortable and rapid approach to the population and the institutions, since trust relations had already been forged. Also, their presence in the area beyond the pilot project meant that they continued to be present during the post-execution phase and assisted the population after works had been completed.

During implementation, the feasibility stage was crucial to ratify whether the preselected models were valid for the communities. In order to have a full diagnosis, checklists of family and community conditions should consider not only economic and social aspects but also cultural, environmental, vulnerability, and legal issues. For the design stage, the costs of the alternatives had already been estimated and were fine-tuned to the needs of each community. Prior to the execution of the work, it was important to develop the preparatory activities related to the commitment of the community and other players in co-financing, the purchase and hauling of materials, the mobilization of skilled and unskilled labor, among otherelements. The executing agency responsible for the pilot project together with municipal technicians and the population were involved in these activities. Due to their dispersion, access to communities was a major challenge, and this fact led to high freight costs, and even to the need to repair roads. Hauling water from collection centers to construction sites was also challenging in some communities because of the remoteness and challenging road conditions (physical and organizational work.) The availability of materials (such as sand, stone and gravel) was not always easy in all communities.

The table below presents the costs of pilot projects (including freight, skilled and unskilled labor and cost of time of technicians who performed community supervision and training). The costs per capita for the construction of new aqueducts

TABLE 6. Costs per Intervention Model

Intervention Model	Costs per Capita (US$)	Fee (family/month) Lempiras / US$
Aqueduct Densification and Expansion	233	30-40 / 1.2-1.6
Aqueduct Construction	166	50-100 / 2.0 - 4.1
Micro Aqueduct Construction	234 (121 – 406)	Annual Fee (not defined)
Individual and Multifamily Systems	531 (279 – 925)	No fee
Filters	14 (57 per unit)	No fee
Average Water	235	
Sanitation	137 (63 – 210)	

Source: Gil et al., 2018

is low as we are dealing with highly populated dispersed rural communities (almost 200 families) and this fact helps to reduce costs. In the case of micro aqueduct construction, the costs per capita were highly variable due to the dissimilar distances between houses and sources. Regarding individual and multifamily systems, variability was also associated with the distance between homes and the source, and accessibility (cost of freight, materials, and transport to housing).

The average rural fee defined by the community was US$1.6 per family per month (40 lempiras), although, for sustainable operation and maintenance, the fee should be close to US$4.1 per family per month (100 lempiras) to ensure the sustainability of the systems.

Regarding the relative weight of the different items and their contribution to the total cost, the materials accounted for more than half of the costs. Freight actually accounted for greater weight, with two of the municipalities of the pilot projects contributing to these costs (they were not included and contributed 0% as relative weight). It is estimated that it could reach 10-12% of the total amount, depending on the dispersion.

Co-financing for construction purposes came from technical cooperation agreements in 64% of the cases, 27% from the municipality, and 8% from the community. It is important to define the financial contribution of each party from the beginning of the project, and how that contribution will be made (economic, unpaid work, etc.)

The selection of technology was largely determined by the settlement pattern, in relation to the location of water sources. Each intervention model yielded its own **lessons**. The construction of a new aqueduct usually occurred with communities formed by < 40 homes and a conveyance line under 10 km. In two communities, such value was lowered to 20 homes due to the type of dispersion experienced (few houses, but close to each other). Good quality levels (safe access) were achieved with the installation of a hypochlorinator for water disinfection in tanks. Service quality improved not only for new aqueduct users but also for those who were already connected.

Dispersed rural settlements are heterogeneous, and situations in the countryside are varied. In consequence,

TABLE 7. Relative Weight Per Item

Item	Materials	Freight	Skilled Labor	Unskilled Labor	Supervision
Relative Weight	51%	7%	15%	10%	17%

Source: Gil et al., 2018

programs should work with certain flexibility with home- and community-level care packages. For example, in the expansion and densification of existing aqueducts, additional works such as storage tanks for some families, network extension and some minor improvements to the existing system were needed. In some occasions, improvements were so significant that it could almost have been considered as a rehabilitation program.

For micro aqueducts (< 20 houses), collection, conveyance lines, tanking, and a small distribution network were built, including home filters to ensure quality. Tank size was determined considering the source and population needs. The system was managed by a committee instead of a Water Supply Community Board. Both bodies are responsible for the operation, minor maintenance and administration, including the collection of fees, but differ in size (Water Supply Community Boards are made up of 7 members and the committee of 2 members) and in legal requirements (Water Supply Community Boards have administrative requirements—legalization, bank account, accounting records, etc.—while the committee does not, as it is not officialized). There is insufficient information to assess the effectiveness of the committees.

For individual systems, the applied technology consisted of protected sources and a conveyance line from sources to homes with a stopcock. This technology was selected in two different situations: Individual families in communities where the core of the community was supplied by an aqueduct or micro aqueducts, but where these families lived so far away that they could not connect; or communities with a very high degree of home dispersion. Although the conceptual model also considers other types of individual systems, such as pump-protected wells (by hand) or rainwater harvesting, they were not considered in these communities because the use of groundwater in this area is not common, nor is the use of rainwater as drinking water. Although some families harvested rainwater, they generally used it only for cleaning and bathing, but not for drinking or cooking.

In relation to filters, they were fully funded by the project. They are replaced every ten years. Filters must be delivered to families together with specific information about replacement (when, how, where to find the filters), as well as the instructions for use. To ensure service quality, filter installation should be an integral part of micro aqueduct models and individual and multifamily systems.

For sanitation, hydraulic-closing latrines with septic tank were installed, as houses were going to have enough water to use them. This provided at least a basic service, versus unimproved service or no service at all prior to the project. In some cases, the outhouse and accessories were built, if they did not exist, were in very bad condition or far from the house, and in others, only the latrine and the hand washing facilities were financed to improve the sanitation model of the houses. It is also important to include alternative programs for excreta treatment in the future.

In general, project implementation could have been improved in several phases. On the one hand, to be more efficient in the diagnosis, it is critical to obtain as much detailed information as possible and to collect all the necessary information (access, socio-economic level, availability and willingness to pay, WSS service needs, alternatives for managing WSS services in the future, among others) right in the first visit to avoid having to return once and again (high transport costs, more project preparation time, etc.) The decision tree for technological solutions in each community should include data on the number of homes, as one of the key factors for the model lesson, as well as simplifying manuals for the population. Depending on the distribution of homes and the distance to the sources, the possibility of having different intervention models in a single community should be cogitated. Other improvements could involve: i) using a checklist for households and the community (economic and social, cultural, environmental, vulnerability, legal aspects) as a tool during the feasibility phase; ii) taking into account efforts on human and financial resources during the intervention process; and iii) including the participation of municipal technicians in the supervision of construction works.

It is important to bear in mind the social complexity of communities, especially when implementing community models (aqueducts) that require action at the community level and the subsequent community management of the system.

Training for operation and maintenance for water boards, committees and individual families, depending on the type of technological solution developed, has to be specific to each player. Coming to an agreement between all parties (community and municipality) on service fees is vital to ensure the operation and maintenance of the systems, although the socio-economic conditions of the communities do not always interfere in the agreement of satisfactory amounts, so institutional support is required to ensure sustainability. Also, health and hygiene considerations are a critical issue that needs to go beyond the project scope. In this regard, it is important to participate and make partnerships with the healthcare and the education sectors. These institutions should be involved in infrastructure initiatives and programs that provide access to WSS services, as well as in community campaigns to support actions that encourage long-term behavioral changes.

Regarding **sustainability,** conditions were analyzed during service provision and post-construction support. In relation to service supply, systems can be managed through three models: Water Supply Community Board, committee and family management, linked to intervention models tailored to each community. In any of the management models, the role of the plumber is key, ideally paid and chosen by the community for aqueducts (and perhaps, for the largest micro aqueducts). It is important to consider additional measures to protect water sources for different water systems. System quality can only be achieved by ensuring overall system protection and proper system management. In dispersed rural contexts, socio-economic conditions and the capacities of the community and institutions are limited, so actions that drive sustainability must be prioritized in the face of the inability to implement all possible actions.

With regard to post-construction support and the functions of the service holder, the mechanisms and capacities initially in place to perform these functions were limited. There were only monitoring mechanisms and some periodic visits, but municipal technicians had no specific training in WSS, and the budget was limited for this item. In general, municipalities do not have strong technical assistance mechanisms and mainly focus on supervision. Building up the quality of technical assistance provided is essential. Also, encouraging improved interaction between technicians and their communities would be advisable. While the institutional capacity has improved, there are still constraints related to high staff rotation levels, low interest, low budget, and logistical difficulties to reach the communities. Programs in dispersed rural settlements should include institutional reinforcement, support during the supervision phase (ensuring the municipality's involvement in the implementation of pilot projects); training (reinforcing the capacity for post-construction support); normative adequacy (include the dispersed rural settlements in its monitoring activities and community visits, plans, roles and activities of the municipality to be able to escalate the intervention model within the municipality) and for the budgetary improvement.

The main **conclusions** after the implementation of the intervention models are presented below:

- Expansion and densification comprise a model with potential effectiveness in: 1) improving coverage within already served communities; 2) improving the service level of both original and new users; and 3) efficiency in the use of existing infrastructure. For this to be achieved, not only the technical conditions for expanding or densifying the aqueduct must be achieved, but also the resolution of social and institutional complexities that may exist in the communities to intervene. The service level achieved with this model is satisfactory and has the potential to emulate the quality level of safely managed water.

- The new aqueduct is a model with potential effectiveness and efficiency in communities with more than about 20 homes, nucleated settlement patterns and relatively short conveyance lines. In terms of sustainability, it offers the same strengths and weaknesses that characterize the application of this model in clustered rural settlements in Honduras.

- The micro aqueduct is a high-relevance model, especially in combination with other models, to serve those groups of families that for some reason cannot be considered for connection to the aqueduct. The main limitation of this model is its identification in pre-feasibility analyses.

- The individual or multifamily system is a relevant model for individual homes typically far from the community and is generally applied in combination with other models within a community. As to micro aqueducts, mere identification is one of many limitations, but the primary and most serious constraint is their unit cost.

- Home filters are not an intervention model per se, but they are applied in combination with micro aqueducts and individual systems. In these cases, they are not an optional complement, but a necessary contributing element to improve water quality.

- In sanitation, it was proven that the demand response model— which is a model applied and validated in clustered rural settlements in Honduras— is also applicable to dispersed rural settlements, with costs and maintenance adapted to the needs of the families, and with high adoption rates.

- The joint work of institutions, communities and the pilot project's executing NGO was key to the program success, as it reinforced system sustainability and program results in the long-term.

- At the political level, the Government of Honduras has acknowledged the recommendations made after the mentioned joint work throughout program execution on how to support even more the improved access to WSS services in dispersed settlements in rural populations, as well as the proposed feasible technical, financial and management solutions.

From the program assessment, it can be concluded that many of the communities have a settlement pattern with a mixture of cluster and dispersion, which requires a combination of models to achieve full coverage. The combination of models is also necessary to serve the population in dispersed rural settlements at unit costs comparable to those found in clustered rural settlements, tailored to the different realities of families.
Finally, the analysis of experiences lived and of the executed projects, and the constant interaction with local and national institutions concluded that the minimum conditions for the replication of the intervention models developed under this program should include: (i) institutions capable of managing the entire project cycle iteratively, with adequate and trained staff; (ii) prioritization of investments in dispersed rural settlements; and (iii) external support available (not only economic, but also technical assistance and post-construction support).

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Participatory Methods in Mexico
Dispersed Rural Settlements and Public Policies

Players: World Vision México, Sarar Transformación, National Water Commission, the Water State Commissions from San Luís Potosí, Veracruz, Michoacán and the state of Mexico, and the municipalities of Xilitla, Mixtla de Altamirano, Zitácuaro and San José del Rincón

24,000,000 Dispersed rural population

Open defecation **5.5%**

Participation diagnosis - CAPITAL INDICATORS

Human capital	Social capital	Natural capital	Physical capital	Financial capital
Skills, healthcare, knowledge and work skills	Networks and connections, participation, trust relations and exchanges	Natural resources, access and quality	Networks, housing, WSS, energy and access to information	Financial resources and main sources, income and payment availability

Technical Solutions

WATER

Spring protection	Rainwater harvesting	Improvement of existing wells
US$115 per capita	US$136 per capita	US$ N/A

1,944 people benefited with access to water

1,608 people benefited with access to sanitation

SANITATION

Composting toilet	Double - vault composting latrine	Urine - diverting dry toilet with fecal collector	Greywater management
US$153 per capita	US$168 per capita	US$145 per capita	US$ N/A

Recommendations for the PROSSAPYS-APARURAL National Program

Reinforcement of the social component and technical options suitable for the dispersed rural settlements

- Eligibility criteria in dispersed rural settlements
- Selection of facilitating agencies to support the social care component
- Participation diagnosis (municipality and facilitating agencies) validated by the community
- Selection of technical options (design criteria and family costs) and development of pilot systems
- Awareness raising in key behavioral changes (hand washing, use of facilities, fees)
- Construction monitored by a supervisory technical group
- Creation and strengthening of committees and associations (Sustainable Water and Sanitation Committee)
- Consolidation in the municipality (strengthening) and in geographical patterns (basins)
- Participatory monitoring (community, municipality and Water State Commission) for decision-making processes

PARTICIPATORY METHODS IN MEXICO DISPERSED RURAL SETTLEMENTS AND PUBLIC POLICIES

.49

PARTICIPATORY METHODS IN MEXICO DISPERSED RURAL SETTLEMENTS AND PUBLIC POLICIES

According to the data of the 2015 Inter-Census Survey, 23% of Mexico's population lives in rural areas (approximately 27.5 million people) in 192,000 settlements with < 2,500 inhabitants, most of them (24 million) in dispersed rural settlements (FAO, N/A). According to the National Commission for the Development of Indigenous Peoples (CDI, 2014), almost 34,000 rural settlements comprise more than 40% of the indigenous population, generally under low socio-economic conditions, extreme poverty, and high marginalization. Also, almost 22,000 of these rural indigenous settlements have < 100 inhabitants. Most of the dispersed rural settlements are concentrated in the states of Veracruz, Chiapas, Oaxaca, Michoacán, Puebla, Yucatán, Guerrero, State of Mexico and Hidalgo.

A **dispersed rural community** is defined as any population that resides in areas where the prevailing geographical pattern is highly dispersed; where the distance between homes is greater than 150 meters; with low population density (<2,500 inhabitants per km^2); interrelated by kinship, necessity, historical factors and/or customs, isolated from urban centers (>10 km from larger centers); with high levels of marginality and vulnerability, and with orographic conditions that pose technical and economic difficulties to traditional forms of supply. Communities are formed by up to 250 families, although most settlements (85%) are concentrated in the range of 1 to 249 people (about 50 families). Only 3% of rural settlements comprise more than 1,000 inhabitants (about 200 families). This fact accentuates the heterogeneity of the settlements according to size (the smaller the size, the more homogeneous).

In 2016, the National Water Commission (CONAGUA) presented the latest **coverage data** for tap water in housing or property, which includes tap water in the house, outside the house, but within the land, obtained by haul, from the public stopcock or another home. Thus, the high coverage rates (94.4% nationally) reflect not only improved water access, as defined by the United Nations, but also some associations with unimproved water access (Joint Monitoring Programme, 2018). With regard to sanitation, national percentages reach 91.4%, but include users connected to septic tanks and even those who discharge to drainage systems, ravine, lake or sea, considered as unimproved services by the Joint Monitoring Programme. At the rural level, there are still important laggards in terms of coverage of WSS services (85% and 74.2%, respectively).

The self-management community model through Sustainable Water and Sanitation Committees is the predominant model in Mexico's dispersed rural communities. In some cases, adequate service management, operation and maintenance exist, but in most cases community organizations do not have sufficient resources for system repair in the face of a major failure, or for expansion of systems that meet the needs of the entire community; or they simply do not have the technical capacity to operate and maintain the built infrastructure properly (De la Peña et al., 2018). In these cases, it is important that local governments and other governmental institutions such as the Water State Commissions provide technical assistance to maintain systems in the medium and long term. On the other hand, it is necessary to have an adequate regulatory framework, so that water committees have a legal entity that enables them to access financing to meet the services' social and financial stability goals.

The possibility of accessing WSS services for dispersed rural settlements is relegated due to various political, economic and social reasons, including high territorial and population dispersion, indigenous presence and related cultural casuistry, a rugged terrain that limits their access, economic levels below the poverty line and an average schooling level of less than 5 years.

In this context, the non-refundable technical cooperation known as **Intervention Model for the Supply of Water and Sanitation Services in Dispersed Rural Settlements** financed by AquaFund and implemented by World Vision Mexico, with the support of Sarar Transformación, was approved in 2013. The main goal of the program was to improve access to safe water and sustainable sanitation services in dispersed rural settlements in Mexico, through the development and validation of an intervention model that would integrate social, institutional, financial and technical elements. The project aimed at contributing to expand the coverage of basic WSS services in eight areas in four municipalities of the country with communities with characteristics typical of a dispersed rural settlement, through the construction of Integrated Water and Sanitation Systems that: (i) had low impact on environmental systems; (ii) were embraced by the community; (iii) empowered community water and sanitation bodies generating participation; and (iv) provided public advocacy.

One of the project's specific goals was to develop recommendations that would enhance the operation of the National Program for the Sustainability of Water and

Sanitation Services in Rural Communities (PROSSAPYS-APARURAL), specifically by reinforcing the social component and generating technical options suitable for the context and culture of dispersed rural settlements.

The program comprised four components: (i) the design and socialization of the intervention model; (ii) the training and adequacy of participatory and informative materials; (iii) the consolidation of the intervention model through the implementation of pilot projects; and iv) the systematization of the experience gained.

The program was implemented in six phases: (i) community selection; (ii) participatory diagnoses; (iii) project identification and design; (iv) implementation; (v) sustainable management of systems; and vi) monitoring and evaluation.

Aspects such as high dispersion, high levels of marginality and poverty, limited access to WSS services and World Vision Mexico's experience with local institutions were prioritized for the **selection of beneficiary communities**. Families with children under 5 years old, with high levels of malnutrition, were also prioritized.

During the diagnosis, identification and design of projects, some families opted out of participating in the program for various social (they were already part of other WSS programs), institutional (political) or financial reasons (without capacity to commit to the contribution defined at the community level or payment for the service). In consequence, other communities were added to the area of intervention to achieve the goals of the program and test intervention models. In this case, the intervention operated on 11 areas.

TABLE 8. Participating Communities

State	Municipality	Community	Beneficiary Families
San Luís Potosí	Xilitla	Arroyo Seco	48
		Cuahuatl	31
		Tecaya	17
		La Tinaja	121
		San Antonio Xalcuayo I	26
		San Antonio Xalcuayo II	89
Veracruz	Mixtla de Altamirano	Tetziquila	36
		Barrio San Antonio	18
Michoacán	Zitácuaro	El Tigrito	40
		Boca de la Cañada	10
State of Mexico	San José del Rincón	Barrio Llano	50
Total number of families			486

Source: Hernández, 2018

Methodologies of **participatory diagnosis** were implemented in the preselected communities to define the intervention models, through tools developed by SARAR-T (transect walks in the target communities and workshops of participatory diagnosis), as well as baseline surveys to obtain information on the level of access of the population to WSS services, socio-economic, cultural and environmental considerations, among others. All of these tools were based on five capital indicators:

- Human capital: Skills, knowledge and work skills, health
- Social capital: Networks and connections, participation in formal groups, adherence to rules, regulations, and sanctions agreed in a neutral manner, trust relations, reciprocity, and exchanges
- Natural capital: Natural resources, access and quality
- Physical capital: Road networks, means of transport, safe housing, buildings, water and energy supply, access to information
- Financial capital: Financial resources and main sources, available deposits, regular income

During this stage, the so-called water and sanitation committees were also formed where this organizational figure had not been developed, and capacities were reinforced in those communities that already had committees. Promoters, community leaders, water committees, project beneficiaries and facilitators on WSS issues were trained. These pieces of training focused on the tools developed by SARAR-T, and require the active participation of the population. The diagnosis and planning stages considered in further detail. The tools used during this process included:

- Sociometry in action, used to integrate participants and obtain general characteristics of their community.
- Unrelated posters to promote the imagination and creativity of the participants by generating stories that reflect their daily life.
- Sanitation ladder to prioritize the technical options based on the sociocultural and topographic context.
- Good, bad and regular: Process used to raise awareness. It puts into perspective the way the community sees environmental issues and then, the same community raises opinions on how to act.
- Flow maps, transect walk, water sources and uses to build a graphical representation of the territory, identify their water sources, their uses and their needs regarding services.
- Pollution routes and barriers, for the community to identify vectors that can contaminate the environment, water, and food. This tool can refer to measures that prevent such contamination and promotes teamwork and community consolidation.

Several algorithms were used to **define intervention models**. They help to determine the appropriate technical option for the development of water, sanitation, and hygiene projects based on the context and characteristics of access to WSS services.

Upon completion of the diagnosis performed in each community, several **technical solutions** were proposed. For the water sector, three possible technical solutions were defined:

- System with spring protection: It consists of a protective box to preserve surface runoff from dust, garbage, contact with animals, etc., and the connection of such box to a storage tank through a hydraulic system.
- Rainwater harvesting system: Rainfall water is collected at the rooftops and drained into a storage tank. The system has a filter of first rains before its storage to prevent the entry of organic matter (leaves and others) that may be found on the collecting surface.
- Improvement of existing supply wells.

In relation to sanitation, the technical options selected included:

- Composting toilet: It is a mobile compost toilet, without water use, that offers comfort, privacy, security, and does not generate odors under adequate maintenance conditions; the resulting fertilizer can be used in tree planting.
- Double-vault composting latrine: Without water use, it allows to recover nutrients contained in urine and feces and use them as soil fertilizer. It comprises an outhouse, two toilet bowls with urine deviation mechanism, a urinal and two closed chambers for direct collection and hygiene of excreta and a section for urine collection.
- Urine-diverting dry toilet with fecal collector: Without water use, it allows to recover the nutrients contained in the urine and feces and use them as soil fertilizer. It comprises an outhouse, a toilet bowl with urine deviation to an area below the toilet for its collection and a closed chamber for the collection of feces with drying mixture, the feces, a sink and an external container with two compartments, the feces collector to empty the feces containers.
- Greywater management: It comprises a washing station with greywater management by infiltration. It consists of a laundry room and gardening biofilter to treat and use greywater. It consists of a trench filled with filtering media such as tezontle, coarse sand or crushed gravel, and plants can be planted around it.

A Guide to the Selection of **Integrated Sustainable Water and Sanitation Systems** was designed. It consists of a package of materials that includes construction manuals (with plans and list of materials), operation as well as use and maintenance instructions for the systems implemented during the intervention. For the definition of the intervention models, several algorithms were developed. These were helpful to determine the appropriate technical option to develop water, sanitation, and hygiene projects based on the context and characteristics of access to WSS services. During the period of implementation of the selected systems, general workshops were held for the construction of the pilot systems, with the guidance of a technical specialist hired by the program. Works were also supervised to ensure the quality of the constructive process. Each home received drawings and construction guides, according to their needs, and manuals for the use, operation and maintenance of the installed home and/or community systems.

Technical alternatives for both water and sanitation must be carefully analyzed and shared with the communities —including costs of construction, operation, and maintenance— so that the population can choose the most appropriate to their needs, habits and customs.

In addition to the home and community-focused intervention approach, the project also included the environmental sanitation approach to consider the quality of the water source, and the watershed conservation approach, with a more comprehensive view of the water resource management. In this sense, several activities were developed to improve, preserve and manage comprehensively water sources and micro basins in the rural settlements. These activities involved community inhabitants, as well as environmental community organizations, and public institutions (local institutions, water state commissions, etc.).

In relation to program **results**, some of the municipalities already had high coverage and the program helped them to reach full coverage. For example, in the areas of San Antonio Xalcuayo I and San Antonio Xalcuayo II, the municipality operated a network for clustered rural settlements. In the community of Barrio Llano, there was a committee, a municipal network, and, in Boca de la Cañada, population installed their own connections to the springs.

Community involvement in each of the phases was paramount. Upon analysis of the results, it is noted that the families that participated from the project inception made further progress regarding hygiene behavior. However, as some beneficiaries were integrated into other advanced phases of the project, it was necessary to increase awareness for the intervention to be comprehensive and to promote a change of habits. During the execution of the works, the inhabitants, by agreed decision, determined that their contribution to the project would be the transfer of materials from the roadside to their homes and work in the construction of the systems. Families who did not have a masonry specialist agreed to receive the necessary support for the construction of the systems (self-construction.)

Construction **costs** (material and labor) as well as the operation and annual maintenance of the technical operations of the systems were defined. The costs associated with community development activities have not been included. The following table presents the overall costs per technical solution.

The cost per capita of each system is also presented, including materials, labor, material transport, and maintenance.

TABLE 9. Program Results and Total Coverage per Area

Municipality, State	Community	Implemented Systems			Beneficiary Families	Coverage (%)	
		New Sanitation	New Water	Improved Water		Project	Total in the
Xilitla, San Luis Potosí	Arroyo Seco	46	46	2	48	80	80
	Cuahuatl	31	26	5	31	97	97
	Tecaya	17	7	10	17	100	100
	La Tinaja	90	112	22	121	100	100
	San Antonio Xalcuayo I	64	70		26	81	100
	San Antonio Xalcuayo II		26		89	33	100
Mixtla de Altamirano, Veracruz	Tetziquila	36	36		10	100	100
	Barrio San Antonio	18	18		50	100	100
Zitácuaro, Michoacán	El Tigrito	40	40		40	83	83
	Boca de la Cañada	10	10		10	9	100
San José del Rincón, México	Barrio Llano	50	50		50	18	79

Source: Hernández, 2018

TABLE 10. Construction and Maintenance Costs per Technical Solution

	Technical Option Material	Construction Costs (US$)			Annual Maintenance Costs (includes labor and material)
		Labor	Total		
WATER	Spring protection system	390	130	520	52
	Rainwater harvesting system	442	182	624	52
	Improvement of supply wells	N/A	N/A	N/A	N/A
SANITATION	Composting toilet	416	52	468	26
	Double-vault composting latrine	650	156	806	31
	Urine-diverting dry toilet with fecal collector	546	156	702	21
	Greywater management	234	26	260	10

*No cost data available
Source: Hernández, 2018

TABLE 11. Cost of Technical Options

Technical Option		Cost per Capita (US$)
Water Systems	Spring protection system	115
	Rainwater harvesting system	136
	Improvement of supply wells	N/A
Sanitation Systems	Composting toilet	153
	Double-vault composting latrine	168
	Urine-diverting dry toilet with fecal collector	145

Source: Hernández, 2018

The consolidation of water committees is vital for the development of the project and its long-term operation, maintenance, and sustainability. In most cases, community meetings were held to agree on a monetary contribution of Mexican pesos 30 to 50 per month (US$1.6 – US$2.6) to be used as a fund for the maintenance of water and sanitation systems. In Barrio el Llano Grande Jaltepec, the community contribution rose to Mexican pesos 150 (US$7.8) to account for the use of the water supply network to which part of the beneficiary population was connected. According to the executing agency's initial analyses, these amounts were sufficient for the operation and maintenance of most systems, although some major repairs or replacements would not be covered.

The **monitoring** processes were led by the community facilitators trained by the program, the water committees and, in some cases, by officials from the health sector of the municipality for the control in hygiene issues, during implementation and further operation and maintenance of the systems. Community facilitators were vital in improving behavioral changes related to the proper use of facilities, responsible water consumption, fee payment, hand washing, among others, not only during the execution of the project but also in the long term, as they were people who lived in the community. Working with the healthcare sector, especially the activities carried out with the staff of the program Prospera and local institutions of the Department of Health, and with the education sector through schools, was also key to transmitting the messages of environmental education and improving hygiene habits, as well as for monitoring and controlling hygiene.

In relation to the **sustainability** of the systems, there are challenges associated with poor operation and maintenance due to the lack of financial resources in some communities, lack of institutional and technical capacities of the entities in charge, or lack of consolidation of the community organization. In this sense, the participation of women has had a high impact on consolidating the sustainability elements of the intervention. Women are the main members of the water committees (approximately 50% of the committees were formed by women) and are responsible for organizing the family economy and commit to paying for the service. In addition, women's leadership in impacted communities has consistently manifested itself in the decision-making process, in the project's tasks under execution and in introducing initiatives to improve water access, to reduce the incidence of acute diarrhoeal diseases and in promoting behavioral changes in personal hygiene habits.

The project's **lessons** indicate the importance of WSS projects in dispersed rural settlements based on the specific characteristics of the context in all its areas (economic, socio-political, cultural and environmental), as well as the type of technological solutions that will be used to provide the services, as this is a key factor that will be involved in the long-term performance and sustainability of the project. Technical alternatives for both water supply and sanitation services must be carefully analyzed and shared with the communities —including costs of construction, operation, and maintenance— so that the population can choose the most appropriate to their needs, habits, and customs. The adoption of new systems by the community greatly depends on the acceptance of the built systems and their engagement throughout the intervention process. It is also important to develop comprehensive programs, including awareness-raising and behavioral change activities (hand washing, fee payments, proper use of facilities, responsible consumption, conservation of sources, etc.) with beneficiary communities.

The economic activities that take place in the community during the implementation of the project have to be considered to avoid any interference with them. For example, in some seasons of the year, the men responsible for the construction of the systems are in charge of harvesting tasks, so they leave aside the implementation of the project, with the consequent delays. There were also delays associated with difficulties in achieving consensus in some respects (especially those related to service rates) or to weather issues (rain).

A formal commitment from the community to make some sort of contribution must be ensured, especially regarding system building, and for the payment of a fee to cover the operation and maintenance costs. The charge for water management in rainwater harvesting systems to contribute to the Sustainable Water and Sanitation Committee (CASS) for maintenance and repair was an issue which required hard work in their communities. Financial education pieces of training were considered for water committees and the community to provide elements of financial sustainability; however, the communities did not understand the purpose of a fixed fee for the service. Despite this, some water and sanitation committees were able to make a significant contribution to the maintenance of systems through extraordinary activities focused on this critical aspect of sustainability.

The work of facilitators in strengthening hygiene capacities was critical; training focused on inhabitants discovering and analyzing the "routes" of transmission of fecal diseases, as well as identifying the physical and behavioral elements that could block the transmission routes of gastrointestinal diseases. It was important to involve the Water State Commission, the operating agencies, as well as the municipal authorities for community training, in order to have their experience and feedback. Also, through these links, all interventions were guaranteed to be aligned with local development plans with the idea of taking care of the most vulnerable population.

In the context of dispersion, it is important to recognize that problems and solutions are multisectoral in nature and, therefore, it is necessary to promote greater exchange, discussion, learning, planning, and collaboration between the various players. The health, education and environment sectors are particularly important when considering aspects of education in hygiene and public community health, as well as resource management in a comprehensive manner. The participation of the community and water committees in the monitoring processes has helped the community identify and quantify the physical changes it has experienced since the project start-up, especially in relation to the WSS infrastructure, and how their hygiene habits have changed.

Promoting the creation of committee partnerships (Association of Sustainable Water and Sanitation Committees) can be a good strategy, as they can serve as support for the functioning of Sustainable Water and Sanitation Committees for an advanced consolidation stage and may even be subjects of higher scale credit and financial support, depending on the legal entity. However, the dispersion scheme of settlements will define the validity and efficiency of such association schemes. Finally, one of the main challenges of the intervention model is to sustain strategic alliances with municipal entities or institutions that have a certain level of interference in the sector and the community. The project comprised several activities with the municipalities to train the technicians and make them partakers of the entire project cycle, together with the community, to encourage them to embrace the project.

The project presented a **proposal for an intervention model** that could serve as a reference to improve the National Water Commission's current Rural Water Program (APARURAL), to integrate aspects specifically associated with the implementation of WSS programs in dispersed rural settlements. Thus, the proposal presents a 4-phase intervention model, covering: (i) the implementation of the model; (ii) sustainable management of WSS systems; (iii) consolidation in the municipality and basin; and (iv) evaluation and monitoring.

Implementation of the model includes:

1) The definition of eligibility criteria for communities and families benefited in dispersed rural settlements. The proposal incorporates actions within the priorities or targets of the subsector, such as the degree of environmental conservation or deterioration, the degree of food insecurity that helps us measure economic vulnerability to access to the necessary amount and quality of food or population density.

2) The selection of facilitating agencies (NGOs, associations, etc.) that support the social care component in dispersed rural settlements, where state and municipal governments are almost absent. These entities must recognize the socio-cultural and environmental dynamics of the region, striv-

ing for an intervention based on the principles of sustainability, in accordance with the WSS needs of dispersed rural communities.

3) Dialogue and pre-diagnosis in the dispersed rural communities were identified, within the framework of the basin or microbasin where they are located. This activity helps to have a broad view of the region (physical and sociocultural context of the community), which will allow identifying communities with the same characteristics and needs in relation to access to WSS within the same microregion or basin.

4) Participatory diagnosis, led by the facilitating agency and the municipality, to obtain data for the proposal and design of technical solutions that respond to the demands of the population.

5) Validation of participatory diagnosis with the community.

PROGRAM DOCUMENTS USED AS REFERENCE
Give to Colombia, 2015. Proyecto piloto de agua, saneamiento e higiene para la zona rural dispersa. Informe final. Modelo propuesto y caso Guachené. Bogotá: Colombia.

Disperse Rainforest, Mountains and Coasts in Peru

Integrality in the Sanitation Sector

3,310,576 Dispersed rural population

Open defecation 20.8%

Players: CARE Perú, Municipality of Catacaos, Regional government of Piura, Municipality of Cátac, Municipality of Iparía, National Program for Rural Sanitation, PepsiCo Foundation

COAST

Nueva Cucungará (Piura)

Pumping
Community service at well

Disinfection at well + house filter

Dry toilet at home

Laundry, kitchen
Multipurpose laundry
Shower
Improved wood-burning stove
Drinking fountains
Eco-filters

Service operator (well)

56 benefited people
2 schools

MOUNTAINS

Romatambo (Huaraz)

Gravity, pumping
Individual house service

Disinfection at home (boiling)

Dry toilet at home

Laundry, kitchen
Multipurpose laundry
Improved wood-burning stove
Water heater
Infiltration trench

Mini Sanitation Services Community Boards and family self-supply

23 benefited people
1 community location

JUNGLE

Atahualpa de Baracoa (Pucallpa)

Pumping, rainwater
Dual house service

Disinfection at home (chlorination) and at well

Dry toilet at home

Laundry, kitchen
Shower
Structure with wooden grates
Rainwater harvesting
Water pumping system

Simplified Sanitation Services Community Board

79 benefited people

Main Project Expenses (US$)	COAST	MOUNTAINS	JUNGLE
Pre-investment and investment studies	20,421.4	22,021.2	19,603.3
Works	185,703.7	174,770,3	222,428,6
Promotion and hygiene education	32,755.0	32,194.8	32,018.7
Monitoring	25,099.1	33,004.2	18,603.2

DISPERSE RAINFOREST, MOUNTAINS AND COASTS IN PERU

.62

DISPERSE RAINFOREST, MOUNTAINS AND COASTS IN PERU

In Peru, there is no single operational definition of the concept **dispersed rural populations** for public policy purposes. For the National Institute of Statistics and Informatics (2007), the rural population center is one that has no more than 100 adjacent homes forming blocks or streets and is not district capital; or that, having more than 100 homes, they are semi-dispersed or completely dispersed. From a healthcare perspective, the Department of Health (MINSA) established technical criteria and standards to prioritize comprehensive healthcare to excluded and dispersed populations, which it defined as those rural populations belonging to geographical territories with access difficulties (mountain range, rainforest), because its terrain is very rugged, which determines that the location of the house is distant and isolated, more than four hours from the populated center and is only accessed by the local means of transport (Department of Health, 2009.) Moreover, the Department of Housing, Construction and Sanitation (MVCS), in the program Nuestras Ciudades (Our Cities), established the definition of dispersed population, which is one with a population range of 1 to 150 inhabitants (Departament of Housing, Construction and Sanitation, 2016). To the number of homes or populations, the Department of Housing, Construction and Sanitation sub-

TABLE 12. Rural Population by Geographic Region and Number of Populated Centers

Rural Population		Number of Populated Centers	Number of People	%[1]	Geographical Region		
					Coast	Mountain	Rainforest
201 - 2,000	Clustered	11,561	4,930,683	18%	19.8%	56.4%	23.8%
< 200	Dispersed	75,470	3,310,576	12%	11.6%	64.2%	24.2%
Total		87,031	8,241,259	30%	16.5%	59.5%	24.0%

[1] In relation to the total population of Peru

Source: CARE. 2016

sequently added additional features to dispersed populations and noted that the vast majority does not have access to basic utilities due to the operational difficulty of providing them (geographical access, lack of communications) and the high costs involved.

The National Program for Rural Sanitation (PNSR) of the Department of Housing, Construction and Sanitation refers to dispersed populated centers as those centers with populations of < 200 inhabitants (National Program for Rural Sanitation, 2013a.) Based on this definition, Peru is home to more than 3.3 million people in dispersed rural settlements, in almost 75,000 populated centers, mainly located in the mountains of the country (Care, 2016.) Reflecting the high dispersion, the Concerted National Health Plan highlights that 26,900 populated centers have a population of < 10 inhabitants (MVCS, 2017.)

In relation to the **coverages in WSS**, the National Plan for Investments in Sanitation 2017-2021 quantified the coverage gap and the resources required to achieve the universalization of WSS services in Peru by 2021. In rural areas, water coverage in 2013 was 63.2%, while sanitation coverage was 18.9% for the same year. With regard to the quality of services, the Group for the Analysis of Development (GRADE) showed that chlorination in rural areas is almost non-existent; continuity of water supply nationwide is 18.5 hours a day and 6.5 days a week, on average; and that, despite these conditions, user satisfaction levels are high (GRADE, 2015).

In rural areas, 11.5% of children under the age of 5 suffer from acute diarrhoeal diseases and 32.3% of the children suffer from chronic malnutrition, 20 percentage points more than in urban areas. Limited coverage of WSS services is one of the main factors that trigger this situation, mainly by: (i) limited WSS service levels, with insufficient availability, accessibility, quality, and performance; (ii) inadequate health practices—90% of the rural population does not wash its hands at critical times (National Institute of Statistics and Informatics, 2012), 98% of the rural population handles water inappropriately; and 54% of the rural population keeps its homes and latrines dirty (National Program for Rural Sanitation, 2013b)—; (iii) low levels of family fee payments (almost half of families make no annual payments); (iv) inadequacy of technological solutions; (v) lack of planning and underinvestment; and (vi) poor state presence, among others.

The supply of WSS services in rural areas corresponds to district municipalities through the Municipal Technical Area (ATM). Services, in turn, are provided by community organizations called Sanitation Services Community Boards. Communities spontaneously chose their community boards to manage, operate and maintain drinking water and sanitation services in one or more populated areas. In dispersed rural areas, access to water supply and sanitation services (WSS) is generally based on self-supply and individual management. In areas with community services, such services are managed informally, and sustainable operation and maintenance cannot be guaranteed.

In this context, the non-reimbursable technical cooperation, **WSS Pilot Project for dispersed rural settlements**, was approved in 2015, carried out by Care Perú and financed by AquaFund, a multi-donor fund. The purpose of this project was to design and implement different models for the provision of individual WSS solutions in dispersed rural settlements or smaller rural communities (< 2,000 inhabitants), including the use of various technological alternatives. Finally, the work was conducted in dispersed rural settlements with < 200 inhabitants to optimize learnings gathered.

The project financed i) a study of national and international experiences with comprehensive and innovative models of alternative technologies for the provision of WSS services in dispersed rural settlements; ii) a systemic survey on management models for dispersed communities with < 200 inhabitants; and iii) the design, execution and later systematization of pilot projects in dispersed rural settlements with < 200 inhabitants on the Peruvian coasts, mountains and rainforest.

The **beneficiary communities** were Nueva Cucungará (district of Catacaos, province of Piura, department of Piura in the coastal region), Romatambo (district of Cátac, province of Recuay, department of Ancash in the mountains), and Atahualpa de Tabacoa (district of Iparía, province of Coronel Portillo, department of Ucayali in the rainforest). Communities were chosen according to the following selection criteria: i) population (< 200 families); ii) district poverty (quintile 1 and high percentages of acute diarrhoeal diseases); iii) population without access to WSS services; iv) innovation in the management model (belonging to indigenous populations, especially in the rainforest; avoidance of competition with other current projects within the region; level of local organization); and v) synergy elements for project replication (interests, local support, and impact on the population).

TABLE 13. Poverty, Basic Services and Chronic Undernutrition Indicators, 2013

	Rural Population %	Poverty %	Shortage (quintile)	Basic Utilities		Chronic undernutrition, children < 5 years, %
				Water %	Drainage %	
Peru	24.4	23.9		23.0	22.1	17.2
District of Catacaos (province of Piura, Piura)	3.1	47.2	2	15.4	25.4	45.7
District of Cátac (province of Recuay, Ancash)	40.4	34.5	2	21.8	24.7	31.3
District of Iparia (province of Coronel Portillo, Ucayali)	96.4	36.6	1	73.6	49.4	58.5

Source: CARE. 2019

In general, families live on wide plains, steep hillsides or by the riverside, creating a dispersed pattern of, at least, two different kinds: i) houses separated one from the other, for example, in Nueva Cucungará and Romatambo; and ii) houses close one to the other and distant from the populated areas of the capital city of the district, for example, in Atahualpa de Tabacoa.

The **pre-intervention status** showed limited access to WSS services in the three beneficiary communities. Nueva Cucungará (in the coastal region) features a dry forest with a mean annual temperature of 30 ºC and only 300 mm annual rainfall. Seventeen families (about 70 people) whose main activity was cattle raising lived in this area. Homes were made of canes and sticks, covered with mud and typically divided into 3 or 4 small rooms (a kitchen, a living room, and one or two bedrooms). The families in Nueva Cucungará collected water mainly from El Morante well (about 1.5 kilometer away -on average- from the populated area) for people and cattle use. Families hauled four cylinders of 220 liters each on average per day. Cylinders were transported on carts pulled by one or two donkeys. Depending on how far families lived, each round trip took about 4 to 7 hours to be completed. Water was hauled 3 to 4 times a week (i.e. each other day). The cost of each cylinder (220 liters) was US$0.4 (Peruvian Soles 1.5). At home, families stored water in different sized containers with top lids, both for family and cattle use, without any kind of treatment. Regarding sanitation facilities, 50% of the families relied on poorly maintained latrines located 50 m away from the house. The other 50% of the families simply used the open field to defecate and urinate. There were two educational institutions in Nueva Cucungará: a kindergarten and an elementary school *with only one teacher for all grades,* both located very close to the water well (80 meters). Thirty-five students attended classes in both schools that lacked access to water supply and had only two hydraulic drag latrines in poor maintenance conditions, which had been built by students' parents.

Romatambo, located on the sides of the snowed Queullaraja (White Mountain Range) is 4,000 meters above sea level, features an area of wide cushion bogs. Temperature ranges from 6 to 20 ºC with 1,700 mm average annual rainfall. It is a dispersed rural area where homes are scattered and separated about 800 meters from each other. At the beginning of the project, a total number of 21 houses was registered, but only 15 were inhabited. These families, all together, totaled 55 people. Most of them were senior people (the head of the household was 56 years old on average). Families used surface water running down from thawing snow on the nearby mountains. This surface water traveled through a network of many small natural channels or emerged from below the surface (springs) on the grasslands. Families used the water from these channels for their own consumption; they boiled it before drinking or cooking. Romatambo lacks electricity and excreta disposal services. Families had latrines, but they were away from their house (about 80 meters) and most of them were out of service during the research for this project.

Finally, Atahualpa de Tabacoa is located in the center of the Western region, deep down in the Peruvian Amazonia. It is a rainy area with 2,350 mm annual rainfall and temperatures ranging from 26 to 36 ºC. The community of Atahualpa de Tabacoa belongs to the Shipibo-Conibo people; access to the community is through the Iparía district through the river (45 minutes) or on foot (1 hour) following narrow and dangerous paths. Houses are aligned in 50-m areas; they lack power supply but have street lighting thanks to a power generator. Operation costs are borne by users withthe eventual support from the local government. This community comprised 140 inhabitants (29 families) whose main activities were fishing, hunting, farm management, wood extraction, and craftwork. In Atahualpa de Tabacoa, people collected water from the gullies near their houses (600 to 1,200 meters). They also manually harvested rainwater on their house rooftops, using pieces of calamine or plastic, and then stored it in containers of different sizes. This untreated rainwater was for family use. Open defecation was a usual practice among these families. Also, they used precarious wooden buildings mounted on an uneven piece of land as sanitary facilities.

The **intervention model** of the pilot program was divided into four stages:

1) Technical design and studies, including the diagnosis of beneficiary populations

2) Execution of technological options, together with the preparation of a technical dossier and hiring of the executing agency (before), the development of the technological options (during) and the organization, operation and maintenance (after)

3) Training of social promoters and development of capacities within the families and the community

4) Reinforcement of community relations with local entities

During the first stage, two key studies were conducted for the development of the program. On the one hand, a study was conducted to identify the best technological alternatives of the WSS systems for dispersed rural populations. The study reviewed and analyzed comprehensive and innovative intervention models and experiences in the WSS sector in Peru, as well as in other countries in the region, to determine the most relevant models and experiences for the selected pilot cases.

Also, another study was developed to analyze different management models for the provision of WSS services in dispersed rural settlements. This study aimed at receiving proposals for the provision of WSS services for each of the selected communities based on the identified technological options, the organizational characteristics of the communities, the legal feasibility of the model for service provision, as well as the operation and maintenance required to ensure project sustainability. Another important aspect in this study was how technical, socio-economical, financial and institutional information was handled.

These studies served as the basis for the development of specific technological options for each community, considering the requirements of their population and the social and cultural contexts. The request for proposals for the preparation of the technical documentation was a critical factor of project management; it took twice the scheduled time due to the lack of interested parties or the high prices of the proposals submitted.

Works were executed following two methodologies: i) service agreements both in Nuevo Cucungará and Romatambo where contractors assumed work costs, and ii) direct administration in Atahualpa de Tabacoa where CARE used project resources to execute the works (equipment, personnel, and infrastructure).

The development of the technological options was defined according to three main criteria: i) modular design, adapted to the environment and suitable to optimize construction times; ii) sanitation approach based on the household, where the service user has the capacity to make decisions regarding the design and environmental sanitation problems must be resolved as close to the source as possible; and iii) the resource management system, focusing on resource protection, recycling, and reuse.

On the other hand, the social strategy of the project was a relevant aspect for the development of all the intervention cycle, from design to post-execution follow-up. In general, the strategy based itself on three pillars: i) training of community promoters; ii) development of healthy practices for the families to implement (use of safe water and dry toilets, hand washing and personal hygiene, house cleaning, and food safety), as well as a healthy household (improved wood-burning stoves, dry toilets, a place for personal hygiene, laundries and other improvements such as organic vegetable gardens, pens for smaller animals, etc.); and iii) advice on service management: community agents and leaders, and officials of local and regional governments. Training promoters was crucial in Atahualpa de Tabacoa, where most of the people do not speak Spanish; the presence of *shipibo*-speaking persons with a good understanding of the culture was essential to transmit key messages.

Finally, local and community institutions were supported through two different efforts: by strengthening internal community relations and the inter-institutional

TABLE 14. Program Beneficiaries

Population	Nueva Cucungará (coast)	Romatambo (mountain)	Atahualpa de Tabacoa (rainforest)	Total
Beneficiary Families	13	14	24	51
Women > 18 years	16	12	17	45
Women < 18 years	16	0	18	34
Men > 18 years	12	10	19	41
Men < 12 years	12	1	25	38
Total number of people	56	23	79	158
Beneficiary Institutions	2 schools	1 local community	1 school	4

Source: CARE. 2019

coordination locally with the public agencies in charge of providing the WSS and technical support services.

Program conclusions included several technological solutions and management models, suitable for each geographical area of intervention. The technological options implemented benefited 158 people from 51 families, as well as three educational institutions and a community center.

A technological solution or different technological solutions were implemented in each community based on its geographical, dispersion, cultural characteristics, or others. Improving housing conditions (kitchen, laundry) was one of the solutions deployed in this program. These home improvements aimed at providing the program beneficiaries on the coast and mountain regions with a better quality of life.

In **Nueva Cucungará**, water solutions were based on the excavation of a well as the recovery of an existing blocked well would be almost impossible. Together with the support of the regional government of Piura and the additional financing of the PepsiCo Foundation program, a new well was drilled in the area of intervention and a submersible pump was installed to pump water to the storage tank. A pumping station and a discharge pipeline were constructed in the perforation area. As it was impossible to make water conveyance lines, a water distribution station was erected so that families could haul water. In this manner, the service is provided at lower costs. As for sanitation services, basic dry toilet units were built, including a urine-diverting dry toilet (UDDT) and a shower. These systems also comprised the installation of grease traps for greywater and biofilters. To improve local houses, a kitchen sink for food preparation and washing kitchen utensils was installed along with a multi-purpose laundry outdoors for personal hygiene and water disinfection. Water disinfection kits were also distributed (clear plastic buckets with lid and sodium hypochlorite). Finally, wood-burning stoves were improved in most of the houses to reduce smoke pollution that caused breathing problems.

In **Romatambo**, due to its land characteristics, water supply and family location, the technical proposal included a combination of alternatives: (a) gravity-fed surface water and springs; (b) water pumping with a hydraulic ram; and (c) micro water distribution networks for individual or joint families. The distribution scheme comprised eleven families with individual installations and three joint families (including the community school). Double-vault composting latrines including a urine-diverting dry toilet and a shower were built for sanitation purposes. A water heater connected to the wood-burning stove was installed for heat transfer. Improving housing conditions consisted of the installation of a kitchen sink for food cooking and washing kitchen utensils, and a multi-purpose laundry outside the sanitary unit. An enhanced wood-burning stove was installed in each house to improve food cooking and reduce smoke pollution.

Ultimately, a combined system of water supply was implemented in **Atahualpa de Tabacoa**. This combined solution consisted in the improvement of rainwater collection systems and the creation of a system including a deep water well (50 m), a submersible pump and a distribution network to each household, plus combined power generation (solar energy / generator). Enhancements included the construction of wooden sanitation units and the installation of a storage tank. The stank was filled either by the rainwater harvesting system on the unit rooftop or the water pumped from the well, which traveled along the distribution network to each house stopcock. Double-vault composting latrines, a urinal and a shower were installed, these last two were connected to the drainage network, and green sloped roofs. A common area for personal hygiene, kitchen, laundry, etc. was built with wooden grates. Also, a filter for the greywater coming from the toilet, the common area and the cleaning of the storage tank was executed so that water could be reused for irrigation.

The foreseen **management models** in each community depended on the implemented technological solution.

TABLE 15. Implemented solutions per pilot project

Pilot project	Water			Sanitation
	Water Collection	Distribution	Home System	
Nueva Cucungará (coast)	Groundwater Deep well (230 m), submersible pump (10 hp) with 2 l/sec capacity Pumping station and storage tank (25 m³) with a power generator (20 kW) Station (2 m²) with 2 faucets and drinking fountains	Delivery of water through foot valve at the pumping station Water hauled by families to their homes (carts and containers)	Family storage (containers) connected to the kitchen and multi-purpose sinks Water disinfection kit for household use (bleach)	Double-vault composting latrine Shower
Romatambo (mountain)	Surface water Individual Systems Gravity fed water: surface water and springs Pumped water (hydraulic ram)	Distribution network to each family connection system	Storage tank (500 liters) kept by families Connection to the kitchen and multi-purpose sinks Boiling	Double-vault composting latrine Hot water shower (connected to the wood-burning stove)
Atahualpa de Tabacoa (rainforest)	Groundwater and rainwater Well (80 m) and pumping with an electric pump Rainwater harvesting system on sanitation unit rooftops	Conveyance line to each house	Direct connection to the well Rainwater storage tank (500 liters) Manual water chlorination in the storage tank In-house disinfection (bleach)	Double-vault composting latrine Shower

Source: CARE. 2019

Therefore, a water service provider model was implemented in Nueva Cucungará, and water was pumped from the well as the primary source of supply. The (private) operator of the pumping station ensured the operation and maintenance of the system, as well as the operation and supply of the pumping station. Both the municipality and the community supervised the activities of the service provider. The families transported and stored water on their own and were responsible for the operation and maintenance of the dry toilet in their homes. A combined model was proposed for Romatambo: family self-supply and mini Sanitation Services Community Boards. Families were responsible for the operation and maintenance of the water supply system (hydraulic ram, conveyance ram), laundries, and dry toilets. Due to the combined nature of the supply system, instead of a "system operator", a community promoter was proposed to supervise the infrastructure, the maintenance, and repairs of the system. Such operator would work together with the Municipal Technical Area of the municipality of Cátac. A simplified Sanitation Services Community Board was proposed for Atahualpa de Tabacoa. Even though a dual technological solution that combined water supply from a tubular well (dry season) and rainwater harvesting (rainy season) implemented, it was advisable to create a Sanitation Services Community Board for the administration, operation and maintenance of the water supplied from the well and the engagement of families in rainwater harvesting and dry toilet maintenance practices. The simplified Sanitation Services Community Board took into account most of the roles and tasks under the responsibility of a traditional Sanitation Services Community Board and adapted them to the inherent conditions of the technological solution. It was recommended to reduce the number of management documents and focus on the records of a meeting in rural areas.

Throughout the intervention, supervision and **monitoring mechanisms** were developed for the different stages of the project. These mechanisms focused on: i) the efficiency of the WSS services (technological proposal): scope, frequency, demand, costs, operation, water quality; ii) changes to family practices: healthy practices (use of safe water and dry toilet, hand washing and personal hygiene, house cleaning, food safety) and community engagement; iii) local institutions: organization and community engagement; and v) household conditions: improvement of housing conditions. During program execution, processes were mainly monitored by promoters in each community. They recorded these processes on a weekly and monthly basis as part of the monitoring system of the project. After construction, this follow-up should be under the responsibility of the municipality and should be within the scope of the service management institutions (Both Sanitation Services Community Boards and simplified Sanitation Services Community Boards). However, there was not such a shift of responsibility during the monitoring stage.

Program costs exceeded initial forecasts, mainly due to the high logistic costs arising from the purchase and transportation of materials to the community of Atahualpa de Tabacoa. This was also the case in other intervention communities. The project cost analysis showed the unit prices of the infrastructure constructed and installed in each pilot community to satisfy the following basic needs: water supply, dry toilet, kitchen, and laundry, as described in the table below:

TABLE 16. Total Cost and Features of Works (Peruvian Soles / U. S. Dollars)

	Coast	Mountain	Rainforest
Access to Water			
Types of Installed Systems	Tubular well, pumping station, discharge pipeline, and elevated tank 13 households and 2 stores	Individual water supply systems: collection, desander, sand trap, collection chamber, hydraulic ram, PVC tank (600 liters) and pumping conveyance line (5 households) Gravity fed (9 households and 1 community location)	Tubular well, wooden pumping station, discharge line, distribution network and 2 PVC tanks (5,000 liters) Pumping and rainwater (24 households)
Total Cost of Project Works	PEN$201,325.21 US$60,685.5	PEN$ 235,568.31 US$71,007.4	PEN$ 320,810.97 US$96,710.7
Unit Cost (home)	US$4,045.7	US$7,100.7	US$4,029.6
Disposal of Human Excreta			
Types of Installed Systems	Dry toilets (15)	Dry toilets (15)	Dry toilets (24)
Area (m^2)	6.75	11.70	6.99
Total Cost of Project Works	PEN$ 355,257.65 US$107,104.8	PEN$ 297,205.08 US$89,602.8	PEN$ 312,593.06 US$94,228.1
Unit Cost (household)	US$7,140.3	US$5,973.5	US$6,281.9
Enhanced Kitchen and Laundry			
Types of Installed Systems	Enhanced kitchen (wood-burning stove) and new laundry (15)	Enhanced kitchen (wood-burning stove) and new laundry (15)	Without kitchen/laundry
Total Cost of Project Works	PEN$ 24,908.96 US$7,507.6	PEN$ 24,535.44 US$7,395.1	0
Unit Cost (household) US$	US$500.5	US$493.0	0

US$1 = S3.3

Source: CARE. 2019

The project considered other costs associated to the implementation of the works (technical assistance, workshops and working meetings, visits to potential communities, and support to institutions), as well as promotion (social work, hygiene education, dissemination). Besides, costs for the implementation of the works in the three areas amounted to Peruvian Soles 108,557.8 (US$54,424.5), while costs in the rainforest were a bit higher than those on the coast or the mountains due to the difficult-access conditions. Promotion costs reached Peruvian Soles 346,960.4 (US$104,582.4) for the whole program, with similar expenses in the three pilot areas.

During the design and implementation of the program in the three communities (rainforest, mountain and coastal regions), immense **lessons** were learned, and technical, institutional, social, financial and project management insights were obtained.

The conclusions reached after the implementation of the projects highlight that service sustainability depends on many variables, which are not static but based on the socio-cultural context of the intervention communities, among other aspects. Therefore, social promotion sustainability in multicultural populations requires an intercultural perspective (language, customs) for its sustainment. In this sense, the role of the local promoter was essential for the transmission of key messages in the language spoken in the community (*shipibo*). Social matters are also a critical factor in the design of the management model. In self-managed family models, the role of the involved institutions regarding sanitation has not been defined. In general, the models implemented in relation to this project do not guarantee sustainability. The role the municipalities play in dispersed rural settlements should be redefined as a role that facilities a families' self-managed service. Municipalities' roles were minimal during pilot projects, especially in the rainforest and the mountains due to the distance from the closest local institutions. Additionally, the functions and roles of the Sanitation Services Community Boards must be revised according to the different settings and needs. The social intervention model must mainly appraise the services as the starting point for a sustainable behavior in the economic, environmental, management and sanitation spheres. Finally, the monitoring of the service management by the community is a task that must be revised considering the dispersed populations, service suitability, and implantation ease.

Comparing the experiences derived from the work done in dispersed rural settlements in this project is a limited task due to different and heterogeneous conditions of the communities, not only in relation to their people's characteristics but also in their dispersion schemes, availability of water sources and other factors. However, some common elements have been identified to boost system sustainability under similar conditions: i) on the coast, the demand for water is higher than the offer and users are willing to pay even for a service delivered right at the well; ii) on the mountains, with plenty of water sources, the water supply service was valued for its proximity, even inside the kitchen; and iii) in the rainforest, the offer of water is higher than the demand, and users value proximity during low-water flows and/or low rainfall, when they are willing to pay for the service.

Regarding the implementation of the social strategy, promoters on the coast and in the rainforest adopted the best methodology and operation of the tools as these are areas with a stronger sense of community. The relevance of cultural aspects was highlighted in the implementation of programs in rural and dispersed rural settlements. The creation of a group of community promoters is a value that the project added to the human capital in those communities.

Regarding the training on sanitation practices, most of the families incorporated water chlorination. However, families in Romatambo prefer boiling water for disinfection due to the extreme cold weather in the community. The information and understanding families gained in healthcare and sanitary matters have proved to benefit in progressive changes introduced in their hygienic practices inside their households. It should be specially highlighted the method of disinfecting water for consumption (chlorination) in Nueva Cucungará and the strengthening of this practice in Atahualpa de Tabacoa (families already disinfected water in their households, although not in a proper or frequent manner). Due to kitchen improvements in Romatambo, people could boil water without smoke.

While the focus of the project was on improving access to WSS services, the approach related to the construction of the household and its surroundings made it possible to substantially improve the living conditions in, at least, 51 households. These improvements included the provision of additional equipment, such as modern wood-burning stoves, laundries, containers with faucets, or having influenced the families to distribute better or maintain their households. In this respect, families accepted WSS services and other complements more openly as they experienced an improvement in different aspects of their living conditions, and this translated into favorable results for system sustainability (proper use, better maintenance, etc.).

Experience has shown that WSS service management in dispersed rural settlements is highly complex in connection to the distance between the households and the capital city of each district. These circumstances turn the service fragile and increase operation and maintenance costs that must be born for by a few users. These conditions make it difficult to rely on the typical sustainability pillars (operation and maintenance, payment capacity, hydraulic availability, and administration).

THE MAIN CONCLUSIONS OF THIS EXPERIENCE ARE SUMMARIZED BELOW:

- **Tailored Solutions**. Each dispersed rural community has its own unique characteristics (whether social, economic, environmental, productive, or cultural) that require specific technological and management solutions. For example, people share water with their animals in most of the dispersed rural settlements. Intervention models must take this fact into account. Prior visits to the pilot communities, field trips and conversations with community leaders enabled a better definition of populations' needs and their subsequent acceptance of the project.

- **Household Integration**. The design of WSS modules should consider the following minimum conditions for families to incorporate into their everyday lives: i) household integration as much as possible, ii) planning focused on household needs, iii) reuse of available environmental resources, and iv) acceptability as users will incorporate these new aspects in their everyday lives.

- **Quality of Technical Documentation**. When incorporating non-conventional technologies, local materials and quality to work additions or execution, technical documents show weaknesses as working on dispersed rural settlements lead to the application of construction methodologies beyond the standard practice in the sanitation industry. A way to overcome these weaknesses is to hire only one contractor (designer) to develop the project and the technical documents, including the support of a larger group of professionals to reduce time and improve quality of the technical documents produced.

- **Small Contractors**. The awarding of the works turned to be a complex process and, in spite of the fact that the number of contractors was quite low, there were some small companies interested in working in the project and in gaining experience in works on dispersed rural settlements, as it was the case throughout project execution. To facilitate the process, the terms of reference of the call for bidders should require basic conditions both for in-house staff and supervisors. A detailed description of the intervention area should also be included along with a list of geographical and cultural features of the rural area, such as work organization, availability of unskilled and skilled labor, field logistics, means of transport, basic weather conditions, local market offering, or whether the area belongs to indigenous peoples, among other.

- **Direct Management**. Pilot projects were implemented in two modalities: i) contracts with unit prices in Nuevo Cucungará and Romatambo and ii) direct administration in Atahualpa de Tabacoa. The first modality proved to be more efficient as contractors took on all the risks, including defects or errors, while direct administration for this type of project required more supervision, time and resources (human, logistical and financial) to keep up with the diverse number of construction components, while the contracting party was fully liable. Due to the complexities of dispersed rural communities, this contracting modality combined with follow-up arises as an opportunity of executing projects that would promote the efficient participation of the new supplier (Sanitation Services Community Boards) in the project execution process and of families.

- **Unexpected Costs**. The project execution process revealed aspects to be considered in future interventions. Operational aspects must also include permit-related costs of trails, bridges, road graveling, etc., which are never considered in the technical specifications, ensure proper logistics for the delivery of materials at the different work fronts, create effective work organizations, and ensure that quality aggregate materials are used and available, as required. These aspects are seldom considered in the technical specifications, and if they are, the quality of data is not verified. At times, these situations demand document review, cause delays, or require changes in the proposals, among other problems.

- **Absence of Institutions**. Local authorities are seldom present, even after local governments have expressed their interest. Given this situation, in their role as supporting institutions, Municipal Technical Areas (ATMs) are endowed with too many responsibilities. In order to fulfill their role and meet the goals of the Municipal Incentive Plan, Municipal Technical Areas should aim for greater interaction with Sanitation Services Community Boards.

- **Interaction between the Healthcare and Education Sectors**. The interaction with the Healthcare and Education sectors to promote long-term sanitation practices is important, even though it is usually non-existent in dispersed areas.

- **Beyond the Basic Sanitation Unit (BSU)**. Technological solutions for pilot projects were developed from scratch and complementary elements were added to improve homes, including the construction of new kitchen areas, the installation of cleaning and personal hygiene accessories in bathrooms such as soap holders, sawbucks for water drums and shelves, organization of kitchen areas with an internal washing area and improved wood-burning stoves. This comprehensive approach to WSS in dispersed rural communities based on homes has significantly leveraged the well-being of benefited families while enhancing the adoption and maintenance of these facilities.

- **The Local Promoter as key Program Replicator**. The interaction of local promoters with families had a positive effect regarding the improvement of the design process and the adoption of technological options, not only on the social aspects of hygiene education. Experience proves that a group of local promoters with more solid training on key contents (functionalities of technological options, operation and maintenance, and healthy practices) will be able to foster the participation and action of families in such processes, as long as such tasks are rendered as paid services.

- **Post-execution Follow-up**. WSS sysºtems require post-execution follow-up for the timely solution of operational problems along with reinforcement of practical recommendations on the operation and maintenance of dry toilets that families must implement and reinforcement of the capabilities of sanitation service providers. In dispersed rural settlements, it is crucial for Sanitation Services Community Boards to have a clear-cut definition of their structure. From the experience obtained through pilot projects, it is clear that this aspect needs to be considered in the creation of Sanitation Services Community Boards, including a clear role description so that these boards can be strengthened during the process. No results have been obtained to this day.

Lessons learned regarding the sector analysis and incidence do not point to one and only strategy, but it is essential to integrate some insights to improve public policies. In the first place, it is important to review the levels of water service in dispersed rural communities that resource to unconventional individual or multifamily solutions (wells, water hauling). New management models are also required to manage these systems (self-management, mixed) in addition to the Sanitation Services Community Boards acting in clustered rural settlements to provide the necessary flexibility to universalize WSS service in the country. Expanding the complete project approach and promoting the interaction among programs (local development, healthcare, education, home improvement, etc.) is imperative. Other important aspects to be considered include the flexibilization of technical regulations for the sector so that they acknowledge the heterogeneous reality of dispersed rural settlements in the country.

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LESSONS LEARNED

The initiative to provide access to WSS services to dispersed rural settlements, funded by AquaFund, improved access conditions to basic water services for at least 3,546 persons and to sanitation services for 2,818 persons. Several insights were derived from the implementation of pilot projects in dispersed rural settlements in Colombia, Honduras, Mexico and Peru regarding institutional, social, financial, environmental and technical aspects. These insights will improve the sector's actions towards the universalization of access to WSS services throughout Latin America and the Caribbean. Due to the limited availability of systematized and detailed data on the operational aspects of WSS programs in dispersed rural settlements, learned lessons are obtained through trial and error methods, typical of pilot projects.

At the **institutional level**, even though most of the national regulations lay the responsibility of WSS services on municipalities and local institutions, in many cases, the operation and maintenance of such services are performed by the communities themselves, through boards, committees or other voluntary community organizations, with limited support from public institutions. This fact is often associated with the lack of technically trained staff, the low or no budget for activities in dispersed rural settlements, the logistical constraints posed by distance and difficult access to these areas or the limited political interest revealed by representatives (Give to Colombia, 2015).

Additionally, there are no specific regulations for WSS interventions in dispersed rural settlements. In consequence, proposed services are often defined according to national or rural standards with no distinction between clustered or dispersed settlements, that represent neither the reality nor the demands of the inhabitants of dispersed rural settlements nor the technical or economic feasibility to meet them. In many occasions, service levels are totally unrelated to coverage levels (high coverage levels do not ensure high service levels), instead, continuity and quality are key criteria to meet the development goals set. There are also no specific building criteria, which often results in, for example, facilities being located in areas of high potential for contamination of water sources. In this sense, it is important to consider the low training level of construction staff in the area.

The creation of economies of scale to reduce the investment costs while improving their efficiency should involve the municipality as the main player who organizes groups of actions aimed at reducing costs. In that respect, empowering municipalities is fundamental, not only in the technical areas to support rural communities (these areas are sometimes non-existent), but WSS/utility areas to improve their technical skills, planning and financing capacities (strategies for fee collection, social work with communities, etc.).

Regarding **technological solutions**, the main aspects to be considered in the definition of suitable technological solutions should include the geographical conditions of dispersed rural communities, their dispersion level, the availability of sources and the remoteness to them. Community involvement during the diagnosis stage, as well as during the analysis of technological options (technology selection and design standards) and feasibility is decisive in the acceptance and adoption process of such solutions by the beneficiaries. This acceptance is indispensable for the sustainability and proper use of the systems. As the economic activity in most of the communities is based on agriculture or cattle raising, it is important to consider the presence of animals and the need to access water services to solve this production-related demand.

Also, due to the heterogeneity of dispersed rural communities, it is possible to find more than one intervention model or system coexisting in one community, involving different technologies, management systems, or post-construction support models. Implementing low-complexity systems is vital to simplify their management and ensure sustainability.

As to technology, a certain service level will be achieved based on the type of source (improved or unimproved, as per the criteria of the Joint Monitoring Programme), accessibility, availability, water quality, and excreta management. In this regard, service levels will be defined based on a ‘sanitation ladder’ to supply at least minimal WSS services to all the population and to gradually improve such services to safe management levels over time. In most cases, in areas with no treatment systems, home water filters will be required to ensure water quality. Most people usually reject water chlorination due to cultural beliefs and the low acceptance of the odor, taste, and color of chlorinated water. As to sanitation, excreta treatment in dispersed rural settlements is almost non-existent. In spite of the various innovations available, including ecological latrines and composting toilets, that ensure proper treatment and use of human excreta, their demand is quite low among communities; this is mainly due to the fact that people are not aware of the existence of these alternatives.

In most cases, the number of construction companies and qualified staff in the WSS sector in dispersed rural settlements is quite limited. With this in mind, project awarding processes and contract modalities, both on the municipality's part and the institution responsible for the project, as well as supervision processes much be flexible, as the case may be. The process provides for basic conditions for the mobilization of managers and supervisors to remote areas, that frequently suffer from extreme weather conditions. Regarding the definitions in the technical specifications, the preparation of the project profile and its technical specifications could be commissioned to the same consultant to reduce time frameworks while improving the quality of such documents.

Social work in dispersed rural settlements is quite complex, particularly due to the difficult access to communities, the limited number of trained staff interested in working in these areas and the acceptance of certain recommendations related to cultural reasons (for example, the use of chlorination to ensure water quality). Activities associated with behavior change (proper use of facilities, fee payment, menstrual hygiene, hand washing, protection of water sources, among others) require not only technical knowledge on WSS services, from people who usually have no previous experience in such type of training, but also basic knowledge on health and skills to work with culturally diverse communities. For inhabitants to embrace the project and support its sustainability, it is vital to consider cultural aspects. Such aspects range from being able to communicate through local promoters that speak the language and interact with key people in the community, to being aware of the community decision-making rules or ancestral considerations on water resources, among others.

In many cases, community work should involve the creation of committees, boards, or community associations that will manage the service or empower existing institutions. It is necessary to review the conditions and requirements of these management models to simplify and adapt administrative requirements and roles to the service levels and technological solutions, among other aspects. In cases of self-supply, a common practice in dispersed rural settlements, training families on basic technical aspects and the use of facilities, in addition to hygiene and environmental health, is also required. The role of women in their families and in dispersed rural communities should be seriously weighed and special attention should be paid to vulnerable members of the community, including elderly people, differently-abled persons or those with physical disabilities, among others, focusing on universalization and equality instead of discrimination (Mateo et al., 2017).

Community work also involves cooperating with the population that provides services and products related to the WSS sector to improve the supply and adapting it to the needs of the population that inhabits the dispersed rural settlements. Time and again, supply chains are poorly organized, especially when new technologies or those that require more specific knowledge are implemented. To this end, it is crucial to encourage the participation of women from the communities in the training initiatives, as well as in the system management and operation tasks.

Finally, it is important to consider that all community training and institutional strengthening will improve not only the management of the WSS systems, but also the capabilities of the population in dispersed rural settlements, and this, in turn, will improve their living conditions in other production areas.

The **costs** of interventions in dispersed rural settlements are one of the main defining aspects to be considered when determining the feasibility of the selected intervention model. It is vital to analyze construction costs (freight, materials, skilled and unskilled staff, administrative costs, among others), as well as those of operation, maintenance and spare parts of systems to estimate how to assign the contributions of the funding institutions, of the municipality and the population. It is also important to include training and community development costs. Other unforeseen aspects to be considered include roads and infrastructure; in most pilot projects, roads had to be improved to develop planned activities in the community. While logistical problems and unavailability of materials are not exclusive of projects in dispersed rural settlements, they are more acute in these locations due to their scale and, in most cases, cause unexpected cost overruns during project execution. The co-financing of the project must be agreed from project inception (pre-feasibility stage), with a clear definition of how the population will contribute and in what form (unskilled labor, materials, cash). In this context, it is important to consider families with high vulnerability rates and to seek solutions for the whole community to engage most of the population in the project.

In general terms, collective solutions, such as aqueducts and sewerage in dispersed rural settlements, imply higher unit costs than those in clustered rural settlements due to higher fixed costs, regardless of the number of users, even though these are not the most frequent solution (Smits et al., 2015) In any case, when deciding on the type of technology to be implemented, municipalities and financing institutions must take into account grants and aids to ensure services will be within reach, especially for the most vulnerable families.

Investment needs to focus not only on infrastructure aspects but also on the support to local and regional institutions, on training activities for promoters and operators and on programs related to environmental health and change in population behavior. Another key aspect is the reinforcing of pre-investment processes, to ensure the quality of programs and their integrality, along with post-construction processes that consolidate that access to WSS services will be sustainable.

In general terms, the technical level of operators is inadequate, as **systems are usually run** through boards or committees formed by community members, with low educational level. The definition of a service delivery model must consider the cultural characteristics of the population, as well as previous community organization, household dispersion, characteristics of inhabitants, etc. Standardized models of clustered rural settlements are not always suitable for dispersed rural settlements and, in some cases, models defined for dispersed rural settlements are not suitable for all dispersed communities, especially due to cultural differences. Having said this, it is important to introduce changes to the intervention models, as necessary. (Care, 2015b). The most frequent management models are formal water boards (for aqueducts, mini aqueducts or multifamily wells), adapted water boards (usually informal, with fewer administrative requirements), and family management (for individual WSS systems).

Post-construction support, whether in the form of technical or financial assistance, has substantial weight to ensure the **sustainability** of the WSS systems built. In general, dispersed rural settlements lack supervision, control, and technical support by public institutions or larger WSS companies (Lampoglia et al., 2008). The role of local social promoters trained for the projects, as well as the community management bodies (boards, committees or other formulas between families), can be a key component in the interaction between the municipality and the community, both for post-community support and for system monitoring. Supervision must go beyond the technical aspects (such as quality control of water sources or water intake points), and must be adapted to the conditions of the dispersed rural area. System monitoring and follow-up enable informed decision processes, within an intervention system where parties (population, promoters, financing parties, operators, and public institutions) work according to clearly defined roles.

It is impossible to create a static list of valid recommendations for all the cases due to the diversity and heterogeneity of the communities that live in dispersed rural settlements throughout Latin America and the Caribbean. However, many lessons have been learned and can be applied to support the design and implementation of WSS programs in dispersed rural settlements and to define the guidelines for public policies so that dispersed rural settlements attract the attention of financing solutions for the WSS sector to universalize such services in Latin American and the Caribbean.

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.84

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