



Water and Sanitation Program

An international partnership to help the poor gain sustained access to improved water supply and sanitation services

Multi-Village Rural Water Supply Schemes

An Emerging Challenge



Small Towns and Multi-Village Initiatives

The Water and Sanitation Program (WSP) in collaboration with the World Bank Rural Water Supply and Sanitation Thematic Group (RWSTG) is studying and documenting appropriate management models and professional support services for small town and multi-village water supply systems which lead to sustainable outcomes.

Small town and multi-village systems serve settlements that are sufficiently large and dense to benefit from the economies of scale offered by piped systems, but too small and dispersed to be efficiently managed by a conventional urban water utility. They require formal management arrangements, a legal basis for ownership and management, and the ability to expand to meet the growing demand for water. While local operators can perform routine tasks well, professional support is needed to maintain good service at a reasonable cost and to expand facilities to meet demand.

The WSP-based Small Towns and Multi-Village Initiatives network supports regional and country water and sanitation representatives and national policy-makers in promoting sector dialogue and in developing action plans in accordance with the knowledge generated.



Andes town in the hills of north-west Colombia.

In March 2000 the World Bank organized a study tour to Brazil and Colombia to enhance understanding of the key issues affecting sustainability of multi-village water supply schemes. The tour was managed by the World Bank's Rural Water Supply and Sanitation Thematic Group (RWSTG) in response to a request by the staff of the World Bank's office in New Delhi who are increasingly engaged with providing support to multi-village schemes.

Experience from the study tour, along with case studies from Colombia, Peru and Côte d'Ivoire, is useful to those designing appropriate institutional and financing models for multi-village schemes, which is an emerging option where local water sources are either scarce or not fit for drinking, or where economies of scale dictate that more than one village be served by the same system. This field note provides some initial findings.

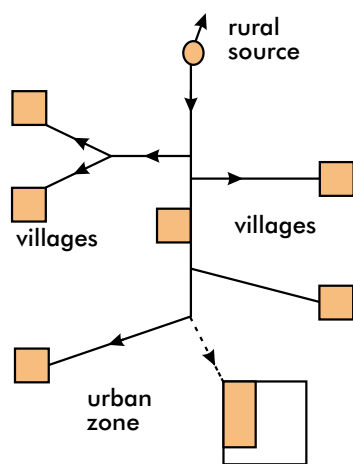


Introduction: What is a Multi-Village System?

Globally, rural water service delivery is shifting more and more towards piped water schemes as a result of improving standards of living and increasing aspirations of the rural population. Where local water sources are scarce or not fit for drinking (for example, in saline belts, or in fluoride or arsenic affected areas) the most common option left is to bring in water from an outside source. If this source is far away or very deep, then economies of scale dictate that more than one village be served by the same system.

Surface water sources, like rivers and reservoirs, also present a chal-

Figure 1



This introductory field note is based on the findings of three case studies from Colombia, one from Peru and three from Côte d'Ivoire. From among the case studies, two types of management arrangements are represented:

- Water User Association (four case studies).
 - Water Utility (three case studies).
- In addition to these case studies, the study tour to Brazil and Colombia provided additional information regarding both WUA and Utility management arrangements.

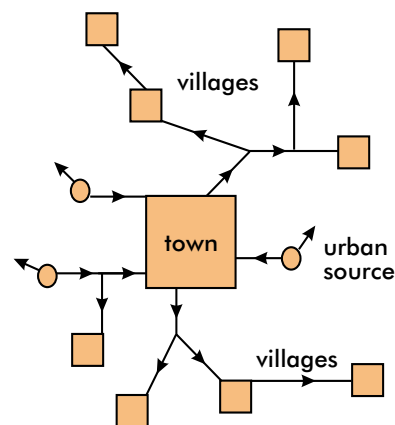
lenge. These sources are often located far away from the group of villages to be served, and involve the construction and operation of more complex installations such as headworks, pumping stations, long pumping mains, water treatment plants, domestic and commercial connections, water meters and other monitoring and control equipment. Reservoir filling operations, distribution management and other complex operational tasks may dictate a more elaborate approach to management as compared to the management of smaller or simpler schemes.

Multi-Village Distribution Systems

Two different types of distribution systems are shown here:

- One rural source supplies several villages and possibly a number of urban zones (scheme shown in Figure 1). This is the only type of system represented in this study.
- A water service primarily intended for a large town also supplies surrounding rural communities (scheme shown in Figure 2). This type of system, in which a utility takes responsibility for management, has been identified (for example in Morocco and Ghana), but is not represented in this study.

Figure 2



Types of Management

The type of management arrangement that is adopted has consequences for all stages of the project cycle including financing the cost of infrastructure, preparation/mobilization, construction management and management/operation of the system. As with single-village systems, a complete management "model" is taken to be defined not simply in terms of *who manages?* but also in terms of *who operates?* and *who provides professional support services?* Some of the differences specific to multi-village systems are now discussed.

Community Water User Association (WUA)

Water user associations are an

Some Multi-Village Systems that have been Identified

Country	Number of systems	Type of system	Type of management
Benin	60	Pumped	Water User Association
Cape Verde	18	Pumped	Municipal Water Agency
Colombia	>25	Gravity	Water User Association
Côte d'Ivoire	48	Pumped	Utility
El Salvador	12	Gravity	Community
Ghana	4	Pumped	Utility or Community
Honduras	3	Gravity	Community
India	>25,000	Pumped	Government or Semi-Autonomous
Mali	3	Pumped	Water User Association
Morocco	40	Pumped	Utility or Water User Association
Nicaragua	>70	Pumped and Gravity	Community or public enterprise
Peru	2	Gravity	Water User Association
Senegal	>30	Pumped	Water User Association

Snapshot of Sucuneta Community Water User Association (Colombia)

Project: Acueducto Regional de Sucuneta.

Cost: US\$ 2,045,610.

Commenced: 1997.

Size: 1,350 connections (designed for 1,835) serving 11,100 people in 15 villages and 6 urban zones.

Method of financing infrastructure: The main sources of finance were: four different government agencies (67% of the total contribution); the four principal municipalities (13%); and the community itself (18%).

Planning support: CORPES (Regional Councils for Planning) and the Instituto Nacional de Salud (National Health Institute).

Who manages? Sucuneta Water User Association via the Main Board.

Who operates? A professional staff comprising a manager, a supervisor, four plumbers, two plant operators, a secretary, and an accountant.

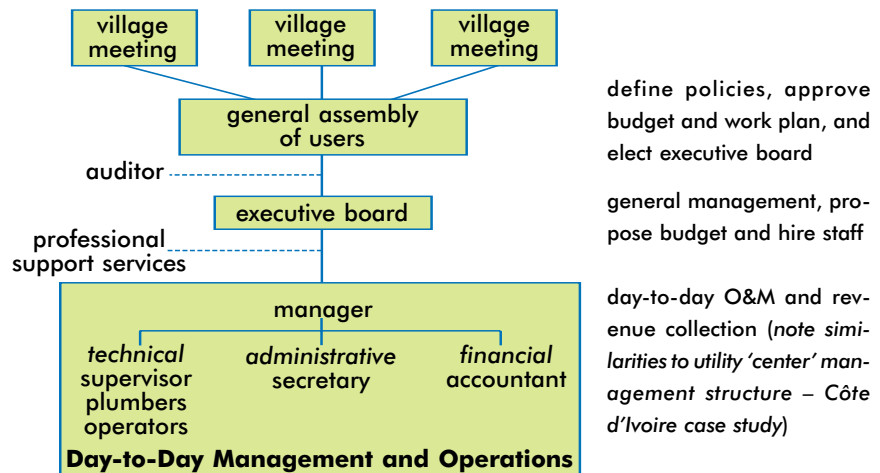
Who provides professional support services? Contracted as required.

Regulation: Government agencies including: the Superintendencia de Servicios Públicos (supervises service providers); the Comisión de Regulación de Agua Potable y Saneamiento (tariffs and management); and the Ministerio de Salud (water quality).

Stages in the setting up of a community-managed multi-village system

1. The idea of a multi-village system came from the community itself, following unsuccessful efforts by individual villages.
2. The first eight participating villages appointed a joint committee to be in charge of soliciting financial support.
3. System design was carried out by the support agencies in consultation with the joint committee.
4. An agreement was made regarding financial support and the community cash contribution.
5. The management organizational model and statutes of association were established, with help from the Instituto Nacional de Salud.
6. The Water User Association was legally registered within the framework of the national law for public service providers.

Water User Association Management of a Multi-Village Water Supply System in Colombia, with Professional Operating Staff (Example taken from Sucuneta case study)



effective form of management for small multi-village systems. This field note draws on case studies from Colombia and Peru, ranging in size from 1,350 connections (about 11,100 people) in 15 villages and 6 urban zones, to 457 connections (about 3,000 people) in 5 villages.

Preparation/mobilization

The case studies from Colombia and Peru describe multi-village projects that have come about when a number of village communities begin to work together and invest in a project. Leadership qualities that were lacking in individual villages were found to be stronger when these villages grouped together, and a joint committee with representative members from each participating village was formed. The joint committee, with the help of support agencies (such as private consultants, NGOs, professional associations, or government extension workers),

was responsible for drafting design plans, soliciting financial support to meet investment costs, and for mobilizing the communities.

Construction

In Colombia and Peru support agencies acted as intermediaries between the community and local contractors, but the joint committee was responsible for the procurement of goods and services. The joint committee also coordinated community contributions from each of the participating villages. These were either in the form of labor or money, and were carefully managed to ensure equitable participation of all villages.

Management/operation

Multi-village systems found in Colombia illustrate a relatively advanced form of management structure. Members of the WUA (or their

Support Agencies and Professional Support Services

Support agencies play a significant role in the implementation and initial operation and maintenance of community-based multi-village projects. Support agencies provide community training, technical assistance and financial support. Advice is provided on technical designs, cost estimates, construction management, financial management and tariff setting, expansion planning, water quality, and registering the WUA as a legal entity. Many of the professional support services described above are negotiated through direct community contracting with the private sector.

village representatives) meet every year in a general meeting, when they have the opportunity to define general policies, approve the work plan and budget, express their opinion over the quality of service, and elect an executive board. Various activities are geared towards accountability to users such as dissemination of financial data, and rapid attention to service repairs. The executive board is responsible for general management of the system, including proposing the budget and hiring the manager and staff to carry out day-to-day operation and maintenance. Staff are usually recruited from within the community, and formal arrangements for ongoing professional support services are contracted as required.

Users themselves set the price of water, with the revenue contributing towards the costs of operation and maintenance. As a result, WUAs are

Investment Costs Per Capita and Depreciation Costs (example taken from Sucuneta case study)

The investment costs for Sucuneta system, operational since 1997, amounted to US\$ 2,046,000, about US\$ 184 per capita based on the actual population served. If the design population is used, the cost per capita is reduced to about US\$ 139.

Supposing that the community was to absorb all the investment costs with a 20-year loan at 10% interest, the cost of water would need to be raised from the current price of US\$ 0.25 per m³ to US\$ 1.00 per m³.

Assuming that all major components of the system must be replaced over a 20-year period, the cost of depreciation for the current 1,350 users (households), each consuming 600 liters per day, would raise the tariff from the current price of US\$ 0.25 per m³ to US\$ 0.60 per m³ (subject to adjustment for inflation).

In practice, full cost recovery requires that the tariff covers both debt service on all outstanding loans and depreciation (replacement) costs.

Elements of the Statutes of Association for Community-Managed Multi-Village Water Supply Services in Colombia

- The *General Assembly of Users* is the main decision-making body. The General Assembly controls an *Executive Board*, responsible for general management, and staff employed for *day-to-day management and operations*.
- Users pay a connection fee and a monthly bill. Failure to pay may result in disconnection from the service and removal from the Association.
- All users are eligible for the General Assembly or the Executive Board. The General Assembly may comprise all users, or elected representatives from each community, or elected representatives from individual groups of users.
- The General Assembly elects members of the Executive Board, and the Executive Board is responsible for employing a *Manager*.
- The system is owned by the community, and all profits from the water service are reinvested in the system as determined by the Association.
- The Association is governed by national laws that regulate the activities of non-profit-making public service providers.
- Internal regulation and compliance with national laws is the responsibility of an *Auditor* who is appointed by, and reports to, the General Assembly. The Auditor sits on the General Assembly and the Executive Board with the right to voice opinions but not to vote.
- In some cases a representative of the municipal administration sits on the General Assembly or the Executive Board with the right to voice opinions but not to vote. This representative links the municipality to other public organizations.
- The General Assembly approves the tariff, the connection fees and the annual budget, that are proposed by the Executive Board.
- Staff salaries are set by the Manager or the Executive Board.
- The Manager is responsible for approving new connection fees, or the Manager may refer cases to the Executive Board.

well suited to implementing service levels, investments and tariffs to fit community willingness to pay. However, none of the case studies from Colombia and Peru presented in this study, are financially self-sufficient.

Water Utility

This section draws on case studies from Côte d'Ivoire, ranging in size from 1,317 connections (about 13,000 people) in 9 villages, to 199 connections (about 2,000 people) in 5 villages.

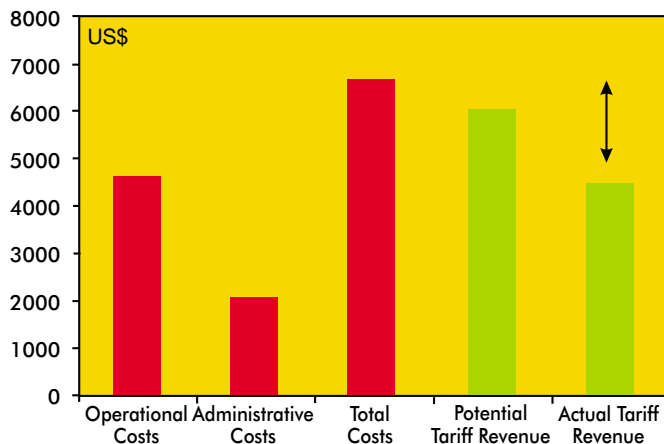
Preparation/mobilization

In the case studies from Côte d'Ivoire with services managed by the national water utility, SODECI, community participation is usually limited to paying water bills and connection fees, and carrying out informal surveillance activities. An exception to this

rule is the employment of local staff for the collection of fees, to carry out formal day-to-day surveillance, and to ensure that the utility is aware of what is going on at the village level. The employment of local staff improves customer relations and accountability to users. For example, it allows the utility to utilize flexible payment schemes, and avoid the need for disconnection. Also, if consumers have confidence in the quality of service provided, they are more likely to accept imposed price rises, and take an active role in surveillance activities.

In the majority of the case studies from Côte d'Ivoire, communities had been unsuccessful in managing a first water system. The construction and management of new systems by the national water utility, SODECI, occurred in response to demand from the communities.

Sucuneta Multi-Village System Annual Financial Data for 1999



Deficit recovered through new connection fees.

Sucuneta system serves 15 villages and 6 urban zones from 1,350 connections (about 11,100 people). It is designed for 1,835 connections. The total investment cost was US\$ 2,046,000 (US\$ 184 per capita actually served).

Construction

Projects may be supported by limited donor or government funds, but in general (even when a system needs to be built to meet future rather than present demand) the utility has the capacity to pre-finance projects requiring high infrastructure costs.

Multi-village systems may require more qualified engineers than single-village systems, because of the complexity and size of the systems. Nevertheless, construction management will be within the range of experience of the utility.

Management/operation

The water utility is responsible for collection, treatment, distribution, maintenance and customer relations. It is financially autonomous, and finances investments, operation and maintenance from its own revenue at its own risk. With its own extensive technical resources, the utility has little need for professional support services.

In Côte d'Ivoire only about seven of the 530 secondary systems managed by SODECI return a profit. Yet remarkably, two of the three multi-village systems described in the Côte d'Ivoire case study are reported to be profitable.

Some of the lessons learned during this initial study of community-managed and utility-managed multi-village systems are given here.

Initial Lessons Learned

Social and Institutional Issues

- **Legal status:** There is need for a proper legal framework to ensure sustainability of water user associations.
- **Accountability to users:** Effective communication and strong leadership are necessary in coordinating between villages that may not have existing social ties and may be separated by long distances. In the case of the utility SODECI, close relations with clients in rural areas are important. The employment of local staff is one effective

means of improving customer relations and accountability to users. Good relations with clients and a good understanding of local context enable the utility to utilize flexible payment schemes that reduce the need for disconnection.

- **Selection of institutional models:** From the Brazil and Colombia study tour it appears that sustainable options include: (i) for large schemes, like Aduto do Feijao in Brazil, a combination of a national or regional agency for planning, construction and delivery of bulk supplies, and village water user associations for local distribution and day-to-day management; and (ii) for smaller schemes, a multi-village water user association.

Infrastructure

- **Technical expertise:** The high level of technical expertise required for planning and construction of larger multi-village systems may necessitate the involvement of state or regional authorities.
- **Water losses:** Multi-village systems are large and relatively complex. Production is often not known and the risk of pipe breaks and blockages can be high. Unaccounted-for water may also be a result of illegal connections, especially where pipelines stretch



SODECI staff inspect the well-head at Songon Kassemble, Côte d'Ivoire.

between villages. It is also difficult to find the cause of problems in one part of the system affecting connections that may be many kilometers away. Surveillance and routine maintenance must be carried out systematically to avoid long-term damages.

Poverty Concerns

- **Access to water services:** All the systems presented in this study have a tariff schedule based on family income. However, some poor households do not have access to the system because they cannot afford the connection fee, and none of the systems include public standposts. To overcome this obstacle for poor households, the connection fee could be reduced through partial integration within the tariff structure. Alternatively, a formal kiosk arrangement could be established, with sales in bulk to a vendor who then resells the water to the public.

Financial Viability

- **Investment financing:** Financing for new infrastructure and rehabilitation of large multi-village systems represents a major investment that will be beyond the capacity of most

communities without financial support. The investment costs per capita of the systems in Colombia and Peru that are presented in this study are at the high end of costs for single-village systems in the region (see *Estudio Costos en Proyectos Rurales que Proven Agua en la Region Andes* – published by WSP Andean Region). This reflects the high standard of service provided by these systems as well as the complexity of systems and the large areas served. The investment costs per capita of the systems in Côte d'Ivoire that are presented in this study are more compatible with the cost of single-village systems.

- **Financial autonomy and ability to finance expanding coverage:** None of the case studies from Colombia or Peru are financially self-sufficient. While revenues from water sales contribute towards operation and maintenance costs, there has been no planning for replacement of long-life items or for new investments to meet growing demand.

In Colombia and Peru the revenue generated through connection fees from new users can be critical to the financial viability of a system, especially during the first few years after start-

Next Steps

- Conduct a follow-on in-depth study to analyze the financial viability of multi-village schemes in Brazil and Colombia.
- Coordinate with WSP-South Asia on the study of large multi-village schemes in India.
- Pilot a new management model for multi-village schemes under World Bank projects in the states of Karnataka and Uttar Pradesh, India.
- Small town and multi-village systems Conference in Africa, with study/learning tour.

up. Also, as the number of users increases, revenue from water sales also increases in proportion to costs. However, it is evident that external support is still required for strategic planning and financing system expansion.

- **Staff requirements per connection:** For multi-village systems the infrastructure serving many villages is usually limited to one source, one treatment plant, etc., and staff requirements per connection are reduced compared to single-village systems.

- **Demand management:** Especially for larger systems, there is need for demand management through metering and appropriate tariff design.

Driving Factors in the Realization of a Community-Managed Multi-Village Project

Multi-village systems usually come about through joint community initiatives, beginning with the search for a solution to the common problem of water scarcity and/or for a higher level of service. A multi-village system may come about for a number of reasons:

Coverage. In areas with few water sources, multi-village systems provide a practical solution to wider coverage amongst neighboring villages.

Leadership. In order to initiate a water supply project, strong negotiating skills are required to open dialogue with support agencies, and to mobilize financial resources and community participation. These leadership qualities are often lacking in small villages, and are stronger when a number of villages group together.

Quality of service. The option of a piped system is unlikely to be available to a small community, but may be justified when villages join together. In addition, communities need to make informed choices about the type of system and level of service that they will be able to maintain. When villages join together they not only have stronger leadership, but are also able to draw on a larger pool of candidates from which to select a higher caliber of professional staff for operation and maintenance of the system, and for financial management. The employment of qualified staff with adequate experience is the foundation for sustainability of community-managed systems. Professional support services may then be contracted as required.

Environmental Concerns

- **Allocation of water resources:** There is need to adopt a command-area approach to the allocation and optimized use of available water resources. A state or regional level agency may be needed to identify the most suitable water resources for a given area.

- **Source protection:** A single source serving many communities requires greater protection. However, purchase of the watershed in order to implement protection and conservation measures, can be more effectively realized when neighboring communities act together than when dispersed communities act alone. Most of the schemes analyzed in this study have adopted measures to protect the source area.

Conclusion

Most of the case studies presented in this initial study are providing good quality and affordable services and covering basic operation and maintenance expenses. Reasons for this success can be attributed in part to effective management arrangements, the small size of the schemes (with the exception of Aduto do Feijao), and the high level of community participation or, in the case of the water utility, SODECI, close relations with rural clients.

While it is known that community water user associations are capable of managing and maintaining small multi-village systems, the needs of larger schemes, such as those found in India and East Africa, have been less well documented. The study tour to Brazil, organized by the World Bank's Rural Water Supply and Sanitation Thematic Group (RWSTG), has provided some initial lessons learned regarding successful implementation and management practices for these large multi-village schemes.

Financial Data from Brazil, Colombia, Peru and Côte d'Ivoire

Town	Connection fee (US\$) including cost of materials	Domestic tariff (US\$) monthly consumption unless stated otherwise	Notes
Guachavita (Colombia)	\$ 458	Basic (30 m ³): \$ 1.50 31-40 m ³ : \$ 0.20 per m ³ 41-50 m ³ : \$ 0.30 per m ³ >50 m ³ : \$ 0.50 per m ³	\$ 0.20 fine for one month late payment, and \$ 9.00 for three months. A six-month suspension for illegal connections.
Sucuneta (Colombia)	Low status: \$ 385 Middle status: \$ 474 High status: \$ 592 V. High status: \$ 829 Plus \$ 32 for water flow regulator	\$ 0.25 per m ³ (flat rate of \$ 4.50 per month for consumption of 600 liters per day per household)	Fine of \$ 0.50 for late payments. Service suspended after two-month delay.
Andes (Colombia)	Low status: \$ 125 Middle status: \$ 250 High status: \$ 350 V. High status: \$ 500 Plus \$ 37 for meters	Flat rate for 0 – 30 m ³ is \$ 0.6 (L); \$ 1.2 (M); \$ 1.9 (H); \$ 2.4 (VH). Additional charge per m ³ is \$ 0.1 for all status levels	3% interest on late payments, and fines for altering meters.
El Ingenio (Peru)	\$ 296 (for members under the original project) (\$ 23 in cash and \$ 273 in labor)	Flat rate of \$ 2.20 per month	Fine of \$ 0.30 for late payments. Fee for a new connection (for new members after the water system is built) is \$ 30 plus \$ 500 in 100 monthly instalments.
Songon Kassemble, Bobouo Bahouan, Pacouabo (Côte d'Ivoire)	Connection fee (US\$) 'social': \$ 26 (subsidized) 'domestic': \$ 251 (full cost) 'normal': \$ 251 administrative: \$ 251 water resale from standpipes: \$ 496	Tariff (US\$) 'social' 0 – 18 m ³ /quarter: \$ 0.31 per m ³ 'domestic' 19 – 90 m ³ /quarter: \$ 0.48 per m ³ 'normal' 91 – 300 m ³ /quarter: \$ 0.78 per m ³ administrative: \$ 0.65 per m ³ water resale from standpipes: \$ 0.52 per m ³	
Aduto do Feijao (Brazil)	Tariff (US\$) Domestic first block 0 – 10 m ³ /month: \$ 0.26 per m ³ Domestic second block > 10 m ³ /month: \$ 0.56 per m ³ Commercial rate: \$ 0.63 per m ³ Industrial rate: \$ 1.42 per m ³		

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The Water and Sanitation Program is an international partnership to help the poor gain sustained access to improved water supply and sanitation services. The Program's funding partners are the Governments of Australia, Belgium, Canada, Denmark, Germany, Italy, Japan, Luxembourg, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom; the United Nations Development Programme, and The World Bank.

Colombia

In Colombia the national institutions concerned with public services include: the Dirección de Servicios Públicos Domiciliarios¹, under the Ministerio de Desarrollo

Economico², which is in charge of policy formulation; the Departamento Nacional de Planeación³, which is in charge of development planning; the Ministerio de Hacienda y Crédito Público⁴, which channels public credit and multilateral support; the Superintendencia de Servicios Públicos⁵, which supervises providers; the Comisión de Regulación de Agua Potable y Saneamiento (CRA)⁶, under the Economic Development Ministry, which regulates tariffs; the Ministerio de Salud⁷, which regulates water quality; the Ministerio del Medio Ambiente⁸, which establishes the policy for natural resources; Ingeominas, under the Ministerio de Minas⁹, who are concerned with underground water resources.

At the regional level, there are 36 Autonomous Regional Offices (one for each of the 32 provinces, and four for large urban centers), each of which intermediates between the national government and towns and cities. The Regional Offices offer technical support to municipal management of public services. Municipalities are responsible for managing and financing public services in their corresponding areas. Under the current law, communities are recognized as providers of public services. As public service providers they must register as Companies for Public Services with the Municipal Secretary. Their assets are represented in shares.

The population of Colombia is 38 million (1997) of which 27% live in rural areas. GNP per capita is US\$ 2,280 (1997). 31.2% of the rural population and 8% of the urban population live below the poverty line (1992). 7.4% of the population earn



less than US\$ 1 per day, and 21.7% earn less than US\$ 2 per day (1991). 76% of the population has access to safe water (1995). Colombia has a surface area of about 1.0 million sq. km. The Andes Mountains dominate the western part of the country together with two important river valleys, the Magdalena and the Cauca. This is the region where the majority of the population lives, between altitudes of 3,000 feet and 10,000 feet where there is moderate rainfall (1,000 mm a year) and cooler temperatures (averaging 14°C to 24°C depending on altitude). The remaining parts of the country comprise Amazon rainforest in the south (2,500 mm and 23°C), and savanna plains in the north (760 mm and 27°C) merging to desert in the north-east. Rivers of the eastern watersheds feed the Orinoco River to the north, and the Amazon River to the south¹⁰.

Case Study

Guachavita Water User Association

Key Points

- The main constraint to water supply in this region is lack of available water.

The scarcity of water sources has given rise to the implementation of multi-village systems.

- Guachavita water system is run by Asociación de Usuarios del Acueducto de Guachavita¹¹, which is community-based, financially autonomous and politically neutral. This locality is remarkable for the dynamic nature of community participation and the close relationship between participating villages. As a result, the need for external support has been less significant than might be necessary in similar schemes.
- The scheme is being run at a profit.

- The system is now 17 years old, and at some stage funds must be reserved to meet the costs of rehabilitation.

Introduction and Description of the Water Supply System

Guachavita water system is located in the rural areas of the town of Fómeque (17,000 inhabitants), (Province of Cundinamarca) in the mountainous north-west center of the country, and has been operational since 1982. Before the construction of the water supply system, consumption of unsafe surface water resulted in many health problems, including goiter. The scheme was initiated by the community in 1978¹², with support from the Fondo de Desarrollo Rural Integrado (DRI)¹³, under the Ministerio de Agricultura¹⁴, the Instituto Nacional de Salud¹⁵, which provided counseling on legal and administrative matters, and the Fondo de Acueducto y Alcantarillado de Cundinamarca¹⁶ which provided engineering services and financial assistance. The community provided labor during construction, and a share of the costs. The total cost of the system was US\$ 406,000.

The system serves 3,000 inhabitants in 5 villages. There are 457 connections (438 houses, 7 schools and 12

industries). This covers 26% of the total rural population around Fômeque, of which 65% are dispersed and 35% form part of a nucleus. The water source is an intake from the Negra River. The system is gravity fed, with a 20 liter per second capacity grit chamber, a 22 km PVC supply pipeline to four 100 cubic meter storage tanks, and a 20 km PVC distribution network. All connections are metered. A treatment plant is currently under construction to improve the quality of the water. It will have a 16.5 liter per second capacity with manual chlorination.

Administration, Operation and Service Level

Guachavita WUA is legally registered, and holds a license for water extraction¹⁷. Tariffs are fixed by the community at the General Meeting, and cover the costs of management, operation and maintenance. Profits are reinvested in the system.

The statutes of association, proposed by the Instituto Nacional de Salud, are as follows:

- All users are part of the WUA on accepting the rules in force and provided that they can afford the fees. They have the opportunity to actively take part in meetings, in particular regarding matters of finance and the quality of service.
- The General Meeting is made up of one delegate per 10 users, or a group of more than five users, from each village. The General Meeting appoints the Main Board, and the auditor.
- The Main Board is made up of five members and their deputies: Manager or President, Vice-President, Secretary, Treasurer, and Auditor. The Main Board is responsible for the performance of the WUA. The Board members are not paid, but receive up to 30 m³/month of water without charge. Management rotation is every five years. The Board is financially and administratively autonomous from the Municipality.
- Operation and maintenance is carried out by a professional plumber.

The connection fee is US\$ 458, including cost of materials. There are fines for

late payment, and a six-month suspension for illegal connections (of which there have been none). The domestic tariff is based on the following bands for monthly consumption (February 2000): basic (30 m³) US\$ 1.50; 31-40 m³ US\$ 0.20 per m³; 41-50 m³ US\$ 0.30 per m³; over 50 m³ US\$ 0.50 per m³. The industrial tariff is based on the following bands (February 2000): basic (60 m³) US\$ 5.50; 61-100 m³ US\$ 0.40 per m³; over 100 m³ US\$ 0.60 per m³. Meters are checked manually, and users billed monthly. The 1999 balance was: income US\$ 16,741; expenses US\$ 11,764; net profit US\$ 4,977.

There is a strong sense of community ownership. Users report leaks or damages to the association, and where possible carry out repairs themselves. The consultant constructing the new treatment plant is also providing a technical manual and training personnel, appointed by the WUA, in operation and maintenance. User satisfaction is reflected by the personal collection of bills, only 5% late payments, and a profit for 1999 of US\$ 4,977 which will be reinvested.

Problems encountered include:

- Poor management of waste water and solid waste.
- The system is now 17 years old, and at some stage funds must be reserved to meet the costs of rehabilitation.
- There is no knowledge of the amount of physical leakage.
- There are concerns regarding degradation and contamination of the source area. The WUA, with help from the Municipality, has taken steps to purchase the watershed basin. There are plans for a restoration and conservation program through reforestation, with the help of the Regional Corporation.

Case Study

Sucuneta Water User Association

Key Points

- The installation of volumetric water flow regulators on each connec-

tion has created a culture of rational water use, and reduced operational costs in terms of meter reading and billing.

- Administrative and operational costs exceed revenues from water consumption. The deficit is financed by connection fees. Financial sustainability requires that more connections are made, an increase in consumption is approved based on demand, and illegal connections are controlled.

- The municipality of Tausa buys water from the Sucuneta system at US\$ 0.25 per cubic meter, subsidizing its urban users who pay a fixed fee of only US\$ 1.25 per month for 600 liters per day. Rural users connected to the Sucuneta system pay US\$ 4.50 for the same service. This has created discontent within the rural areas.

- Contamination of the water source due to agricultural activities and livestock, together with the construction activities of an upstream water supply system. Help from local and regional government is required to purchase and protect land around the source. The system is sometimes suspended due to the high level of turbidity in the water, especially in winter. Accumulations of waste water and solid waste are a health hazard.

- The community did not contribute through labor, for cultural reasons and due to the demands of coffee growing.

Introduction and Description of the Water Supply System

The Acueducto Regional de Sucuneta¹⁸ is located in the rural areas of the towns of Sutatausa, Cucunubá, Nemocón, Tausa and Cogua (Province of Cundinamarca) in the mountainous north-west center of the country. The system has been operational since 1997. The scheme was initiated in the 1970s when an inter-village committee was formed. With the Instituto Nacional de Salud¹⁹ and the Fondo de Acueducto de Cundinamarca²⁰, the committee participated in organizing labor and

fees from the villages, and in making technical choices regarding the system. The committee also instigated financial support from: ECOCARBON (Colombian Coal Mining Company) (23%), Fondo DRI (18%), Fondo de Acueducto de Cundinamarca (24%), ECOPETROL (Colombian Oil Company) (2%), and local municipalities (13%). The Sucuneta User Association itself contributed 18% of costs. The total cost of the scheme was about US\$ 2,046,000.

The system serves 11,100 inhabitants (40% of the area's rural population) in 15 villages and six urban zones in Tausa. There are currently 1,350 connections, but the system is designed for 1,835. The water source is an intake from the Guandoque River. The system is gravity fed, with a pretreatment system, a 22 km supply pipeline, a 100 m³ storage tank together with 13 auxiliary storage tanks of 479 m³ additional capacity, and a 245 km distribution network. In the zone of Tausa there is a 22 liter per second capacity treatment plant. The system is regulated to provide 600 liters per household per day, and requires each household to have a 500 liter storage tank. All connections are metered. Complications include:

- High pressures of up to 80 meters head of water.
- Distances of up to 1.5 km between connections.
- High levels of mud in the water, which require careful monitoring.
- Unaccounted-for water.

Administration, Operation and Service Level

Sucuneta WUA is legally registered. The management model was proposed by the Nacional de Salud:

- Village meetings are assembled to inform, decide and approve different issues, which are then presented by village delegates (a President and two delegates) to the WUA General Meeting. The General Meeting appoints the Main Board.
- The Main Board is made up of a President, Vice-President, Treasurer,

Secretary, four committee members and two delegates per town hall. Elections are held every two years.

- The Main Board appoints the company director (responsible for service) and the staff of the water system, and approves the budget.

The connection fee is based on socio-economic status: Status 1, US\$ 385; Status 2, US\$ 474, Status 3, US\$ 592; Status 4, US\$ 829. In addition, each user pays US\$ 32 for a water flow regulator. The tariff per month is US\$ 4.50 for consumption of 600 liters per day per connection (household). It is the same for all users. This compares with an average income per family of US\$ 100. A fine of US\$ 0.50 is levied for late payments (about 25% occurrence). Service is suspended after a two-month delay. Potential revenue is US\$ 6,000 per month, of which about US\$ 4,500 are collected. Administrative and operational costs amount to about US\$ 6,700. The deficit is financed by connection fees. 90% of users are satisfied with the level of service, expressing complaints only with regard to the tariff which is set by the community itself.

Problems include:

- Accumulations of waste water and solid waste.
- Financial sustainability requires that more connections are made, an increase in consumption is approved based on demand, and illegal connections are controlled.
- The system is sometimes suspended due to the high level of turbidity in the water, especially in winter.
- Contamination of the water source due to agricultural activities and livestock, together with the construction activities of an upstream water supply system. Help from local and regional government is required to purchase and protect land around the source.
- Tampering with the water flow regulators to increase water supply.
- Corrosion of steel pipes due to saline conditions.

- No knowledge of water losses.
- Poor regulation of residual chlorine concentrations.

Case Study

Andes Water User Association

Key Points

- Community participation has been poor, partly as a result of the dominant role played by the Provincial Coffee Growers Committee. The community did not contribute labor, due to cultural reasons and the demands of coffee growing. There is little sense of community ownership, and little active community participation in the WUA regarding matters of finance or the quality of service.
- Technical choices, such as treatment plants, were made by the Coffee Growers Committee, and do not reflect the communities' ability to pay or manage the facilities.
- There has been poor coordination of water supply, basic sanitation and hygiene education. Waste water and solid waste result in a high incidence of associated diseases.
- At present the scheme is fully financed by revenues collected from water consumption, and there is a US\$ 9,000 reserve for investment.
- A high quality of service is provided.

Introduction and Description of the Water Supply System

Andes water system is located around the town of Andes (41,679 inhabitants) (Province of Antioquia) in the mountainous north-west center of the country, and has been operational since 1996. The Comité Departamental de Cafeteros de Antioquia (Provincial 'Coffee Growers Committee' of Antioquia) has been the driving force in all aspects of planning and implementation, including 45% of costs. Financial support also came from: the Municipality of Andes (18%), the Sectional Health Service (19%), and the

Fondo DRI (7%). The community contributed 11% of the costs. The total cost of the project was about US\$ 1.7 million.

The system serves 9,600 inhabitants in 37 villages (40% of the total rural population in the area) and six urban neighborhoods of Andes, and three other villages around the town of Betania. 80% of the houses are widely dispersed. There are 1,203 connections, but the system is designed for 1,400. The system has three main branches supplied by an intake from the Negra River and two intakes from the Los Chorros River. Each branch is gravity fed, with a sand remover and a 12 liter per second treatment plant. In total there are 45.4 km of supply pipeline, 14 storage tanks of 590 m³ total capacity, 133 break pressure tanks, and 208.3 km of distribution pipeline including 3.5 km of special pipeline to resist pressures of 420 meters head of water. All connections are metered.

Administration, Operation and Service Level

The statutes of association were agreed in 1993 with a management structure proposed by the Coffee Growers Committee:

- A General Committee is made up of one delegate for every 30 affiliated users. Its decisions are mandatory. The General Committee defines general policies and approves the budget proposed by the Main Board. The statutes indicate that tariffs be set during the General Meeting. However, lack of community participation in planning and implementation of the project has resulted in an apathetic attitude towards management of the system. Decision-making is left to the Main Board.
- The Main Board is made up of a President, Vice-President, Auditor-Counselor, Treasurer, and Secretary. None of them receives a salary. The Main Board manages, operates and maintains the system.
- The Coffee Growers Committee is

Status	Fixed Charge 0 – 30 m ³	Additional Charge per m ³	Connection Fee
Low	US\$ 0.6	US\$ 0.1	US\$ 125
Middle	US\$ 1.2	US\$ 0.1	US\$ 250
High	US\$ 1.9	US\$ 0.1	US\$ 350
Very High	US\$ 2.4	US\$ 0.1	US\$ 500

currently negotiating for an external auditor for all the water supply systems that they finance.

- Two plumbers are in charge of operating and maintaining the system as well as reading meters, delivering bills, and disconnecting or reconnecting users.
- The WUA has purchased the watershed around the source areas and hired a forest keeper exclusively to guard and conserve it.

The connection fee ranges from US\$ 125 to US\$ 500. An additional charge of US\$ 37 is also made for meters. The Coffee Growers Committee gives technical approval for new connections. Monthly bills are delivered and must be paid at the WUA's office. The tariff is structured along socio-economic lines (see table).

Monthly bills range from US\$ 1.75 to US\$ 2.00. There is a penalty of 3% interest on late payments (about 30% occurrence), and fines for altering meters. At present the scheme is fully financed by revenues collected from water consumption, and there is a US\$ 9,000 reserve for investment.

Problems include:

- There has been poor coordination of water supply, basic sanitation and hygiene education. Waste water and solid waste result in a high incidence of related diseases.
- Community participation has been very weak. There is little sense of ownership of the system, and no administrative participation regarding matters of finance or the quality of service.
- Technical choices, such as the treatment plants, were made by the Coffee Growers Committee, and do not reflect

the communities' ability to pay or manage the facilities.

- There is no knowledge of water losses.
- Mudslides cause damage to the pipeline.



References

- ¹ Directorate of Residential Public Services.
- ² Economic Development Ministry.
- ³ National Planning Department.
- ⁴ Treasury Ministry.
- ⁵ Public Services Supervising Department.
- ⁶ Commission for Regulation of Water and Sanitation.
- ⁷ Ministry of Health.
- ⁸ Ministry for the Environment.
- ⁹ Ministry of Mining and Energy.
- ¹⁰ World Development Report 1998/99, Encyclopaedia Britannica, World Bank archives.
- ¹¹ Guachavita Water User Association.
- ¹² The committee of community leaders actively participates in the Municipal Committee for Rural Development - Comité Municipal de Desarrollo Rural (CMDR).
- ¹³ Fund for Rural Integrated Development (DRI).
- ¹⁴ Ministry of Agriculture.
- ¹⁵ National Health Institute, which was responsible for water supply services in the 1980s.
- ¹⁶ Fund for Water System and Sewage of Cundinamarca.
- ¹⁷ Authorized by the Regional Office, which acts as the environmental regulator.
- ¹⁸ Sucuneta Regional Water Supply System.
- ¹⁹ National Health Institute.
- ²⁰ Fund for Water Supply Systems of Cundinamarca.

Peru

The executive agency for the water and sanitation sector in Peru is the Ministry of the Presidency (PRES). The regulating agency is the National Superintendency for Sanitation Services (SUNASS). The Ministry of Health (MINSA) is responsible for water quality and the environment. The provincial municipalities are responsible for the provision of public services in their corresponding areas.

Urban water utilities are called Entities for the Provision of Sanitation Services (EPS). Community water services are managed by Water and Sanitation Services Management Boards (JASS). There are 45 EPS (one state-owned, SEDAPAL, and 44 municipal-owned), that serve approximately 357 districts.

In addition there are about 1,450 district municipalities with direct control of water supply services. There are approximately 10,000 JASS.

The main investment source for the water and sanitation sector is the state, currently through PRONAP (National Drinking Water Program) in urban areas, and FONCODES (National Compensation and Social Development Fund) in rural areas. Also providing investments are the Transitory Councils for Regional Management (CTAR), government entities tied to the Ministry of the Presidency, and NGOs.

According to the former law, in urban areas infrastructure belongs to the state with concessions permitted only to the EPS. Investment recovery is made in urban areas, with tariffs set by the relevant EPS and regulated by SUNASS. In rural areas ownership of state built infrastructure is being transferred to the JASS, who are responsible for management and operations.

The population of Peru is 25 million (1997) of which 28% live in rural areas. GNP per capita is US\$ 2,460 (1997). 64.0% of the rural population and 45.0% of the urban population live



below the poverty line (1986). 60% of the population has access to safe water (1995). Peru has a surface area of about 1.3 million sq. km. The country can be divided into three zones stretching north-south: the Costa in the west (average temperatures of 20°C) has one of the driest climates in the world and many small, mostly seasonal rivers draining from the interior; the rugged Andes Mountains in the center where temperatures depend on altitude and rainfall decreases from north to south and from east to west; and the hot, wet and humid lowlands of the Amazon Basin in the east which occupies three-fifths of the country, and where annual rainfall exceeds 2,000 mm and temperatures are characterized by diurnal variations of 15°C to over 30°C.¹

Case Study

Water and Sanitation Association El Ingenio

Key Points

- The system is managed by the Water and Sanitation Association El

Ingenio (ASAP El Ingenio). ASAP El Ingenio is legally recognized by SUNASS and SUNAT (National Superintendency for Tax Management) and thereby exempt from consumption and rental taxes.

- External financial and technical support was provided for construction works, and in capacity-building for community-based management and operations.
- ASAP El Ingenio provides a good quality service that is profitable.
- Various activities are geared towards accountability to users, including: dissemination of monthly financial reports; mid-year assemblies for balance sheet approval; annual assemblies

for approval of the work plan and budget; and rapid attention to service repairs.

- Flow from each of the reservoirs is measured.
- There are no individual water meters.

Introduction and Description of the Water Supply System

El Ingenio water system is located in the rural District of El Ingenio (Province of Nasca, Department of Ica) on the central coast of Peru. The system has been operational since 1995. Before construction of the water supply system, untreated water was collected from wells situated with difficult access on private property. The cost of the system was US\$ 346,660 (including a latrine construction program). Technical and financial support came from FONCODES (39% of the project costs) and WUS-Canada² (16%), and to a lesser extent from the Provincial Municipality of Nasca (2%) and the District Municipality of El Ingenio (3%). The local community contributed 40% of project costs through labor and US\$ 23 per participant. In particular, WUS-Canada

provided support in capacity-building towards the realization of community-based management and operations. Participation was not enthusiastic. There were difficulties in collecting the financial contribution, with organizing physical labor, and in arranging transport to the work site.

The system supplies water to 3,214 people in the 10 populated centers of the district. There are 583 connections. The water source is an intake from the El Ingenio River. The system is gravity fed, with 27.3 km of PVC supply pipeline, one surface reservoir and five elevated reservoirs of 150 m³ total capacity, and a 19.6 km PVC distribution network. The system has nine break pressure tanks. Flow from each of the reservoirs is measured. There are no individual meters.

Administration, Operation and Service Level

In 1995, as stipulated under the former law, the Municipality of the Province of Nasca transferred management of the system to the community. The Administration Board for Sanitation Services (JASS) El Ingenio,

a traditional management arrangement for a single community system, which was based upon the executive board set up during construction, was charged with management responsibilities. JASS El Ingenio performed poorly. In 1997, following seven months training under WUS-Canada, the users formed a Water and Sanitation Association El Ingenio (ASAP El Ingenio).

ASAP El Ingenio is legally recognized by SUNASS and SUNAT (National Superintendency for Tax Management) and exempt from consumption and rental taxes. It is made up of the following:

- The Users' Assembly includes all participants and is the highest governing body.
- The Governing Council, made up of six men and five women, is responsible for governing and representing the WUA. Its members are elected by the users, and include a President, Vice-President and Treasurer.
- An Administrator is responsible for operations, with two operators who take care of routine operation and maintenance work (disinfecting,

cleaning the reservoirs, surveillance, distributing bills).

Almost all users are satisfied with the quality of service. The system provides water 24 hours a day, and covers about 90% of the population. Chlorine is applied every two days. Of 583 connections, 14 have been disconnected, in most cases because the user left the community, but have the right to be reconnected after paying the reconnection fee. Maintenance is carried out once a month. Water quality is checked every four months.



References

- ¹ World Development Report 1998/99, Encyclopaedia Britannica, World Bank archives.
- ² World University Service Canada (WUS-Canada).



Côte d'Ivoire

Management of the water sector in Côte d'Ivoire is shared between the Ministry for Economic Infrastructure and Transport, the Ministry of Economics and Finance, and SODECI, a private national water utility which serves the entire country. The Ministry for Economic Infrastructure and Transport through the Direction de l'Eau (DE) acts as the national executive agency and defines the national water policy. Implementation and control of service contracts is carried out through DE which has six regional headquarters. DE also acts as the regulatory body for the sector. The Government of Côte d'Ivoire (GOCI) through the Ministry of Economic Infrastructure and Transport owns the assets of the sector. GOCI sets the price of water in consultation with the utility.

The Water Development Fund (FDE) and the National Water Fund (FNE) have been set up to cater to the financial needs of the water supply and sanitation sector (service of debt, small to medium-size investment needs, social policy matters, expansion, rehabilitation of older systems, etc.). The FDE and FNE are replenished through taxes integrated into the price of water. Large investment needs are taken up by government loans through the Ministry of Economics and Finance. This Ministry is thus responsible for the service of the debt of the sector and manages the National Water Fund.

SODECI was established by Société d'Aménagement Urbain et Rural (SAUR) in 1960 as a private company working through a management contract which later evolved into a concession contract (1967/1987). The company is responsible for collection, treatment, distribution and maintenance. About 52% of SODECI's subscribers live in Abidjan and account for 66% of total billings. Profits from water supply in Abidjan and other large centers subsidize secondary and small non-profitable systems. SODECI has 10 regional departments overseeing some 259 local management entities called 'centers' which cover 530 small towns and villages. Management of multi-village systems fall under these 'centers'. The 259 secondary systems include: 15 regional capitals outside Abidjan (over 40,000 users); 70 towns



(10,000 to 40,000 users), and 174 small towns and villages (of less than 10,000 users). The 174 small town and village systems serve a total of 257 settlements; about 40 of the systems are multi-village systems serving between two and nine settlements each.

The population of Côte d'Ivoire is 15 million (1998/99), of which about three million live in the capital Abidjan. The rural population is about 54% of the total population. GNP per capita is US\$ 690 (1997). 17.7% of the population earn less than US\$ 1 per day, and 54.8% earn less than US\$ 2 per day (1988). 72% of the population has access to safe water (1995). Côte d'Ivoire has a surface area of 320,000 sq. km. In the coastal fringe, which has lagoons at its eastern half, monthly temperature variations are small, but diurnal temperatures vary from 21°C to over 30°C. Annual rainfall is 2,000 mm. Further inland is humid, equatorial forest which has been largely deforested to the east. The diurnal temperature range here is from 16°C to 39°C. Most of the northern half of the country is sparsely populated savanna, which is cooler and drier than the rest of the country, but subject to the Harmattan wind from December to February. Rainfall is between 1,100 mm and 1,600 mm. The western border of the country is marked by mountain ranges with rainfall in excess of 2,000 mm.¹

Multi-Village Systems in Côte d'Ivoire

Key Points

- The three multi-village systems described below are managed by the

private national utility: SODECI. The primary advantages of the multi-village arrangement are economic and the need for efficiency in management. Each system requires only one borehole, one treatment plant and so on. SODECI currently manages about 40 multi-village systems serving between two and nine villages.

- Management is decentralized and rests upon the center chief. Depending on the importance of the center, the center chief is assisted by a plumber, or a plumber plus a commercial agent, or both of these plus an administration assistant. However, SODECI is able to call upon its extensive resources in terms of technical backstopping, that is, goods and services based at central, regional and local levels. There is a close working relationship with the village communities, that permits flexibility in the method of payment of bills and allows for a rigorous explanation of changes in SODECI's policy.

- SODECI applies uniform tariffs nationwide, using profits from major centers such as Abidjan to subsidize secondary centers. Only about seven of the 530 secondary centers managed by SODECI return a profit. Two of the three multi-village systems described below are remarkable in that they are reported to be profitable.

Introduction and Description of the Water Supply Systems

Songon Kassemble water system in southern Côte d'Ivoire has been operational since 1980. The system serves about 65% of 20,154 inhabitants in nine villages. There are 1,317 connections, of which 147 have been disconnected due to non-payment of bills at the time of the present study. The water source is a borehole which supplies up to 37 m³/h, a 100 m³ cement reservoir, and a 42 km PVC distribution network. The water is chlorinated before distribution. Pumping of the system is automated and needs little intervention. The total cost of the new project was US \$136,000.

Bobouo Bahouan water system in west central Côte d'Ivoire has been operational since 1995. The system serves more than 60% of 25,241 inhabitants in five villages. There are 199

connections, of which 18 have been disconnected due to non-payment of bills. In this village, one connection can service many households. The water source is a borehole which supplies up to 9 m³/h, a 50 m³ cement reservoir, and a 12.45 km PVC distribution network. The water is chlorinated before distribution. Pumping of the system is automated and needs little intervention. The total cost of the new project was US\$ 123,000.

Pacouabo water system in central Côte d'Ivoire has been operational since 1984. The system serves about 67% of 4,325 inhabitants in three villages. There are 292 connections. The water source is a borehole whose yield has dropped down to 4 m³/h, an 80 m³ cement reservoir, and a 7.5 km PVC distribution network. The water is chlorinated before distribution. Pumping of the system is automated and needs little intervention. The total cost of the new project was US\$ 96,000.

Non-chlorinated water used to be supplied by handpump in Boboua Bahouan and Pacouabo, and from a small community-managed piped system in Songon. Water point committees were responsible for management, maintenance and the collections of fees. Irregular payment of fees and inadequate O&M were a major factor in jeopardizing sustainability of the schemes.

The current Songon and Pacouabo inter-village systems were established within the framework of the KFW-funded program to supply potable water to villages meeting the following criteria: more than 3,000 inhabitants, an existing borehole capable of producing at least 4 m³/h, access to the national electricity grid, and the communities to raise 10% of the investment costs. The Boboua Bahouan inter-village system was entirely funded from the FDE without any contribution of the communities. All of the systems have individual metering, and therefore come under the distributorship agreement with SODECI.

Administration, Operation and Service Level

Two locally-based SODECI staff (the 'center') manage the Songon system (a center chief and a plumber). These two

agents have to perform the four basic tasks of the center: technical, commercial, administrative and management of the stock of material of the center. The Boboua system is managed from the Daloa centre (a head of operations assisted by two plumbers, a head of marketing, a head of production/billings, two electricians and four area officers). The Pacouabo system is managed from the Bouaflé center (a head of operations assisted by two area officers, an operations officer, a plumber and a head of marketing).

SODECI holds the view that if subscribers do not receive their bill, they will not collect it themselves and make their payments. Furthermore, it is SODECI's view that subscribers from the villages should not be expected to spend money on transport before coming to pay for their bills. For these reasons, SODECI employs local agents identified by village communities to be responsible for surveillance of the system, distribution of bills and collection of receipts and fees in the villages. There are two such local agents in Songon and one each in Boboua and Pacouabo. These agents, not SODECI staff, are paid about US\$ 30/month and travel expenses, in addition to 3% of the receipts they collect. Close monitoring by local agents ensures a good and trustful relationship with users. This foundation permits some flexibility to the method of payment, for example through installments, or by allowing users to negotiate softer terms rather than face disconnection. Collection rates are high: 91% in Songon, 98.5% in Boboua and 97% in Pacouabo. The Songon and Pacouabo systems are being run at a small profit, while the Boboua system covers only 40% of its operating costs.

The quantity of water supplied by the systems is sufficient for the present demand, and the quality is perceived to be very high. Both Songon and Boboua systems have enough water to meet future expansion, where this does not involve large distances and major investment costs. Pacouabo system does not have sufficient water to meet major expansion. The quality of service is perceived to be permanent and regular by the users. Occasional distribution

interruptions are quickly restored. Progressive tariffs are applied nationwide: 'social' (0–18 m³/quarter) is US\$ 0.31 per m³; 'domestic' (19–90 m³/quarter) is US\$ 0.48 per m³; 'normal' (91–300 m³/quarter) is US\$ 0.78 per m³; 'industrial' (>301 m³/quarter) is US\$ 0.89 per m³; 'administrative' is US\$ 0.65 per m³; and water resale from standpipes is US\$ 0.52 per m³.

This quality of service is a direct result of SODECI's decentralization (down to the local level) and the availability of its resources in terms of reliable human resources with good performance incentives, good internal communications and accountability, well-stocked supplies of spare parts, available logistics, and backstopping ready-to-meet operating requirements. The center chiefs (in charge of management of the multi-village system or any other local system) determine the annual budget and performance objectives for the center, and are expected to achieve these objectives. They are evaluated on this and paid incentives on the basis of the financial and technical performance of their system. They work closely with the community whom they educate and inform about any change in policy, and who in turn report leaks and damages or any other mishap to the local agent or directly to SODECI staff. Leakage is very low: 2% for Songon, 6% for Boboua and 7% for Pacouabo.

SODECI carries out its own maintenance. The following problems arise:

- Relatively infrequent prolonged electricity cuts.
- Power surges (after electricity cuts) and lightning strikes may damage relay switches and delay the water supply service.

The Songon center faces the following specific problems:

- Damages to the pipeline caused by agricultural machinery and bulldozers that work on the industrial plantations.
- Vandalism to expensive electric casings.

References

¹ World Development Report 1998/99, Encyclopaedia Britannica, World Bank archives.

Brazil: Utility Management of a Large Multi-Village Scheme

While it is known that community water user associations are capable of managing and maintaining small multi-village systems, the needs of larger schemes, such as those found in India and East Africa, have been less well documented. A study tour to Brazil, organized by the World Bank's Rural Water Supply and Sanitation Thematic Group (RWSTG), provided an opportunity to see at first hand some successful implementation and management practices used for large multi-village schemes. Some of the lessons learned during the Brazil study tour are recorded here.

The case study provided is that of Aduto do Feijao, located in Bahia District. The system serves a population of over 130,000 in six towns and 56 villages, and is managed by the state water utility, EMBASA.

Study Tour Notes: EMBASA Water Utility

EMBASA is a state water utility located in Bahia District, north-east Brazil. EMBASA supplies water for most of the 415 municipal towns and over 900 villages in the state. It has 60% government equity and 40% private sector equity. It is responsible for planning, construction, operation and maintenance, and billing and collection. In short, all the functions involved in water service delivery.

The positive and innovative features of the model are:

- For new investment projects, Federal funding to EMBASA is zero, state



funding is about 20% and the rest is raised by EMBASA as loans from financial institutions (World Bank, OECF, IDB and Bank of Brazil).

- EMBASA generates an operating surplus of over 40% every year. Though the tariff throughout the state is uniform, including rural areas, the systems are run efficiently, costs are cut down through use of private sector contracts, and the collection efficiency is high.

- First the Federal Government and then the State Government took a policy decision to privatize most infrastructure (energy, telecom, transport, water) in the country, and as a first step asked EMBASA to tighten its belt and start earning a profit. The Government also provided funds to modernize the systems and reduced political interference in procurement, service delivery, and collection of revenue from consumers.

- The most effective way of cutting costs was by entering into competitive service contracts with the private sector to provide skilled manpower, such as operators and plumbers, to

run the system. They cost half the cost of the regular staff and are more efficient. These staff are managed by EMBASA.

- Government pressure in asking for financial accountability was the prime reason for the turnaround in EMBASA's operational and financial performance.

- Most connections are metered and these are strictly disconnected on non-payment of bills. Even the poor pay their bills regularly and do not mind doing so since the situation without the scheme was very

difficult. The tariff for initial consumption is low to ensure that a minimum service standard is available even to the poor.

- The main limitation of the utility model seems to be the high investment costs involved in building urban style multi-village schemes. How EMBASA can simultaneously meet the requirement of past debt servicing and using current operating surplus for financing new investments is not clear. This will need to be studied further.

Lessons Learned

Key principles and approaches that need to be adopted to achieve sustainable operations of multi-village RWSS schemes are:

- A state or regional level agency is needed to identify the most suitable water resources for a given area.
- There is a need to adopt a command-area-based approach to allocate and optimize the use of available water resources.

- Due to the high level of technical expertise required for planning and construction, a state or regional agency is necessary.
- A combination of two models: (i) a central agency for planning and construction, and (ii) a multi-village water user association for operation, may be one suitable institutional model for replication.
- It is important that the user groups are involved right from planning

stage to correctly assess the extent of demand so that the most appropriate level of service standard can be identified (a mix of top-down and bottom-up approaches, as opposed to only a bottom-up approach in single-village schemes).

- There is need for a proper legal framework for sustainability of water user associations.
- As a policy, government should make it clear right from the begin-

ning that no external support will be provided to the users for running their system. Willingness to charge for water and recover costs is the key to sustainability.

- In large systems, demand management through metering and appropriate tariff design is vital for sustainability.
- Overall, the institutional model has to be developed with due consideration for the local context.

Name of scheme	Aduto do Feijao (Bahia District)
Management	EMBASA (State Water Utility)
Coverage	6 towns and 56 villages
Source	Irrigation reservoir 60 kilometers away
Raw water pumping	600 HP pumps; Static Lift = 450 m; Rising main 700 mm dia. cast iron
Water treatment plant	Conventional 42,500 cubic meters per day capacity
Present supply	18,900 cubic meters per day
Population served	134,400 (of which 85% urban)
Distribution reservoirs	1 per town and 1 per village
Distribution system	Length = 327 km; mostly PVC pipes
Private connections	30,000 (90% domestic, 3% industrial, and 7% commercial)
Tariff	Domestic first block: Reals 0.5 per cubic meter up to 10 cubic meters per family per month Domestic second block: Reals 1.06 per cubic meter per family per month Commercial rate: Reals 1.2 per cubic meter Industrial rate: Reals 2.7 per cubic meter
Income (FY 99)	Billed: Reals 4.4 million; Collected: Reals 3.88 million
Expenditure (FY 99)	Reals 2.5 million (energy bill + staff cost + staff contracts for operation and maintenance + maintenance and minor repairs)
Investment cost	Reals 55 million (Reals 410 per capita)
Operation and maintenance costs	Reals 18.65 per capita

1 US\$ = 1.9 Reals

Comparative Data from Brazil, Colombia, Peru and Côte d'Ivoire

Name (commenced)	Served zones	Served population/ no. connections/ (design no. conn. if data available)	Investment costs (US\$) based on actual pop./ (design pop.)	Technical aspects: main line and sec. line (km)/no. of tanks/treatment	Source and system	Type of mgmt./ Legal status	Financial status and quality of service
Guachavita Colombia (1982)	5 villages	3,000 457 connections	\$ 406,000 \$ 135 per capita treatment plant	22 km and 20 km 4 tanks (400 m ³ cap.)	River Gravity	WUA Community- owned	1999 profit of US\$ 4,977. User satisfaction reflected in low level of late payments (5%).
Sucuneta Colombia (1997)	15 villages 6 urban zones	11,100 1,350 connections (1,835 connections)	\$ 2.046 million \$ 184 per capita (\$ 139 per capita) (one zone)	22 km and 245 km 14 tanks (579 m ³ cap.) treatment plant	River Gravity	WUA Community- owned	1999 loss of US\$ 2,200 (excluding connection fees). Occasional loss of service. 25% late payments.
Andes Colombia (1996)	37 villages 6 urban zones	9,600 1,203 connections (1,400 connections)	\$ 1.735 million \$ 181 per capita (\$ 155 per capita)	45 km and 208 km 14 tanks (590 m ³ cap.) 3 treatment plants	River Gravity	WUA Community- owned	Profitable (US\$ 9,000 in savings). Good service. Poor community part- icipation. 30% late payments.
El Ingenio Peru (1995)	10 villages	3,214 583 connections	\$ 347,000 \$ 108 per capita	27 km and 20 km 6 tanks (150 m ³ cap.) disinfection	River Gravity	WUA Community- owned	Profitable (US\$ 2,000 in savings). Good service. 15% late payments.
Songon Kassemble Côte d'Ivoire (1980)	9 villages	About 13,000 1,317 connections	\$ 136,000 \$ 10 per capita	42 km distr. line 1 tank (100 m ³ cap.) chlorination	Borehole Gravity	Utility (concession) Government- owned	Profitable. Occasional loss of service, but customer satisfaction good. 9% late payments.
Bobouo Bahouan Côte d'Ivoire (1995)	5 villages	About 2,000 199 connections	\$ 123,000 \$ 61 per capita	12 km distr. line 1 tank (50 m ³ cap.) chlorination	Borehole Gravity	Utility (concession) Government- owned	Not profitable. Occasio- nal loss of service, but customer satisfaction good. 2% late payments.
Pacouabo Côte d'Ivoire (1984)	3 villages	About 3,000 292 connections	\$ 96,000 \$ 32 per capita chlorination	8 km distr. line 1 tank (80 m ³ cap.) chlorination	Borehole Gravity	Utility (concession) Government- owned	Profitable. Occasional loss of service, but custo- mer satisfaction good. 3% late payments.
Aduto do Feijao Brazil	56 villages 6 towns	134,400 30,000 connections	\$ 29 million \$ 216 per capita	327 km distr. line 1 tank per town or village treatment plant	Reservoir	Utility (state) Government- owned	Profitable. 1999 profit of \$ 0.726 million. Good service. 12% late payments.