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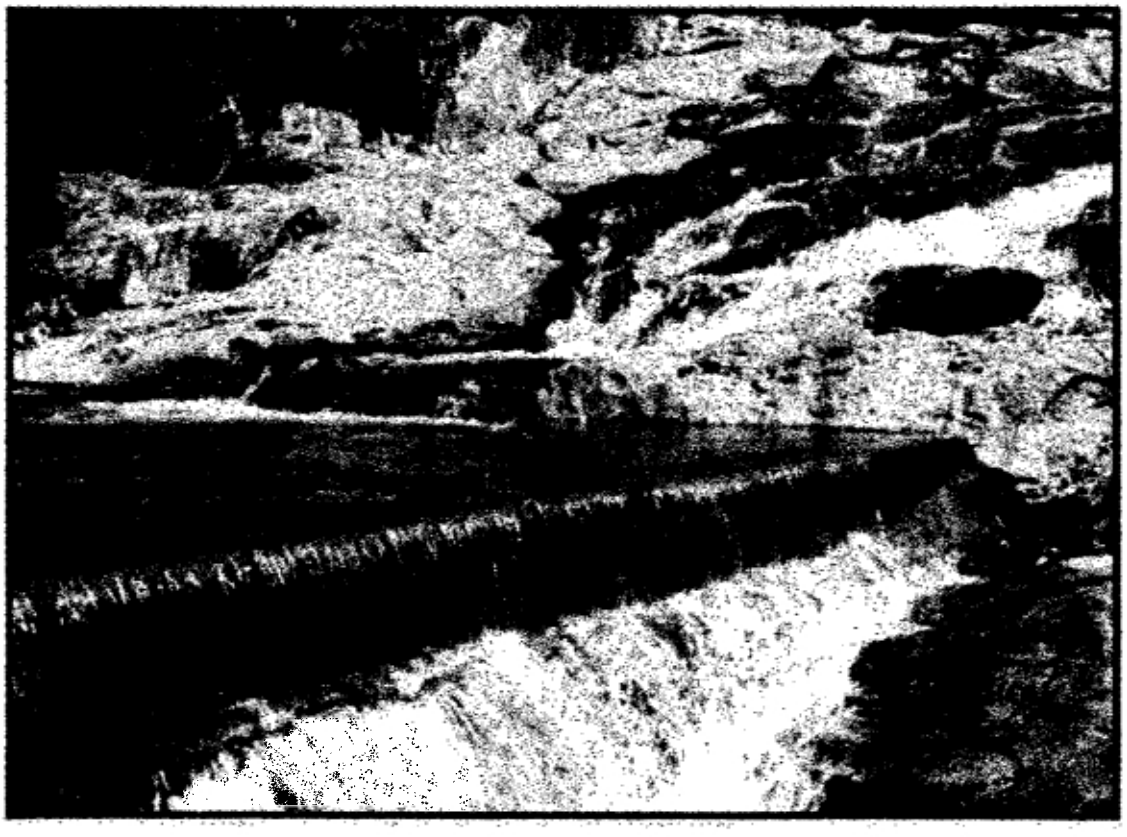
PROMISING WATER RESOURCE MANAGEMENT APPROACHES IN THE DRINKING WATER SUPPLY AND SANITATION SECTOR



Rural Water Distribution and Management: The Case of San Felipe Water Supply Utility

Cali, Colombia, December 1997

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by: Edgar Quiroga R; Claudia Nieto; Alberto Benavides

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SUMMARY

Water availability in quantity and quality is a main constraint to development worldwide. This document presents the preliminary experience of San Felipe made in the field with addressing the 8 Water Resources Management Principles. The experience has shown that we need a more comprehensive approach to the management of the water resources. Some of the important aspects are:

- the lack of participation at a local level in the catchment protection.
- the absence of the surveillance and control programme.
- the existence of a legal national framework is an important tool but it is not enough.
- it is necessary to redefined role for the governmental organizations with emphasis on facilitation and technical assistance rather than providers or only regulatory functions.

The results clearly demonstrate the importance of participatory institutional support and validate a systematic approach to problem analysis and solving primarily by the community with support from the agencies. The experience showed that helping communities to identify problems and making them visible for all parties concerned is what seems to be the root problem solving. It is also encouraging to note that people are very willing to accept an increase in water tariffs, provided tariff development is transparent and good service is provided. Higher average water prices for excesses of consumption encourage water users to economise on water and strengthen water institution at local level.

However, considering the abundant sources originating from Andean rivers, the communities still have difficulties to understand the relationship between the deterioration processes in their watersheds and the cost which represents the water treatment due to the high contamination levels.

There are many and important efforts focused on skills development and capacity building in the management of the water resource. However, it is necessary to strengthen the institutional capacity. On the other hand, the active women participation in the water resource management projects is crucial. It needs to be recognised, but it is clear that the needs and interests of men and women often are different, and therefore a gender balance is needed to ensure that the views of all groups are duly taken into account.

Finally, it is clear that any program oriented to develop an integrated water resources management must consider a conception of the development that establishes the creation of conditions in which strategies and tools are brought making possible to the participants to be the makers in the construction of solutions to the problems they face. It is understood then, that the development is a process that implies a weakness of the creative forces of the communities, institutions and people insistent in changing their living conditions. For that reason, in the execution of the actions it is necessary to consider ways of working that facilitate the assertion of the participants as individuals and as a member of a collectivity of own cultural characteristics. Being a world citizen without loosing the roots, building an autonomy that confronts the strain between the tradition and the modernity.

ACKNOWLEDGEMENTS

This work would not be happened without the financial and practical support from different international and national institutions such as:

- ODA, Overseas Development Administration, UK
- British Embassy in Colombia
- SDC, Swiss Development Co-operation
- IRC, International Water & Sanitation Centre
- Tolima Health Service
- CORTOLIMA
- Municipality of Armero-Guayabal
- Municipality Unit of Agriculture Technical Assistance (UMATA)
- Planning Municipality Office of Armero-Guayabal
- Universidad del Valle

We would like to express our recognition to Mr. Johnny Welsh and Mrs. Luz de Henriquez in the British Embassy; Dr. Barry Lloyd, Centre for Environmental Health Enginnering, CEHE, University of Surrey; and Ing. Jan Teun Visscher, IRC, for their strong support and confidence in Cinara's work.

Considerable help was provided by the members of the regional institutions, especially Mr. Eduardo Lozano, Dr. Victor Hugo Castellanos and Dr. Jairo Villamizar (Tolima Health Service); Mr. Rogelio Chavez and Mr. Edgar Bonilla (CORTOLIMA).

Also it was very important the guidance and support provided by Mariela Garcia, our colleague in Cinara.

Finally nothing at all would have happened without the San Felipe community support and participation through the Water Board co-ordination. The participation of the people like Mr. Jaime Buenaventura, the Water Board treasure, Mr. Alfonso Zarate the water supply operator, and Mr. Agustin Vargas, community leader.

Many thanks to all of them.

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Cali-Colombia
December 1997

RURAL WATER DISTRIBUTION AND MANAGEMENT: THE CASE OF SAN FELIPE WATER SUPPLY UTILITY

TABLE OF CONTENT

"I am struk that many of the difficult choices that confront developing countries regarding water management are similar to those encountered in the industrialised world. We must exchange experiencies" The RT Hon Baroness Chalker. Minister for Overseas Development, United Kingdom. Opening address at the International Conference on Water Policy: Allocation and Management in Practice. Silsoe, College, 23 Sept. 1996.

INTRODUCTION

In Colombia a recent evaluation of 49 water supply utilities in small municipalities, with less than 10,000 population representing 95 per cent of all municipalities in the country (1,066 in 1996), shows the poor functioning of water supply schemes in terms of water continuity, quantity and quality (Cinara-FINDETER, 1996).

The important causes of water supply problems include the deterioration of micro-catchments as a result of deforestation, inadequate land management, detrimental agricultural practices and poor disposal of liquid and solid waste. The problems are aggravated by the absence of an adequate policy which stimulates the conservation of catchment areas with active participation of the communities concerned. It estimated that 300,000 to 600,000 hectares of forest is removed annually, 30 per cent of forest coverage has been destroyed, 8.5 per cent of soils present severe erosion, and less than 5 per cent of the municipalities have waste water treatment facilities (Ministry of Environment, 1996). On the other hand, water loss which in Colombia on average is over 50 per cent (National Planning Department, 1995) and inefficient water use, leading to high consumption levels, often well over prevailing design norms, which ranges between 120 and 230 lpcd (FINDETER, 1991).

Access to water needs, in equal way for everybody, demands a integrated water resources development and management approach, which include aspects as to use water efficiently and to dispose waste water without compromising the environment. However, within the framework of the decentralisation policy that is actually happening in the country, where the Colombian municipalities has been placed in charge of the provision of water services, it is necessary to clarify how different development actors at regional and local level recognised the key element involved in the Water Resources Management Principles.

In the context of the project "Promising Water Resources Management Approaches in the Drinking Water Supply and Sanitation Sector", which is supported by the United Nations Development Programme (UNDP) and the IRC International Water and Sanitation Centre, the case study presented here evaluated at the local level in a rural area, the principles agreed in Dublin related to water resources management.

The document comprises four chapters. In the first the background of the case study are presented, showing the existing infraestructure in the locality, the criteria for its selection as a pilot demonstration project. The second chapter presents the overall assessment method of the project, gives an overview of the procedures and methods used for the compilation of the information and its subsequent interpretation and management. In the third chapter, for each one of the WRM Principles addressed, it is presents the methodology used, results, lessons learned, perspectives and highlight key project findings. Finally, in the fourth chapter the conclusion of the case study are presented.

CHAPTER 1

BACKGROUND

1.1 Tolima department general information

The department of Tolima, as shown in Figure No. 1, with its capital, Ibagué, is located in Centrewestern Colombia, between the Central and Western mountain ranges, on the River Magdalena valley. It is approximately 23,562 Km ^{2}, representing 2.1% of the total surface of the country. It has 46 municipalities and nearly 1,900 townships in the rural zone, of which approximately 80% is located in the mountains. The 65% of the population lives in the towns and 35% in the rural zones.

According to Unidad Regional de Planificación (Planning Regional Unit - URPA) of the Secretary of Agriculture and Development, there are 34 rivers of importance in Tolima, of which 24 are born in the region and flow into the River Magdalena. It is the largest and most important river in the country. There are 76 catchments (rivers flowing into the River Magdalena), 310 smaller catchments (flowing into the basins) and 136 microcatchments (with no flowing).

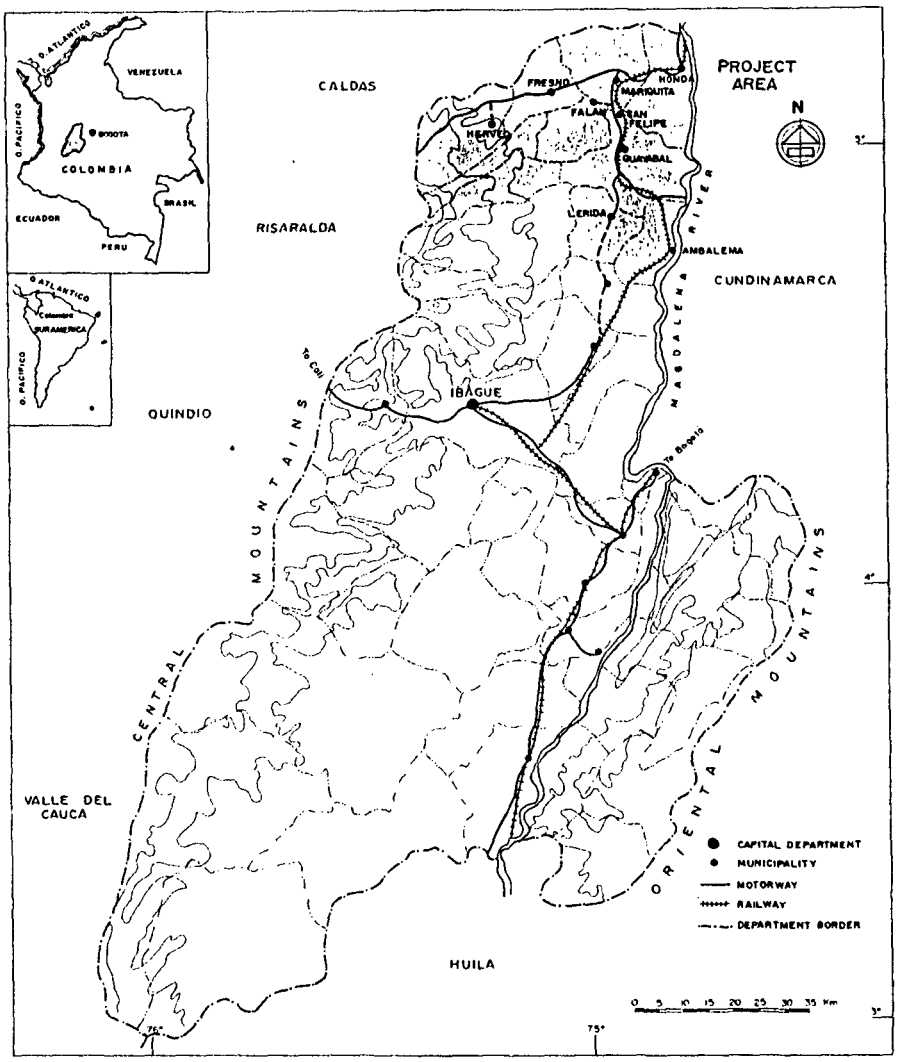
All the catchments areas show intervention signals. According to CORTOLIMA (1995), the current demand for firewood is estimated in 188,485 m^2 equivalent to 7,852 hectares of wood cutting, while only 2,500 hectares of trees have been planted in the past 10 years. That is, an average of 250 hectares per year. Erosion affects at the moment 3,319 Km^2 approximately representing 14.1% of the total area of the department.

On the other hand, the total combined load of non-treated sewage flowing into water sources in Tolima department is 29.86 tons/day, that is 10,898 tons/year. In the coffee plantation regions, the water which results from the coffee bean cleaning represented a combined organic load of 498,738 tons, equivalent to the sewage pollution produced by a city of 5.7 million inhabitants.

Regarding the treatment of the sewage, only 2 of the 46 municipalities (Lérida and Armero-Guayabal) have treatment systems with oxidation ponds. In Ibagué, the Municipal Institute of Aqueduct and Sewer (Instituto de Acueductos y Alcantarillados), IBAL, has undertaken a large programme of sewage recollection and treatment to protect the River Combeima, which gets a Total Combined Load of 13.80 tons/day when it flows through the city. In the rural areas of the department, there is 43% of coverage with individual sanitary systems.

Respect the solid wastes, in the urban area only 8 (17%) municipalities have applied systems such as the sanitary filling for availability. At the moment, other 9 (18%) municipalities are building or have already designed their correspondent sanitary fillings. Pollution due to rubbish is estimated 660 tons per day in the whole department.

FIGURE 1 Project area.



1.2 *The San Felipe case study*

The present case study was developed in the disaster area generated by the Nevado del Ruiz volcano in the northern part of Tolima department. The volcano began to erupt on November 13, 1985, which caused an avalanche of melting ice, water and mud which ran through the basin of the Lagunilla river and devasted the city of Armero, leaving 20,000 people dead and 5,000 homeless. Another 18 neighbouring communities were also affected and approximately 3,000 hectares of the most fertile land in Colombia were buried under the mud.

This disaster also affected the existing sanitary infrastructure and brought about the migration of the survivors to the adjacent villages which caused a very delicate sanitary situation because as existing sanitary services were not sufficient for the increased population. This brought about an international campaign, which resulted in emergency measures such as the improvement of water supply and sanitation systems including waste stabilisation ponds to treat the sewage of Guayabal and Lerida municipalities.

It was clear that serious sanitary and health problems caused by the disaster, would not be solved by only providing sanitary infrastructure, but also required capacity building in the institution in charge of the implementation and management of the systems in the area. In 1988 with support of the British Red Cross, the Tolima Health Service also with the counselling of the University of Surrey (UK) and the Cinara Institute, developed a Water Surveillance and Control Project for the improvement of environmental health. The project involved activities such as training workshops organised for sanitation promoters and community technical staff, field work using sanitary inspection formats and field equipment for the analysis of water quality.

The general information produced was reviewed about estimate coverage of the water supply systems and the bacteriological quality of the water produced, and also information on the operation, maintenance and management of the systems in the disaster area. Once the main causes of the problems were identified, the next phase included the implementation of a demonstration project of water supply with non conventional treatment. Making use of the opportunity that a technology transfer project on slow sand filtration was initiated in Colombia, one of the communities evaluated, San Felipe, was selected to implement an integrated demonstration project on drinking water treatment.

The locality of San Felipe is located in the north of Tolima department. The locality is 106 Km from the department's capital. The land is flat and is 450 m above sea level, with an average temperature of 27^{0}C. The community has 120 houses and approximately 650 inhabitants of which the great majority are peasants. There are two centers of primary education, a health post and police station, rural electrification and telecomunications service.

For the demonstration project the San Felipe locality was selected based on a following criteria which took into account the technical, economic and social viability of the project (Quiroga, 1994):

- the community is representative for communities in the area;
- it has active community leaders in search of solutions to their various problems;
- the community, knowing of the poor water quality, was in agreement with the measures to improve the system;
- public sector agencies interested in the experiences to promote its replicability in other regions, were present in the areas and willing to participate;
- the community and treatment plant are easily accessible and have suitable facilities for training and dissemination.

The demonstration project included the construction of a filtration plant comprising a combination of different roughing filters as pre-treatment with slow sand filter followed by a desinfection unit. This technology which is now called multi-stage filtration, is an appropriate alternative for drinking water treatment for small and medium communities and especially in rural areas where the existing infrastructure is not very well developed. The water treatment plant has now been functioning for five years.

1.3 The San Felipe Water Supply System

The gravity system, was built in 1968, amplified in 1979, and using the investments effected after the Nevado del Ruiz volcano disaster was rehabilitated in 1987, including the sand filtration plant. The system consisted of: intake, conduction line, sedimenter, up-flow slow sand filters (with filtration velocity of 0.40 m/h), storage tank with a capacity of 70 m^3, disinfection and distribution network in a length of more than 8 kms. The network was improved in 1984 and some water meters were installed that were rejected by the community.

The system is supplied by the Murillo river, which upstream the intake receives the residual water discharges from Falan municipality (2,125 inhabitants) and wastewater originating from washed coffee grains.

An evaluation of water quality supplied by the system, showed microbial contamination and turbidities in a range of 22-300 UFC/100 ml and 5-40 TU (CINARA, THS, Robens Institute, 1989). Terminal disenfection was not applied. The treatment plant was not operating adequately, and in the rainy season was "by passed" because:

- The upflow slow sand filters and sedimenter were the only treatment barriers;

- Given the absence of a roughing pretreatment system and the high filtration velocity[1], in the rainy period, the turbidity peaks were penetrating the slow sand filtration units, forming a mud cap of almost 6 cm thick in the upper part of the sand beds;
- There were no entry structures, nor flow control regulators;
- Due to construction deficiencies, the walls of slow sand filters remained smooth, causing short-circuits in all the structure, furthermore, for lack of protection of the filtered water, the effluent was poor;
- The sand washing was deficient due to the upflow wash process that was very difficult for the operator.

The treatment plant was redesigned in May 1989 for the optimal improvement of the system. The design of the treatment barriers was based on: pluviometric information, where according with data from 18 years, the rainy season is between March-May and September-November months of each year, with maximum precipitation of 202,2 mm on average; raw water quality study (Table No.1), the results obtained from a research project in pilot units for processing water from a valley river (Rio Cauca) (Quiroga, 1988), and also on treatment plants processing water from mountain rivers, all located in the Department of the Valle del Cauca in the south western region of Colombia (Galvis et al, 1989).

TABLE No.1
Faecal Coliform Descriptive Statistics. San Felipe Water Supply System (FC/100 ml). March-November 1989

DESCRIPTIVE STATISTICS	RAW WATER LOAD
Mean	194
Standar Dev.	138
Min	32
Max	700
No Samples	74
Range of Confidence (95%)	(163-225)

The treatment barriers selected, including a new CINARA development in pretreatment stage, have been introduced in the multistage filtration technology, enabling the removal of most bulk material in the first stage while the following ones remove fine particles and microorganisms (Galvis, 1992). The system's improvement included the following stages:

Dynamic Roughing Filtration (DyRF), that includes a fine gravel layer on the surface and an other of roughing gravel in contact with a lower drainage system. The filtration is downflow. The cleaning

[1] The flow design was of 5.0 liters per second (lps), however, in the system evaluation was found that the flow affluent was 7.0 lps, that was generating a filtration velocity of 0.56 m/h.

is done once or twice a week raking the fine gravel layer (Galvis et al, 1991). The old sedimenter structure was modified for the new DyRF treatment barrier.

Upflow Roughing Filtration in Layers (URFL), consists of a single unit with different size gravel in layers from bulk in the bottom gradually becoming finer towards the surface. This stage has the advantage that the retention of the solids occurs in the lower part of the filtering bed, therefore its removal is very easy by the drainage system of the unit (Galvis, 1992).

Slow Sand Filtration (SSF), designed with the inflow control, starts the filtration run with a minimum water level of almost 20 cm, required to overcome the losses with a clean filter bed and gradually to increase the level as the sand becomes dirty, which permits flexible operation of the system without demanding too much time in its control (Visscher et al, 1992). A new unit was designed in order to reduce the SSF filtration velocity.

Energy dissipation structures were designed for the inflow of water to the slow filters. Also structures for the storage of washed sand and for its washing after each scraping were designed. In the Table No.2 and Figures No. 2, 3 and 4, the San Felipe water supply scheme and the redesigned water treatment system and basic parameters used are shown. The construction phase was begun in June of 1990 and was finished in March of 1991. Subsequently it was put into operation.

TABLE No.2 BASIC DESIGN PARAMETERS

ROUGHING FILTRATION										
DyRF						URFL				
FLOW (lps)	GRAVEL BED		# UNITS	AREA PER UNIT (m^2)	FILTRATION VELOCITY (m/h)	GRAVEL BED		# UNITS	AREA PER UNIT (m^2)	FILTRATION VELOCITY (m/h)
	SIZE (mm)	LENGTH (cm)				SIZE (mm)	LENGTH (cm)			
3.5	6.0-9.0	20.0	1	2.76	4.5	3.0-6.0	30	2	8.4	0.75
	12.0-19.0	25.0				6.0-12.0	30			
	19.0-25.0	20.0				12.0-19.0	30			
						19.0-29.0	30			

SLOW SAND FILTRATION					
# UNITS	TOTAL FILTRATION AREA (m^2)	FILTRATION VELOCITY (m^2)	SAND SIZE		SAND BED DEPTH (cm)
			D_{10} (mm)	C_u	
3	84	0.15	0.19	2	100.0

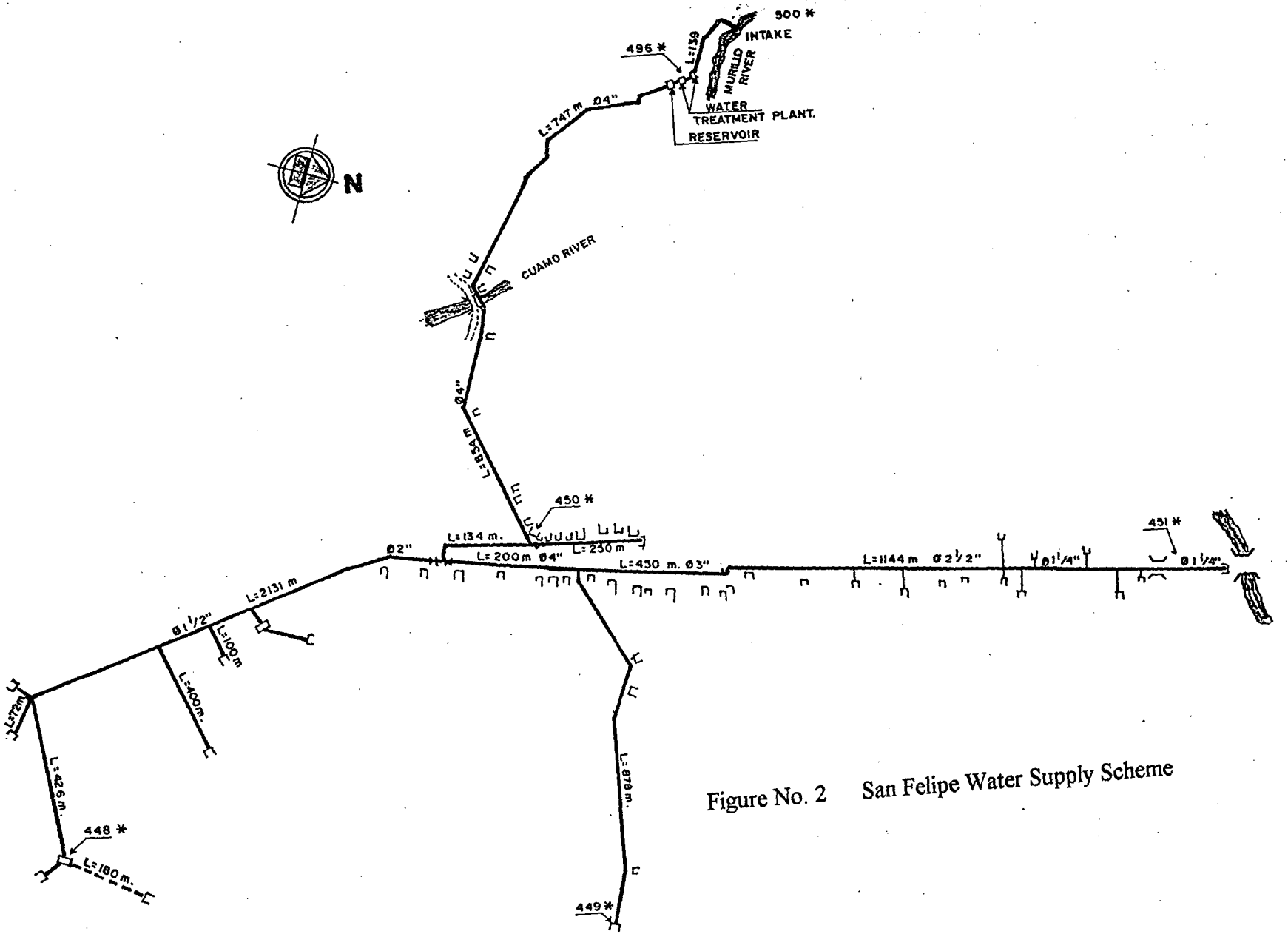


Figure No. 2 San Felipe Water Supply Scheme

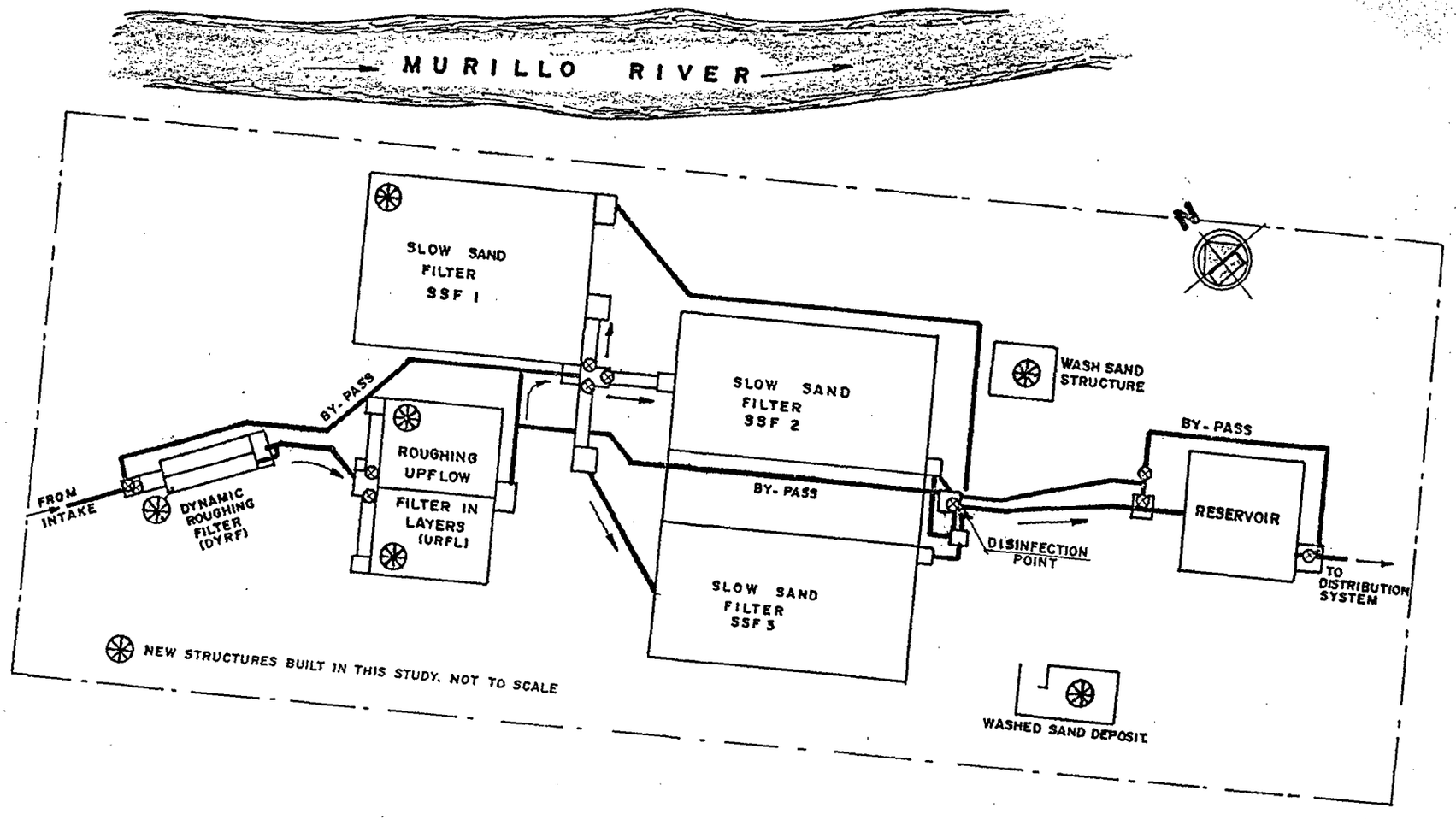


Figure No. 3 San Felipe Water Treatment Works

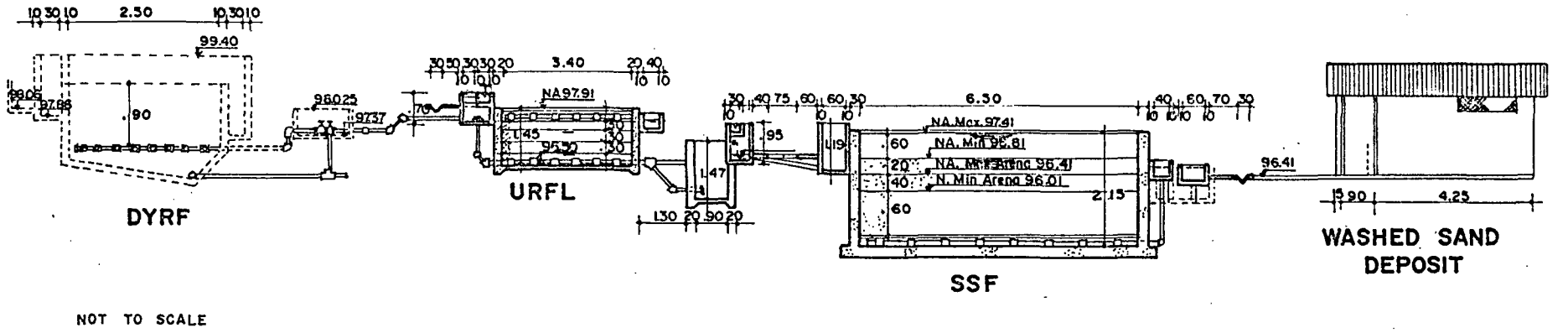


Figure No. 4 Profile of the San Felipe Water Treatment Works

CHAPTER 2

OVERALL ASSESSMENT METHOD

For the achievement of the case study, a series of preparatory activities were organised which included: institutional contacts to create an interinstitutional and interdisciplinary work team with participants at a regional and local level; creation of the team preparation and training workshop for the project development; format design and elaboration to collect data among the different factors identified with the actions of the water resource at a regional and local level; the development of the fieldwork in San Felipe; systematization and analysis of the collected data, elaboration the document of the case study. The development of the main activities was:

2.1 Institutional contacts to prepare the workshop

The preparation of the activities for the development of the case study were initiated with meetings at a regional and local level which were oriented to achieve the support and willingness of the executives for the creation of a work team and the organization of actions of training and development of the fieldwork. The meetings carried out were:

- In Ibagué, the capital of Tolima, with the executives of the Tolima Health Service and CORTOLIMA (entity responsible for the management of the water resources in the department). As a result, support was gained for the project execution, and the appointment of two officials per institution in order to participate directly during the project work.
- In the municipality of Armero-Guayabal, where San Felipe depends on, administratively speaking, to establish contacts with the mayor for the training workshop organization in such municipality and achieve their support in the project execution. Participation of UMATA (Municipal Unity of the Agriculture Technical Assistance), Municipal Planning Office and Municipal Office of Works was achieved.
- In San Felipe, contacts were established with local leaders and members of the administrative committee, to whom the project was presented and they were invited to participate in the activities which would be put forward in the area.

2.2 Workshop development

The workshop was programmed to be carried out within three days of continuous work, one of which corresponded to the field work in San Felipe. The activities were:

- Presentation by Cinara of the international context regarding the action of the water resources, such as the Promising Water Resource Management Project.
- CORTOLIMA officials presented the legal frame of the water resource management in the country and in the department.

- Revision of the indicators proposed for each participant and for each one of the 8 principles, to introduce adjustments adapting them to the conditions of our national, regional and local context.
- Presentation and discussion of the proposed techniques for data collection.
- Creation of the work team, which was co-ordinated by the engineer Eduardo Alfonso Lozano of the Tolima Health Service.
- Field work in San Felipe using the techniques for data collection applied to the Administrative Committee, operator and the community.

As shown on Table No. 3, 16 officials attended the workshop representing 5 institutions and 2 community leaders. The workshop attendants were divided into 4 groups representing a participant: Institutions, Water Administrative Committee, System operator, and community. Each group analysed the questions for each one of the principles which had been previously handed out in the correspondent format and they presented them before the others using one of the techniques previously explained. A group was created out of the participants to gather information related to the topic. The group which found inconsistency or would not apply to the specific case of the region, would write an explanatory note on the format.

Table No. 3 Participants in the development of the case study.

NAME	*PROFESSION*	*INSTITUTION*
Salma A. Guarnizo	Agriculture Engineer	Cortolima
Mauricio Flesher	Sanitation technical promoter	Espinal Hospital
Avelino Quintero	Sanitation technical promoter	Armero-Guayabal Hospital
Germán Murillero Oviedo	Biologist	UMATA Armero-Guayabal
Eduard Castro Cardozo	Technical promoter	Cortolima
Fernándo Mollona	Teacher	Municipal Education Office
Dagoberto Gutierres	Teacher	Cortolima - Pacofor
Fernándo Molina	Teacher	Jiménez de Quesada School
Daniel Varón	Teacher	Jiménez de Quesada School
Agustín Vargas	Comerciante	San Felipe Community Leader
Jhoanna Magally García	Agriculture Engineer	UMATA Armero-Guayabal
Julio Cesar Quintero	Sanitary Engineer	Tolima Health Service
Eduardo Lozano	Sanitary Engineer	Tolima Health Service
Jaime Buenaventura	Comerciante	San Felipe Water Board Treasure
Fernándo Gomez Vargas	Technical promoter	UMATA Armero-Guayabal
Roman zarate	Sanitation Technical promoter	Tolima Health Service
Eliud Díaz Barreto	Sanitation supervisor	Tolima Health Service
Jose Alberto Granada	Sanitation Technical promoter	Tolima Health Service

For the group work with the Administrative Committee a mapping for the whole system was used starting from the basin to the houses and in this way all the questions were contemplated in the principles one by one. It was a long process due to the large number of questions and

principles. With the operator it was used the technique of time of daily use, discussing topics dealing with each one of the applied principles. There were some questions which could not be answered because this type of information is not handled. With the Institutions, the Venn Diagramm (Diagrama de Venn) and the basin map were used. It could be noticed on the Diagram the relationship at the institutional level, mission and co-ordination among them.

2.3 Field work in San Felipe

After the group acknowledged the principles, the participants involved, the questions for each specific principle, and the techniques, the field work was carried out in San Felipe. The group was divided in three: one worked with the Administrative Committee, another with the system operator, and the third group with the community. CINARA always supported and oriented them.

Visits were carried out where, with the involvement of residents, especially women, a relationship of data exchange and identification is established of the aspects influencing, particularly, in water management in the region. A format of visit was elaborated and 10% of the houses was chosen based on the water distribution network, locating them at the furthest points and centre. At the end of the visit, a socialization of the information gathered was carried out together with the committee and local leaders, and an assessment of the event.

The interesting part of the techniques, according to the participants' comments, was in allowing crossings with the collected data as the perception obtained by the official with the committee in the water use, or protection and recovery of the basins, for instance, is visualised when work is done with the operator or they visit the houses and talk to the residents. Moreover, a conversation is established to create a fluent process with the interviewee. It was also established that the techniques can be adjusted and applied to different specific contexts, for instance, a school teacher said that the techniques could be co-ordinated to explain his students the mathematics processes in topics of interest. Officials of CORTOLIMA acknowledged that it is important the richness of information generated with the techniques and the reliability of the information as it is directly obtained from the field and from different local participants.

CHAPTER 3

WATER RESOURCES MANAGEMENT PRINCIPLES ADDRESSED

3.1 Principle 1: Water resource and catchment protection are essential

3.1.1 Methodology used

- A group was organised formed by four people from three institutions: UMATA, Municipal Education Office, and a community leader from San Felipe.
- The mapping technique was used to obtain a general overview of the system, from the catchment to the water distribution in the houses.
- Once the map is acknowledged, the rest of the people brought information.

3.1.2 Results

*** Water quantity and quality in the catchment area**

Regarding the quantity of water, during the last five years, according the community's observation, the operator and the Committee, the flow has decreased. The community people state that in the past it was possible to use the Murillo River for recreation but it was no longer possible due to flow decrease.

Although the flow decrease is noticed in the small catchment, it still has capacity to fully supply the different needs such as: water system supply, cattle, coffee bean cleaning and agriculture. Therefore, no problems have been observed up to now as far as water use is concerned. Anyway, according to the members of the Committee in San Felipe, the idea to initiate a reforestation program has started to expand. However, they are conscious that landowners are not ready to give away lands for this purpose and it is not easy that they accept programmes or agriculture methods appropriated for the catchments and soil recovery. 100% of the interviewees expressed that the quantity of water at home is enough, and, moreover, they have a house storage in the event of water cuts.

For crop watering, rainfalls are the most important source of water. They use the water from the small catchment to this aim but at a lower scale. They assured that water from the aqueduct is only used for human consumption as they are aware that they should make good use of it.

As for the quality, different contaminating factors have appeared in the catchment supply area of the River Murillo. Among these factors are:

- The mining activity which was expressed in the water taste and in the community complaints because their health was affected. At the moment, this problem has been under control as the mining activity stopped.
- The agriculture activity carried out by the misuse of insecticides for coffee plantations. Nevertheless, no continuous analyses have been carried out which help to determine, systematically, the toxic content poured in the water.
- Pouring of sewage caused by inhabitants of the municipality of Falan (2,500 inhabitants) located in the upper part of the catchment. There is also a farm where contaminated water from the pigs is poured directly to the river without any kind of treatment. According with Tolima Health Service report, the microbial quality of the raw water in the intake is in average 3,295 Faecal Coliform in 100 ml (in a range of 54 to 138,000 FC/100 ml).
- Deforestation and enlargement of agriculture barriers in the catchment area. These have generated the erosion process of soil increasing the turbidity of the water. According to the report from the system operator, using a portable column that comes included en the "Del Agua" testkit, between 29 March and 8 May, 1994, show turbidites in a range of 75 to 300 TU. This affected the filtration runs of the slow sand filters, that initially were of four months on average, and were reduced to one month and a half months (Quiroga, 1994). During the visit no updated data was obtained because the operator left and the new person in charge was not trained for the development of this activity and, moreover, supervision of the administrator and institutional support of the Tolima Health Service became weaker.

* **Institutional support programmes for water resource and catchment protection**

CORTOLIMA, together with other three regional environmental corporations of the neighbour departments of Quindio, Caldas and Risaralda, in the frame of PAFC, *Plan de Acción Forestal de Colombia* (Plan of Forest Action of Colombia), are undergoing the project PACOFOR, *Desarrollo de la Participación Communitaria en el Sector Forestal* (Development of Community Participation in the Forest Sector); it creates the conditions in order to have a conscious use of the forest richness contributing to the stability and recovery of water resource.

The current project, with the Government from Holland and FAO co-operation together with the National Government, aims to contribute to the improvement of peasants life standard of the Andean zone of these four departments, by means of forest and forest plantation activities self-conducted, identified, designed, implemented, and assessed by the community.

Through strategies such as community organization and participation; training; forest community self-diagnosis; motivation and accompaniment; linking of the forest sector to the productive system; the development of enterprise spirit and institutional co-ordination the project has as immediate objectives to create temporary or permanent communal tree nurseries, create forest plantation for different purposes, protect catchments and water flow, create a conscious management of rainforests, recover and preserve soil and support the development of small associated forest enterprises.

Regarding pollution, CORTOLIMA has established mechanisms to make physic-chemical analyses of river water. However, there is not a programme of surveillance and control for the small catchment supplier to carry out regular follow-ups in the area of water resource. Visits are carried out on time requested by those interested or by the community if any problem is detected in the catchment, but it is not part of a monitor programme made by the institution. One of the reasons the institution states is that there are only 6 technicians to cover the entire department what makes this activity difficult to follow up; moreover, the lack of economic resource is another important restriction.

The Tolima Health Service with the support of Cinara, is initiating the implementation of a project of *Surveillance and Control of Water Supply Systems* which makes emphasis on rural communities. It has a methodology including actions of participant diagnosis; training workshops to technicians of sanitation; sanitary inspection of the water supply system and catchment. It is a very important planning tool which enables to identify and assess on time, by the institution or community, deficiencies and restrictions affecting or might affect the normal condition of the catchment and water system.

3.1.3 Lessons learned

This principle drew the attention of the people called as they are aware that while the catchment is in good conditions, the water treatment for consumption will be available. Moreover, they agree living in the catchment area and the proper use of the resources found there, should be two elements compatible between them.

The lack of participation at a local level in the catchment protection, has led to a critical deteriorated situation of the water resource in terms of quantity and quality. No programme of surveillance and control has been implemented by the institutions with a social responsibility in this field, neither has it been integrated to the community so existing and potential problems can be detected on time and the priorities for the relevant activities can be established. The way institutions operate, is on the ground of punctual requests of the community and not as a systematic programme of action.

Also, it was evident, that in the way more projects are created joining inhabitants from the upper areas as well as those from lower ones, it will be possible to avoid situations such as the one in San Felipe. While the catchment areas make of them rich in biodiversity which represents the possibility to have access to the resources allowing human survival, the generation of conflicts of interests in these areas has become a reality which needs to be faced. The projects have to be designed based on the creation of relationships between the different users. That is, those who only benefit from the resource water just because they live in the lower areas and those who, besides benefiting, can be considered potential producers.

3.1.4 Perspectives

Based on the context and situation of the water resource management in the area, there is some slight possibility of change as the conditions are being created at a political level as well as legal and institutional to make operative the effort and concern towards the protection, recovery and preservation of the catchment suppliers. Given that this concern is at a community level as well as an institutional one, a team work is required among institutions of the water resource sector, community and local level in the search of the expected results.

3.2 *Principle 2: Adequate water allocation needs to be agreed upon between stakeholders within a national framework*

3.2.1 Methodology used

- The team which worked on this principle was formed by four people: one from CORTOLIMA, two representatives of the Armero and Espinal Hospitals and one from UMATA, Armero-Guayabal municipality.
- The technique used was the Venn diagramm having as reference the water resource. The type of relationship different organizations, from the government or community, have with water was illustrated.
- The people elaborated the diagramm based on their knowledge of institutional officers. They exchanged data with the other participants when they put forward the results. What other groups put forward helped as information to complement aspects the diagram did not show.

3.2.2 Results

*** National Framework**

The Law 99, 1993, created the Ministry of Environment, re-organised the Public Sector of the Environment Preservation and Action and the Renewable Natural Resources, and organised the Environment National System (Sistema Nacional Ambiental-SINA). This is the national framework which rules the Colombian environment policy. This Law gives the Autonomous Regional Corporations, as Corporate entities, the duty to administrate within their administrative area, the Environment and Renewable Natural Resources and expand their affordable development based on the Ministry of Environment policies.

Regarding the legal dispositions in the protection of the water resource sources, the Article 43 of this Law states that for the use of water by juridical, public or private people, fixed rates will be charged by the Government which will be to pay the expenses for protection and renovation of the water resources. To sum up, it is established that every project involving the use of water brought in a direct way from natural sources, whether it is for consumption, agriculture, recreation or any other industrial activity, has to pay no less than 1% of the total investment in recovering, preserving and surveillance of the water catchment.

The Article 111 of this Law states that the projects for the construction of irrigation districts should pay a percentage of no less than 3% of the total cost to the acquisition of strategic areas for the conservation of the water resources which provides the water. The minimum area of protection of a running, stream or river, whether it is 30 Mts. at each bank in relation to the maximum sides of the water, for sources is of 100 Mts. round about. The people who interfere in the reforestation are stopping the maintenance of the catchment or source and, therefore, will be liable for sanctions by the State. This Article also states the interest for areas of strategic importance for the conservation of the water resources which supply the municipal and district aqueducts. The departments as well as the municipalities should pay, for a 15 years, no less than 1% of their income with the purpose of having paid the total cost for those areas before the period ends.

* **Application of the legal frame in the region**

CORTOLIMA is establishing agreements with the users associates having a legal proxy to buy property around the catchment areas. The institution provides nearly 100% of the total cost of the property which, by law, keeps the property title, however, management is by the community through the association. The Administrative Committee of the aqueduct of San Felipe does not have any agreement of this type with CORTOLIMA yet, although the situation of the catchment requires it.

According to the national legislation, the institution responsible, at a regional level, in case of having the concessions is CORTOLIMA. There is a procedure through which those interested conduct, before the institution, the application for the use of the resource. They should present a study of environmental impact, a management and alternative plan, depending on the situation. When it is requested for water for blocks of flats, a certificate is demanded from the Municipal Planning Office, to prove that the construction will not spoil the urban development plan.

In the rural zone, water is assigned previous request by the potential user in which it is specified the use it will be given. If it is for consumption, it should be informed the number of people who needs the resource. The institution carries out a visual inspection, it assesses the needs and calculates the amount that should be assigned. In the use of the water resources, human consumption has priority over any other use. It follows, cattle, agriculture, and industry. The amount assigned, in average is as follows: if it is for human consumption, the concession is from 200 to 250 lpcd for 10 to 15 years, depending on the situation; if it is for irrigation, depending on the type of agriculture, is 2 l/s per hectare provided that the water resources are enough; if it is for animals, is 60 l/d per animal.

Nevertheless, there was no information about some river regulations, stated by CORTOLIMA, regarding the flow available in the zone of Armero-Guayabal. The regulation is an analysis of the catchment in every aspect. By means of measurements the maximum, minimum and average flow of the catchment is estimated.

Water distribution is done based on the data of minimum flow to avoid future controversies. Once the data has been produced, it is announced, to all the means of communication, in the town hall, UMATA, a project which calls all those who might be interested in using the resource. Or, on the contrary, there are requests on the resource, it is also announced allowing a month to whom may claim the same right. Thus, it creates the participation of people in which their request the petition of water before the institution. Once the resource is distributed, CORTOLIMA ensures that the remaining of the catchment is 20% of its maximum flow.

It is important to mention that it is considered the decrease of quantity of water in the superficial sources and the variation of its demand for different uses. The institution has planned to do a redistribution following the guidelines of the procedure for the assignment. This procedure is very important because the institution produces an information and makes a decision from a survey opened to all the participants involved.

In San Felipe, the Administration Committee carried out the paperwork of law before CORTOLIMA and now they have the official concession of water for the supply system. For a new user, the mechanism of connection to the water supply is done through a petition to the Administrative Committee which should approve the applications provided that it is available. For instance, at the moment, the petition of connection for a new neighbourhood of 32 houses has been denied because they believe there is no water available. Such is the case also with a chicken farm near San Felipe which gets water from the system but the community demands the service to be cancelled on the grounds that the farm uses water for industrial purposes and the Committee has not established the industrial tariffs yet.

3.2.3 Lessons learned

In Colombia and chiefly in Tolima, conditions are being generated so the responsible entities providing the services make legal the water concessions as in many of the zones this process has no been yet fulfilled.

There is no systematic distribution of the resource, which makes that sectors with strong economic power benefit with respect to others, as it is the case of sugar cane manufacturers which require large quantities of water for the plantation irritations.

Nevertheless, the methodological process followed in the study case, the institutional group which worked on this principle, makes reference to the water assignment in the small catchement area, while for the operator and Committee, this is understood from the point of view of the water distribution network. It was clear that the work of each institute is not interrelated with the other ones.

3.2.4 Perspectives

As a result of the workshop, the proposal established of working in co-ordinated way between CORTOLIMA and the other institutions, having under consideration that the officials are

present in the zone itself. Moreover, it is important they work allow having an impact in the region environment policies.

3.3 *Principle 3: Efficient water use is essential and often an important water source*

3.3.1 Methodology used

- This principle was formed by five people from the Tolima Health Service, CORTOLIMA (PACOFOR), Health Centre and system operator of San Felipe.
- They illustrated, through the Matrix with ranking, most of the questions asked in the principle, from the participants point of view.
- The matrix socialization allowed to exchange and compare data with the other participants.

3.3.2 Results

*** Efficient water use national framework**

The Colombian government, with the Law 372, 6 June, 1997, has established the National Programme for the efficient use and water saving. It states that every regional and municipal environment plan, will have to create a series of projects and actions for a period of 5 years based on the diagnosis of the water offer of the supply sources and water demand. The programme of efficient use and water saving will be orientated to achieve some goals on a year basis of loss reductions, develop educational campaigns to the communities, the use of superficial water sources, rainfalls and underground water, determining the incentives and other aspects the Regional Autonomous Corporations determine, other environmental authorities and entities providing the sanitation and water services and those which manage irrigation and drainage projects, hydroelectric and users of the water resource.

Among the important aspects of the Law 373 the following can be mentioned:

- the obligatory nature in the reuse of used water, in primary and secondary activities when the technical and economic process requires it and advice according to the socio-economic analysis and environmental quality regulations.
- the compulsory installation of meters for water consumption to all users.
- the obligation of the user entities to include in their budget the costs of the educational campaigns and community awareness for the efficient use and water savings.
- the regulation to install equipment, systems and tools of low water consumption to be used by users.

* Institutional support programmes in Tolima

There is consensus among the different participants consulted, in that water misuse is a regional problem. However, they do not agree in the quantitative appreciation related to the formalities of requested information. There is no information about water availability for the different use, in the catchment as well as in the supply system.

Given the problems found in water misuse, the national government has been implementing an educational programme in small municipalities and rural zones leading to a positive influence in the community attitude in the adequate use, management and support of their water and sewage systems. The project has been denominated as *The Culture of Water* (La Cultura del Agua), and it is orientated to encourage the sociocultural aspects of the investment projects in the water sector, taking as the starting point the community participation. It makes a special emphasis in the institutional development of sewage and water services and it is expected to be considered financing policy by governmental entities and which aims to be the promotion of territorial development. One of its strategies of work is the collective work which seeks training and the joining of the different social participants such as housewives, organizations and school teachers in the process.

The project deals with topics such as the water sociocultural and environmental dimension, water system characteristics, the community participation in the service negotiation, self control, rates and measurements. It is a process in an analysis and assessment stage which is having adjustments in the methodology as well as in the teaching material. Armero-Guayabal is included in the project although, according to an official of the Ministry of Education, it has not yet been studied in depth. The *Defender Groups of Water* (Grupos Defensores del Agua) have been created as part of the project strategies.

According to the institutional officials, many of the negotiations for measurement extensions proposed for the efficient water use usually remain unfinished for the lack of decision, policy willingness and administrative effectiveness. In this sense, greater participation is needed by the locals whose consumption is regulated in the Law 142, 1994, in which it is established the national rule of public domiciliry services. This Law gives the civil society the right of this services through private or community entities. It is the expression of the recent process of administrative decentralisation which not only does it take place in Colombia but in many other countries. In Colombia it is evident the need of support in technical, financial and administrative aspects at a local level, whether it is public, private or community so it is under the conditions to assume its new role.

The UMATA work have also been very important in the municipality. However, their consultancy to the communities requires strengthening of orientation in the social aspects. Although it is worth mention that according to the officials, UMATA of Armero-Guayabal, have achieved to draw attention to these aspects. The PACOFOR project, dealt with in principle 1, constitutes an effort of the regional government in the promotion of efficient use of the water resource by the peasant community, in the area of agriculture-forest production.

* San Felipe experience

In San Felipe in 1991 once the system was in place using the distribution network, water demand was well in excess of the treatment plant design which was based on a supply of 200 lpcd. An inspection of the distribution network with the water committee, showed that over 90 per cent of the users had leaking taps, pipes and sanitary facilities. To solve the problem the community assembled in a meeting and decided on their own initiative to establish a period of some weeks, within which all users should repair the defects that had been identified and purchase water meters.

These meters were installed in January 1992 with technical assistance of the Tolima Health Service. A five months period followed of meter reading, without tariff implications. This showed that consumption levels in many households surpassed 350 lpcd and in some cases even rached up to over 1,000 lpcd. With these data the water committee with agreement of the community has established new tariffs, which favoured a basic service level of less than 40 m^3 per household per month and discouraged higher consumption through incremental tariffs.

This approach helped to bring down the average consumption of 90 per cent of the users to 200 lpcd (range 60-500 lpcd). On average 70 users (61 per cent of the total), used less than 40 m^3 per month (Figure No. 5) but their total share in water consumption is only 25 per cent.

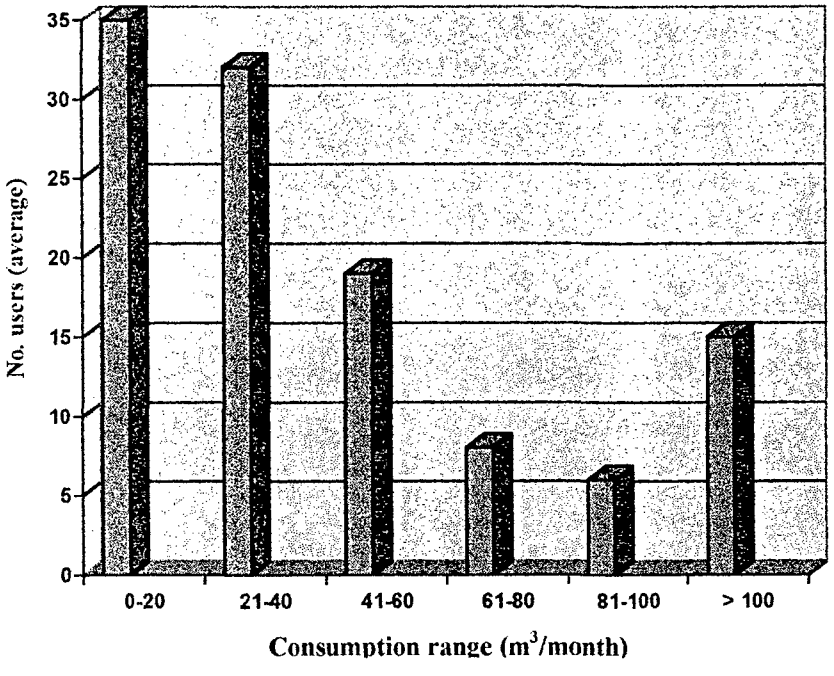


Figure No. 5 Distribution of consumers according to consumption level in San Felipe (Quiroga et al, 1996)

The high water consumers, with consumption over 81 m^3 per month representing 10 per cent of the users consumed 50 per cent of the total water supply (Figure No. 6). These large users include a small hotel and some cattle, chicken and dairy farms.

The smaller users maintained their service level after the installation of the meters and the consumers with lowest consumption levels, below 20 m^3 per month even somewhat increased consumption. The users with high consumption however initially reduced consumption as a result of the incremental tariffs. Gradually this effect was somewhat reduced as tariffs have not been raised since 1992 and consumption increased again, but not to the initial level. (Quiroga et al, 1996).

It was identified, in the work in San Felipe, that how a new user should pay the cost corresponding to the meter reading plus the costs for installation. Records have been kept of the volumes of consumption by the users, although due to current problems in the committee this control have decreased.

Based on the house visits, only 2 (16%) out of 12 houses visited showed leaking inside, one in the toilet bowl and another in the plumbing. None of the houses with storing areas shows leaks in such places.

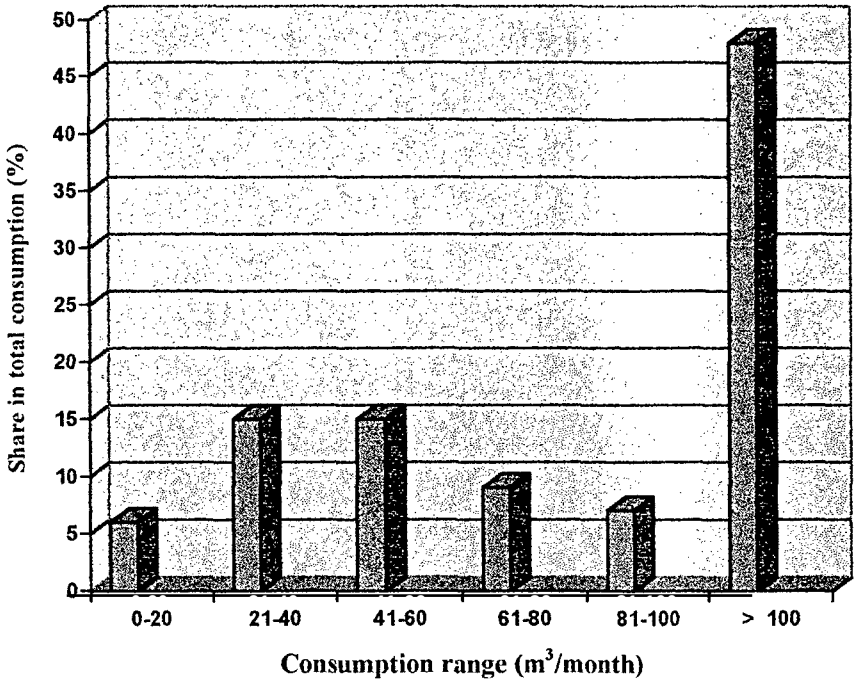


Figure No 6. Share of total consumption for users in different consumption ranges in San Felipe (Quiroga et al, 1996)

3.3.3 Lessons learned

This principle created a discussion atmosphere as in many places of the department large consumption over the recommended quantity by the institution, between is presented between 150 and 200 lpcd, increasing wastes and misuse of water. It has repercussions in the high costs for treatment, overloading of the treatment units, lack of opportunity for other users who need the service and the deterioration of the treatment units.

The questions were understood and easy to answer by the participants to the workshop and the community during the field practice carried out together. The effects of the overloading to treatment units and the implications to the responsible entity providing the service were not included. Although it is possible to say that awareness is raising from the people on the resource management and in general of the natural resources, it is not possible to state that there is a protective culture, responsible and completely strengthened.

For the members of the Committee of the Water Supply in San Felipe, more orientation towards the community is needed for the application of technical measures such as the installation of meter readings

3.3.4 Perspectives

The results clearly demonstrate the importance of participatory institutional support and validate a systematic approach to problem analysis and solving primarily by the community with support from the agencies. This approach has great potential to improve water distribution and reduce water loss in existing schemes which in turn has great impact on the production and treatment cost of water supplies.

3.4 Principle 4: Management needs to be taken care of at the lowest appropriate level

3.4.1 Methodology used

- A group formed by four people from: Tolima Health Service, CORTOLIMA, UMATA; and one person of the Water Supply Administrative Committee.
- The principle was emphasised on the aspects related to the system administration, taking advantage of the presence of a Committee member.
- The starting point was the supply system, which was sketched with the participants help and was part of the design process two years ago.
- During the work talk, it was possible to prove the limits of involvement of the Committee as the aqueduct administrator and of CORTOLIMA as the general administrator of the water resource.

- The indicators and questions related to the resource administration could be dealt with in the principle 2 and confirmed with the plenary of this principle.
- The questions in the format were followed to ensure they were discussed.

3.4.2 Results

There were difficulties to tackle this principle as there are two different scopes. On the one hand, the water resource administration, in general, and, on the other hand, the water supply system administration. The principle fluctuates from one topic to the other and this creates confusion to the people consulted. It was decided to answer with the participation of the local level in the administration of the public services, to deal then only, specifically, with the water resource administration.

In Colombia, after demonstration around the demand of public services, the new Constitution of 1991 has provided the spaces and mechanisms of participation which make possible the intervention in the processes. As mentioned in principle 3, the Law 142 of Public Domiciliry Services, opens a way for this process to carried out by the lowest possible level. Apart from providing the right to civil society of constituting their own supply entities of public services, it establishes three types of citizen participation to this respect. Let us see:

- The Committee of Development and Social Control of Home Public Services, being the members the users or the social organizations. Their aim is to: propose plans and programmes; make the community contribute with sources to solve deterioration in the service supply; request reforms or modifications in the stratification; study and analyse the financial help, criteria and mechanisms of fine to entities of public services.
- The right to claim and complain. Both procedures give the users or organizations the right to express their unhappiness with the situation with any official action, certain conditions of the service supplied or the billing. The user has the right to request the billing revision.
- The Executive Committees of Official Enterprises of Public Services. It refers to the users' participation only in official enterprises of the municipality.
- The Administrative Committees of Water Supply constituted by the community in cases that the provision of public services it is not under centralised entities management. Their functions are to: loan and direct public services; report the authorities of the anomalies found; request information to officials and citizenship about the help the entity of home public services offers.

In the specific case of San Felipe, the community has created the Administrative Committee of Water Supply, to which reference has already been made. This Committee is formed by five people, elected by vote in the users' general meeting. Besides being legalised by the community itself, it has legal proxy according to legal dispositions. Its functioning is ruled by the statutes in which the rights and responsibilities of users are established.

It is important to make reference here to the Guardianship Action (Acción de Tutela) one of the mechanisms stated in the Colombian Constitution in 1991, to which citizens have access in

order to give protection and claim fundamental constitutional rights. This "acts against every action or omission by the public authorities, which violate, have violated or attempt to violate any of the fundamental rights. It also acts against actions or omissions of particulars..."[2]. According to the law, public services are fundamental rights and in this view, any person whose rights are violated, can make use of this Action.

3.4.3 Lessons learned

The water resource administration, as explained in principle 2, is responsibility of the regional corporate, CORTOLIMA. It is important to stress here that there are some legal dispositions which are giving these responsibilities to Administrative Committees of the Water Supplies of acquiring and managing the strategic areas around the water intake. At the moment, the Administrative Committee of San Felipe has not initiated this procedure.[3]

3.4.4 Perspectives

According with Robbins et al (1991), based on a national survey of surface water systems and state primacy agencies and on case studies of 24 successful watershed management programs in United States, the most effective watershed control measures, according to water managers, were obtaining land acquisition by the water utilities. However, it is important to study in the Colombian rural conditions the possibilities to apply this measure where existing to many different conflicts and interests.

3.5 Principle 5: The involvement of all stakeholders is required

3.5.1 Methodology used

- This principle was analysed by the members of the Administrative Committee of the Water Supply of San Felipe.
- Through mapping technique of the supplying system and the Venn diagramm, answers were attempted to be given to the items on this principle.
- This was appropriate to complete and discuss, with the participants of the different institutions, the information from the above principles, especially principle 4.

3.5.2 Results

In San Felipe, for this principle, the Committee expressed the desire and agreement with the administration of the supplying system. They agree with the current scheme of administration through a users association who decide, with the community in general meetings and at meetings among there members, about the situations which have to do with the administration

[2] Decrete 2591, 1991
[3] See principle 1, the explanation of the article 111 of the Law 99, 1993.

of the service. They themselves decide the rate for the consumption and type of use, payment periodicity and sanctions for misuse, rights for the connection to the aqueduct, installation of meter readings, among others.

The administration of water source makes it the responsible entity of the water resources in the department, CORTOLIMA, and the Committee as well as the community agree that this responsibility should continue belong to the entity and not to the community.

As a result of the visits by institutional officials together with members of the community during the field work, 9 (17%) of them stated that they are told when there is going to be a water cut. In addition, 50% (6) of the interviewees stated that they do attend the meetings programmed by the Committee, in which decisions are made on topics related to the system management of water provision.

The municipal administration of Armero-Guayabal has planned the construction of 32 houses in San Felipe, for which they have requested the Committee the service of water supply, but it was denied on the grounds that water supply is not available. In this view, collection of water was proposed above the one San Felipe has but it was also denied as the severe dry season reduces the flow and there would not be water. The alternative is related to the construction of an aqueduct for such sector from another supply source. This data has been handled through meetings with the community and members of the Committee. This shows the community's participation in decision-making in situation which might affect their own interests. 50% of the interviewees expressed that their complaints are solved when they are presented.

It is important to emphasise that, in general, landowners of the zones where the water source is found for the community are not users of the service as they have their own system from such sources or from sources located in their own lands. They are owners of the lands but not of the superficial sources going through their lands; they are the State's and for its use it has to be requested before CORTOLIMA for approval. Therefore, there is not a close relationship between this two groups, upper part of the catchment and users as those from the upper part pour wastes into the source without considering the use by the people of lower areas.

The relationship among the members of the Committee is good and the decisions are made by vote, mainly for the management of their own resources generated with the rate payment and the management of operation and maintenance activities; there are no conflicts but there are doubts among some of the users in the management of aqueduct money by the Committee in that they fail to produce receipts and bills to the community. Regarding the operator point of view related to this principle, the group had several questions focused mainly to the relationship of the operator with his activity, community and committee who controls his work. How the operator is related to the community, complaints are dealt with, and how is communication with the Administrative Committee.

3.5.3 Lessons learned

This principle applies in San Felipe and the region of Armero Guayabal in the sense that the community is the owner of its own system and manage it with its own resources, but it does not have a direct relationship neither with the entity that handles the water resource nor with the inhabitants or the lands owner where the provided water source is located there is any direct dependence, they are only responsible for the service attention. Inside of the new plan about the handling water resource it is anticipated that the entities or people who make use of the provided water source must assign resources for its recovery and preservation of such sources with the support of the responsible entity in its handling in this case, CORTOLIMA.

In the water resources handling it is important the generation of spaces in where the own user can express his needs, demands of the service levels, participate in the decisions, in the negotiation and discharge of a attorney's duties related to the water resources. It is as just as the Constitution, inside its fundamental principles contemplate that is an essential end of the State, among others, "facilitate the participation of all in the decisions that affect them and in the economic, politics, administrative and cultural life of the Nation".

For the water resources sector it is also establish that there must be duties and rights of the users, and a government that legalise their participation in the management and attorney's duties of the lender companies of public services, which is legalise with the Law of the Public Domiciliary Services (Law 142 of 1994) through the creation and conformation of the Development Committees and Social Control of the Public Domiciliary Services, instances that operates in a municipal level.

3.5.4 Perspectives

The projects that are related to the water resources must ground as much inhabitants of the high parts as the low parts, users of the source, to generate a clear conscience regarding the good use that they have to give to the resources.

3.6 *Principle 6: Striking a gender balance is needed as activities relate to different roles of men and women*

3.6.1 Methodology used

- This principle was worked with 2 women of the community and 1 of the Water Board that make presence in the field work. It also depended on the participation of the 3 women who participated on the part of the institutions in the preparing's workshop.
- It was used the technique of the Venn diagramm and Pocket chart, taking aspects like: administration, decision, information, attendance, interest, etc. They were located so near or

so far of the center, illustrating the existing relationship between the community's woman and the mentions topics.

- In the socialization of the results, the current men brought important commentaries related to the topic.

3.6.2 Results

As much for the civil servant as far for the Administration Board it is important to take in mind the differences of kind for the System Administrations matter. It is recognised that the women participation has been traditionally very incipient while men has been always in charge of the processes of taking directions. For the administrator Board members the women's participation level is really low. In the cases which make presence to the meetings, their participation is not influential. This is assumed to the fear that she feels to acquire responsibilities in subjects which she has never have any link. Even, sometimes her attendance to the meeting surpasses the men, and no for this it increases her capacity of influence in the collective.

For the members of the Assembly the lack of influence, by side of women, in the decisive process of the collective life of the community, it is perceived as a negative characteristic of the Community. Not only in the context of the Assembly we can perceive the absence but also in other Communal public area. Specifically in San Felipe, there are few women who practice any kind of leadership in general terms. They think that the woman is already the person who has more relation with the water, she has to guarantee its insertion in the administrative subjects of the resource.

CORTOLIMA is advancing programs guided to motivate the participation of the family in subjects of the collective. The PACOFOR project , which has been mentioned in principle 1, thinks over between its strategies the community training in topics such as participation, organization and gender.

There is evidence in the community the necessity in producing offers in community work that consider the generic dimensions in the relationship between men and women. Both have the possibility of building multiple identities of gender and different kinds of relationships which can potentate their vital experiences as it is his relationship with natural resources.

The more frequent argument, presented by the members of the Aqueduct Board, on behalf of implementation of programs that incentivate the women participation in the administration of the supply system and in other matters of the community life, is that she requires training. By inference if the woman does not participate is not due to the lack of interest on her part but she needs knowledge to do it. To participate it is necessary to know to do it; it is not only the desire. With the Administration Board one can establish that the great participation in taking decisions in the Assembly concern to the men, around 70% and this situation is normal for them which does not mean that it does not have to change.

Concerning to the questions of this principle for each of the actors, the group admitted that boarding makes too much emphasis on quantitative considerations in detriment of the qualitative aspects. It is suggested to ask for example, what kind of activities are performing to motivate the women participation on Board matters, instead of asking "percentage of specific activities of gender."

For the operator case, it is suggested to make questions more suggestive in the sense of extending the question to know if there is any support from his/her husband/wife with: are there any women interested in training for being operators, for example.

3.6.3 Lessons learned

It is common to find in the majority of the working proposals with a gender focus, that the special emphasis is made on the matters related to the woman. It means, there is a presence of a strong tendency to conceive the genders focus as a collection of considerations and methodological actions head's exclusively to female population. Unfortunately, this conception neglects a comprehensive boarding of the relations between man-woman and forgets that the construction process of the individual and collective persons have an intimate relation with the construction of the identity, being this one female or male.

The projects that have as one of its emphasis the look of gender, must conciliate proceedings of a deep meditation about the identities conformation instead of giving recipes of few appropriation by the communities and the firms that work for the development.

3.6.4 Perspectives

Women often are the main responsible for water supply, sanitation and hygiene education at the household level and in the community. Therefore their active participation in the water resource management projects is crucial. It needs to be recognised however that the needs and interests of men and women often are different, and therefore a gender balance is needed to ensure that the views of all groups are duly taken into account.

3.7 Principle 7: Skills development and capacity building are the key to sustainability

3.7.1 Methodology used

- There is neither any specific group nor any special technique for the treatment of the indicator and key questions raised on this principle.
- The boarding of the previous principles, let go the necessary information to give answer to some points of this principle. As a resort there was revised the bibliography sources to complete the information.

3.7.2 Results

On an institutional level, CORTOLIMA has been driving training programs for the reforestation, environmental education for the functionary of the UMATA. By this year, it will be extended to the police functionaries and inspectors.

Taking as a basis the scholar population, the Tolima Education Office has driving the achievement of the Environmental Education workshops which have generated initiatives, by some educational centres of Armero-Guayabal, as the conformation of the Environmental Support Group which encourages a group of 60 students to learn how to identify the environmental problems of their region.

In Armero-Guayabal region has been performed agreements between institutions like Proxy[3], the House of mayor, the Health office and the UMATA with the purpose of giving continuity and enriching the environmental education programs to the community started by CORTOLIMA. As it was commented on previous pages, has been performed, in the region, activities of strengthen of the negotiations capacity of the communities inside the projects frame as the Water Culture. This project points out to generate processes of communal participation and organization that conciliate the improvements of the levels of the aqueduct and sewerage systems negotiation. To make operative its pedagogical purpose, its fundamental strategy is the creation of groups of communal instructors and promoters to be in charge of being multiples.

According to the new legal context, that grants to the civil society the right to fit and manage its own companies lender of domiciliary public services, the State has been publishing support materials to socialise between citizens as much duties as rights they have on their double quality of service lenders and of the users themselves. By means of this elementary treatise the citizens are guided to promote the participation of the communities on gestion works and surveillance on the lending domiciliary public services.

It is appropriate for the handling thematic on this principle, to refer to the surveillance and control of the supplied microcatchment area and the water system. Actually and based on a signed agreement between the Tolima Health Service and Cinara, the sanitation promoters of this governmental institution are working on an inspection and control program. By means of workshops they receive training for sanitary inspection, preparing and handling formats, handle of fields simplified equipment, communication and information handle, design and planning of communal workshops and communal participation. The workshops are completed with didactic material and field work. There are negotiations facing to try to mingle CORTOLIMA, by means of a working plan that makes possible the interaction between the functionaries in the field work.

With the intention of taking to the practice the precepts of the Participate Democracy expressed

[3] Proxy is a state entity which role is to represent the civil society rights before the State assuring that the Social State of Right which is Colombia, actually, is given.

in the National Constitution in force, the Government Minister, through the General Direction of the Integration and development of the Community Action (DIGEDAC), structure and support the Organizations National System and Communal and Social Participation. To achieve this, some of the functions are: assure that the social and communal organizations perform their objectives and give the necessary support to the promotion and development; facilitate a citizen and communal culture through the formation processes that allow to the social and communal organizations agree with the mechanisms of participation in the national, departmental and municipal area.

The DIGEDAC depends on, as a one of the four strategical areas of operation, with a school of Communal Formation that drives the following programs: design and socialization of pedagogical packets in constitutionals development organization, participation and communal autoeffort; a national and regional net of information programs and communal training; pursuit, evaluation and control to the educational proceedings of communal training

With regard to the participants of the Aqueducts Manager Board, have informed that they have received training from some institutional functioner, as the Tolima Health Service, CORTOLIMA and from Cinara in operation activities, maintenance and administration of the system of waters supply. Furthermore, the security furthered performs control activities of waters quality as well in the water source as in the system.

3.7.3 Lessons learned

There are many and important efforts focused on capacities development in the management of the water resource between the communities; however, it is unknown the real impact that these programs have generated in terms of the creation of a true participant culture and auto arranged in the use and handling of this resources. Besides, in the time of examine the programs repercussion, is more important its quantitative effects taking away attention to the socio cultural considerations.

According to the works made by Cinara (1996) in the frame of the Waters Cultural Program, with the support of the Water Supply and Sanitation Directorate of the Development Minister, in Colombia has existed a tendency in training programs promoted by the institutions, where the conceptual planner that base them, are not reflected on the materialisation of themselves. This is for example, the case of those programs that are oriented to tie up the culture dimensions and on its application, they end ignoring the knowing and traditions proper of the communities "object".

With regard to the educational, the methodological and didactic strategies of the programs, don not leak out the information transmission level. There is no expressed a continual educational process that makes possible a real creation of the conscience and dinamization of the culture.

3.7.4 Perspectives

One aspect that is not considered in the previous programs is the establishment of spaces for negotiation and concertation. Assuming that in around about the management and use of the material resources, are shown dissenting interest and frequently opposed, it is urgently to generate educational proposals where the negotiation of conflicts is a central thematic. There is a try, then, to create educational spaces that induce the construction of dialogue and communication persons.

On the other hand, it is necessary that the promoted training programs are conceived as an element of the development local process, regional and national, which is foundamented on a conception of the development that establishes the creation of conditions in which strategies and tools are brought making possible to the participants to be the makers in the construction of solutions to the problems they face. It is understood then, that the development is a process that implies a weakness of the creative forces of the communities, institutions and people insistented in changing their living conditions. For that reason, in the execution of the actions it is necessary to consider ways of working that facilitate the assertion of the participants as individuals and as a member of a collectivity of own cultural characteristics. Being a world citizen without loosing the roots, building an autonomy that confront the strain between the tradition and the modernity.

Based on the above, the activities to develop must start from the principles of the educational process, that could be registered in the planning expressed by the UNESCO (1966), from an education for the XXI century where four essential columns are rescued: "learn how to **know**, learn how to **make**, know how to **live together** and know how to **be**". This process then:

- Is centered on the man as a participant to break down with the passivity and apathy above all his surroundings;
- Assume as an essential element, the practice, an atmosphere well known and a coherent information;
- Assume the cultural identification as a basic aspect to make the work;
- Recognise and integrate the experiences and knowledge's of the participants;
- Persuade the generation of the transformation actions no only in the participants but also in the human group where he belongs and his context;
- Is flexible and consequently fits to a different situations;
- Is dynamic, to facilitate the relation: theory-practice-theory; and
- Reiterate the education as an activity for the whole life.

3.8 Principle 8: Water is treated as having an economic and social value

3.8.1 Methodology used

- No group was formed and no technique in particular was used to discuss the principle.

- In view that the topic of this principle is implicit in the others, it was possible to cover the questions and all of them discussed.

3.8.2. Results

As a result of the balance of the Water Decade, the water resource has a finite characteristic and for this reason it has an economic value in all its uses and therefore, it is an economic property. However, it is acknowledged that water directly affects the public, creating development opportunities, becoming, then, in the right that every human being should has access to clean water. Factor that makes of water a social property (Statement of Nueva Delhi, 1990; Puerto Rico, 1990; Delft, 1991; and, Dublin, 1992).

However, for these two concepts not to contradict, each person has right to clean water for a reasonable cost ensuring access to the poor. The nature of water of public property, of non exclusive characteristic (as potentially speaking everybody has the right to its use) leads that aspects such as source control, drinking characteristics, pollution, privatisation of its use and cost recovery, rates and financial help appear to be central elements in the debate.
Then, it can be claimed that this service should not be offered free of charge despite being public, as it is acknowledged this benefit has a cost with the following elements:

- Cost of water distribution to users, in which the cost of investment, functioning and replacement is included.
- Costs of opportunity.
- Environmental cost, related to the use itself of the water resource, whether it is for the own benefit or as receptive source of pollution; and,
- Cost of depression associated with underground sources.

The classification of water as an economic property means that the projects and their rate structure should be designed to give incentive to efficient and effective use of the services, having a balance between the economic value of water for users, the cost of service provision and the costs charged for them.

To balance the economic with social, the rate policy should respond to three main considerations: economic efficiency, financial sufficiency and impartiality (Fernández 1994). The communities should have water at a low cost, trying to make very good use of the resource which is poor and that the financial situation of the service provision is saved.

The cost for the use of provision sources has not been included in the principle which for the case of Colombia, entities managing water resources charge the users, whether they are official or private, a cost for the use of such sources. The cost is fixed by the institution and no consulted with the user. Moreover, this situation applies to people or entities legally registered as users. Currently, this is trying to be extended to municipalities where they have to bring these costs to users in the rates.

For the case of San Felipe this is not applied as the Committee is not charged for this same reason. The Water Board do not pay the entity of the water resources the rate for the use of the source as but it is expected to be charged by the institution.

The supply service is paid for, but before 1992 the tariff was very low and the payment was independent of consumption. Based on the water meter readings of the January-March quarter of 1992, the Water Board requested support from the Tolima Health Service to calculate a monthly tariff that would cover the operational cost of the system and leave a margin for future investments.

For this calculation, payment to the operator was increased to the level of a minimum salary defined by the Colombian labour law, with reserve for their medical and social provision, purchase of calcium hypochlorite and the creation of a reserve for unforeseen events. In 1992, the total monthly expenditure was calculate at $ 132,000 (US $ 132)[4]. The approved tariff by the community was $ 1,200 (US$ 1.20) as fixed charge for consumption of 0 to 40 m^3, which represent an increase of 600% with respect of the old tariff. The consumption excesses above this value were to be charged in an increasing block depending the quantity consumed.

In May 1994, the penalization of excessive consumption had generated a monthly average surplus of $ 40,000 (US$ 40) that made possible to have a reserve fund of $ 5 million pesos (US$ 5,000) and to carry out some small repairs to the system by themselves.

Five year later, (May, 1997), the Water Board informed that in 1997 the total monthly expenditure was calculate at $ 318,000 (US$ 318)[5]. The fixed tariff is $ 2,500 (US$ 2.50), over this costs an extra cost is charged per m^3 corresponding to $ 100 (US$ 0.10). The average consumption is from 28 to 30 m^3 per month; although there is an average of 8 users who use between 100 and 150 m^3 per month because they recreation activities what increase the consumption, paying about between $ 15,000 (US$ 15) and $18,000 (US$ 18) monthly. Now the Water Board have a reserve fund of $ 12 million pesos (US$ 12,000) which is in a savings account with interests. There is no delay in payment for water supply in San Felipe, therefore, there are no fines or problems for water cuts in case of no payment. In this sense everything works fine.

The installation of the meter reading for a new user is $28.000 (US$ 28) which should be paid to have the right to water service. An important factor is that the costs shown correspond only to costs to the water supply system but not to the wastes and rubbish system. This has not been discussed and there are uncertainties with this considering that concern has focused towards the drinking water system; this situation has to be tackled.

[4] US$ 1 = $ 1,000 colombian pesos in January 1997
[5] US$ 1 = $ 1,000 colombian pesos in January 1997

3.8.3 Lessons learned

The community is satisfied with the supply service as they think the service is good. Those who consume more, pays more and they are identified as they contribute with more money. If they need more water, that is not a problem as they are paying for it.

The willingness to pay for the service is achieved clearly when the user receives a water supply that fulfils his expectations and offers satisfaction, convenience and safety. It is interesting to underline that, in San Felipe the drinking water quality improvement was one of the principal arguments that the Water Board used for the meter installation and the establishment of the tariff scale, and that it was accepted by the community. However, considering the abundant sources originating from Andean rivers, the communities still have difficulties to understand the relationship between the deterioration processes in their watersheds and the cost which represent the water treatment due to the high contamination levels.

3.8.4 Perspectives

The San Felipe experiences showed that helping communities to identify problems and making them visible for all parties concerned is what seems to be the root problem solving. It is also encouraging to note that people are very willing to accept an increase in water tariffs, provided tariff development is transparent and good service is provided.

CHAPTER 4

CONCLUSIONS

The preliminary experience of San Felipe contributed positively to understanding the potential of the 8 Water Resources Management Principles. It is clear, however, that we need a more comprehensive approach to the management of the water resources.

The lack of participation at a local level in the catchment protection, has led to a critical deteriorated situation of the water resource in terms of quantity and quality. No programme of surveillance and control has been implemented by the institutions with a social responsibility in this field, neither has it been integrated to the community so existing and potential problems can be detected on time and the priorities for the relevant activities can be established. The way institutions operate, is on the ground of punctual requests of the community and not as a systematic programme of action.

The existence of a legal national framework is an important tool but it is not enough. Access to adequate water demands a redefined role for the governmental organizations with emphasis on facilitation and technical support rather than providers or only regulatory functions. As a result of the work, the proposal established of working in co-ordinated way between CORTOLIMA and the other institutions, having under consideration that the officials are present in the zone itself. Moreover, it is important they work allow having an impact in the region environment policies.

The results clearly demonstrate the importance of participatory institutional support and validate a systematic approach to problem analysis and solving primarily by the community with support from the agencies. This approach has great potential to improve water distribution and reduce water loss in existing schemes which in turn has great impact on the production and treatment cost of water supplies.

The San Felipe experiences showed that helping communities to identify problems and making them visible for all parties concerned is what seems to be the root problem solving. It is also encouraging to note that people are very willing to accept an increase in water tariffs, provided tariff development is transparent and good service is provided. Higher average water prices for excesses of consumption encourage water users to economise on water and strengthen water institution at local level.

This experience also has show that communities can play an important role in managing domestic water supplies. However, considering the abundant sources originating from Andean rivers, the communities still have difficulties to understand the relationship between the deterioration processes in their watersheds and the cost which represent the water treatment due to the high contamination levels.

On the other hand, women often are the main responsible for water supply, sanitation and hygiene education at the household level and in the community. Therefore their active participation in the water resource management projects is crucial. It needs to be recognised however that the needs and interests of men and women often are different, and therefore a gender balance is needed to ensure that the views of all groups are duly taken into account.

There are many and important efforts focused on capacities development in the management of the water resource between the communities; however, it is unknown the real impact that these programs have generated in terms of the creation of a true participant culture and auto arranged in the use and handling of this resources. Besides, in the time of examine the programs repercussion, is more important its quantitative effects taking away attention to the socio cultural considerations.

Finally, it is clear that any program oriented to develop an integrated water resources management must be consider a conception of the development that establishes the creation of conditions in which strategies and tools are brought making possible to the participants to be the makers in the construction of solutions to the problems they face. It is understood then, that the development is a process that implies a weakness of the creative forces of the communities, institutions and people insistented in changing their living conditions. For that reason, in the execution of the actions it is necessary to consider ways of working that facilitate the assertion of the participants as individuals and as a member of a collectivity of own cultural characteristics. Being a world citizen without loosing the roots, building an autonomy that confront the strain between the tradition and the modernity.

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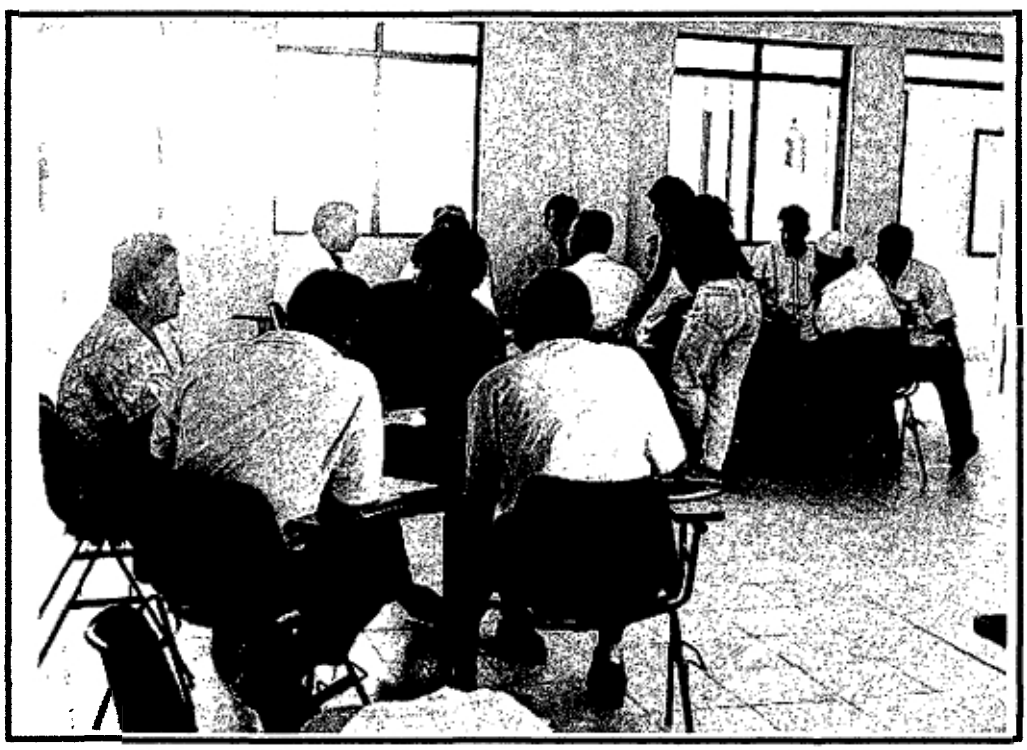
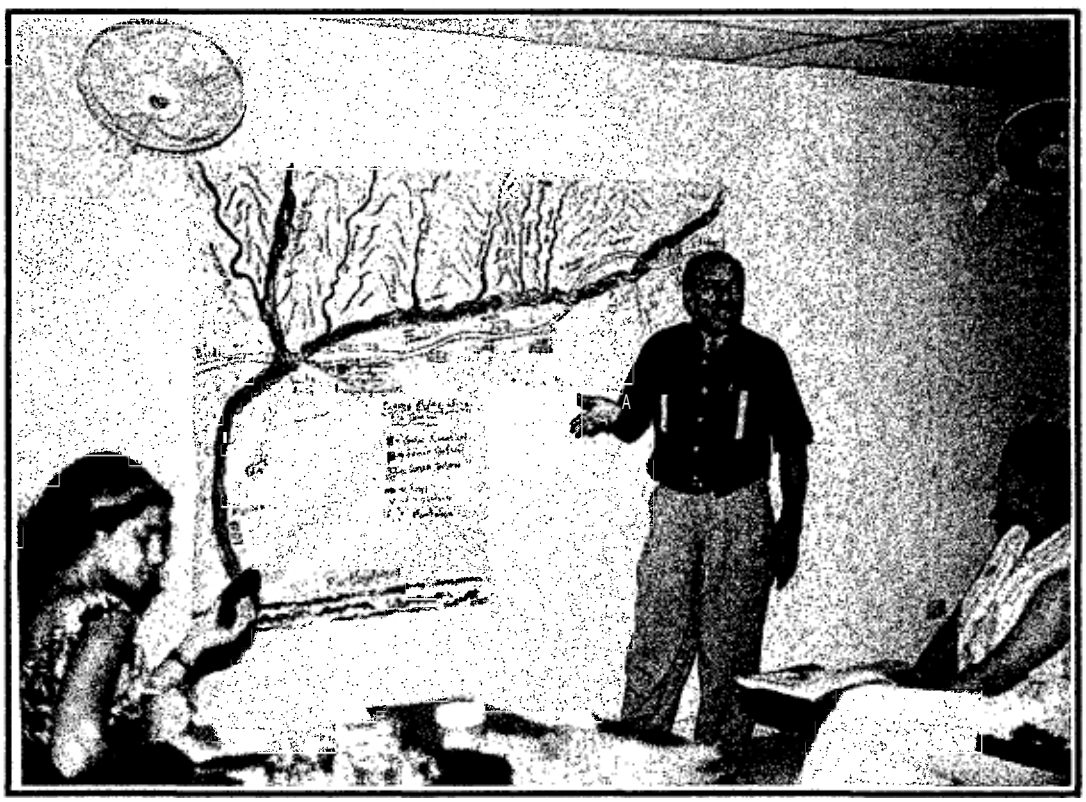
PHOTOGRAPHIC ANNEX

Introducing Each Other



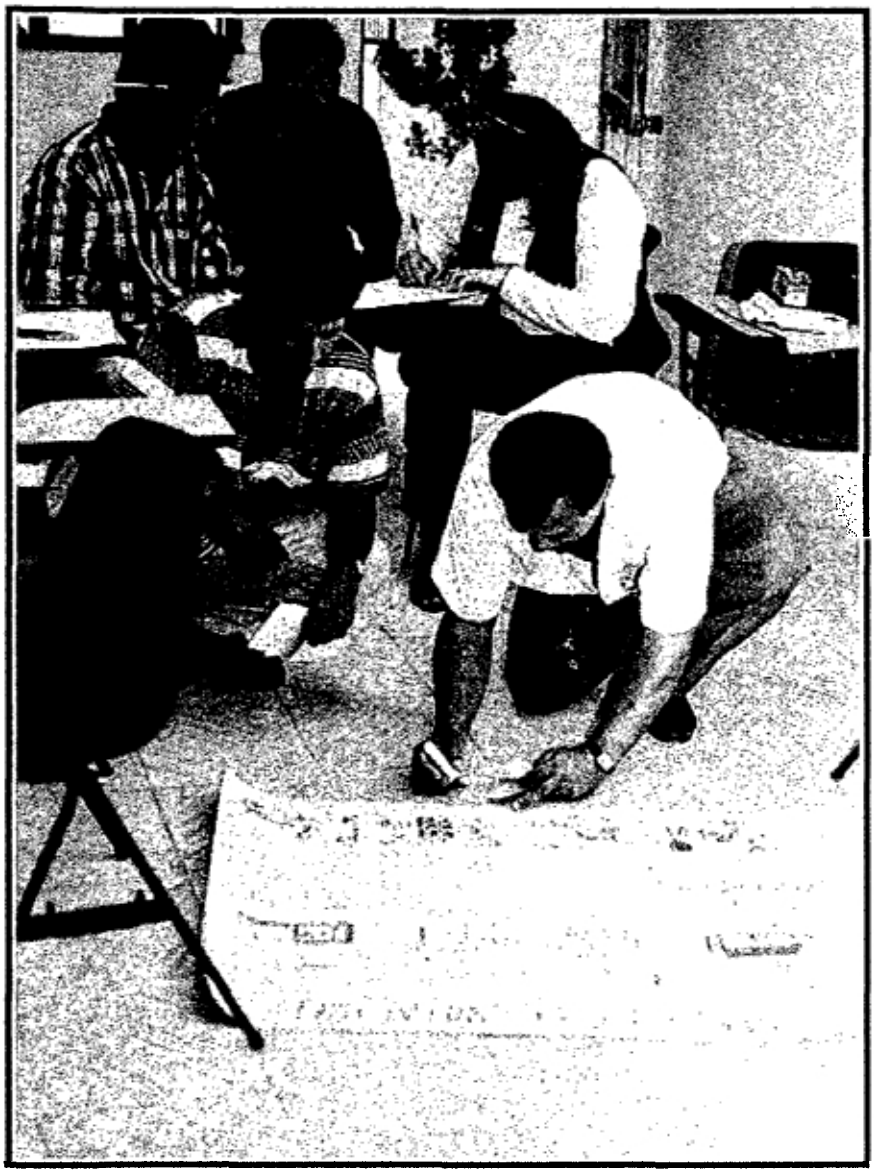
Groups Discussing THE PRINCIPLES

Community Leader and Group of Institutions Drawing the Map of the Watershed

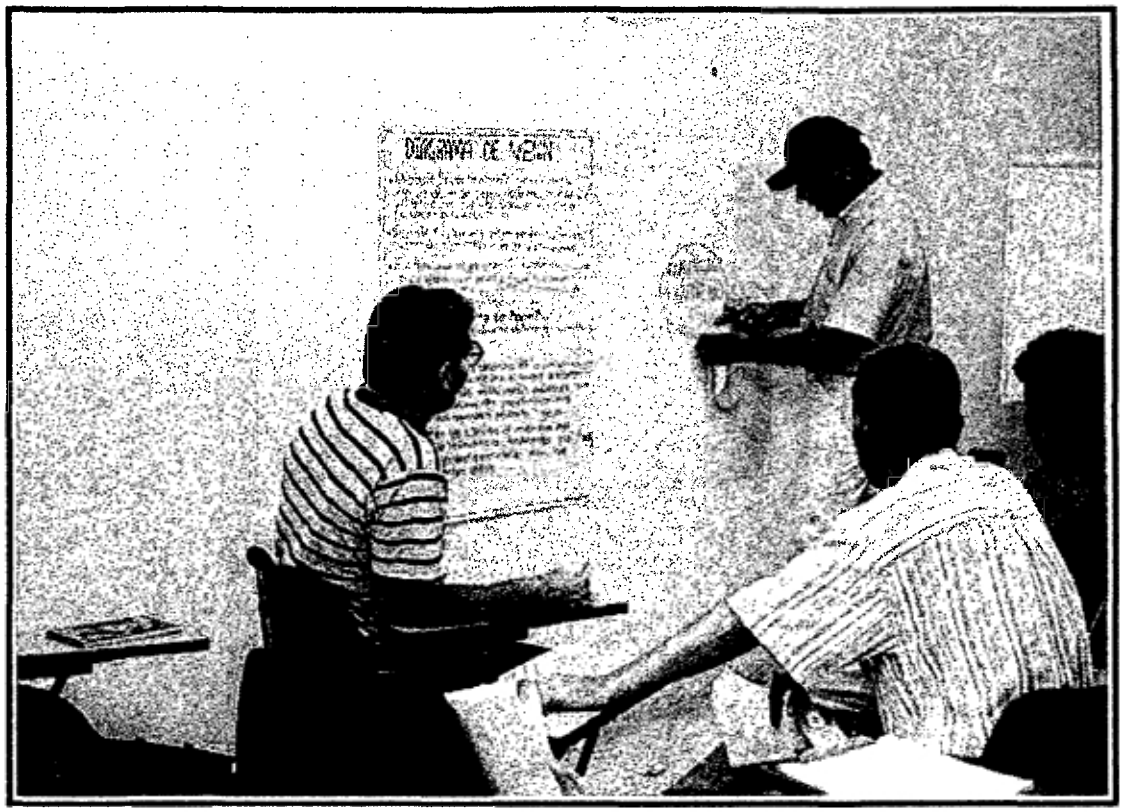


Community Leader Showing the Map

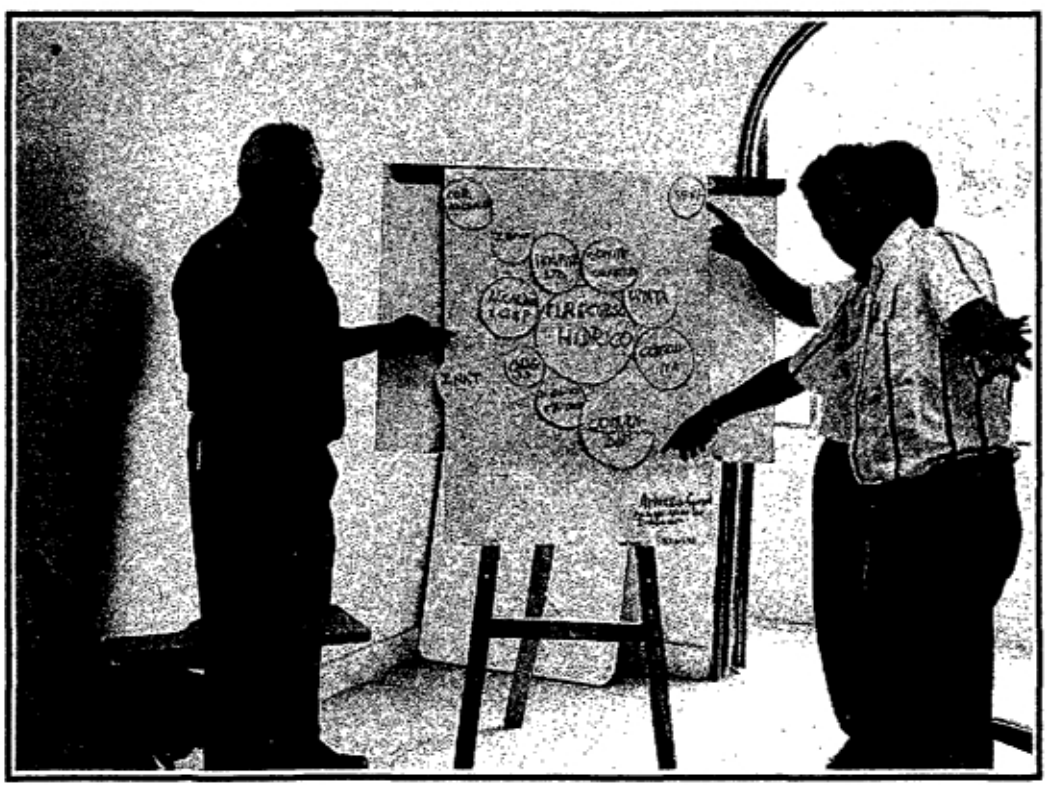
Institutions and Water Association (JAA) Drawing the Map of San Felipe Water Supply System



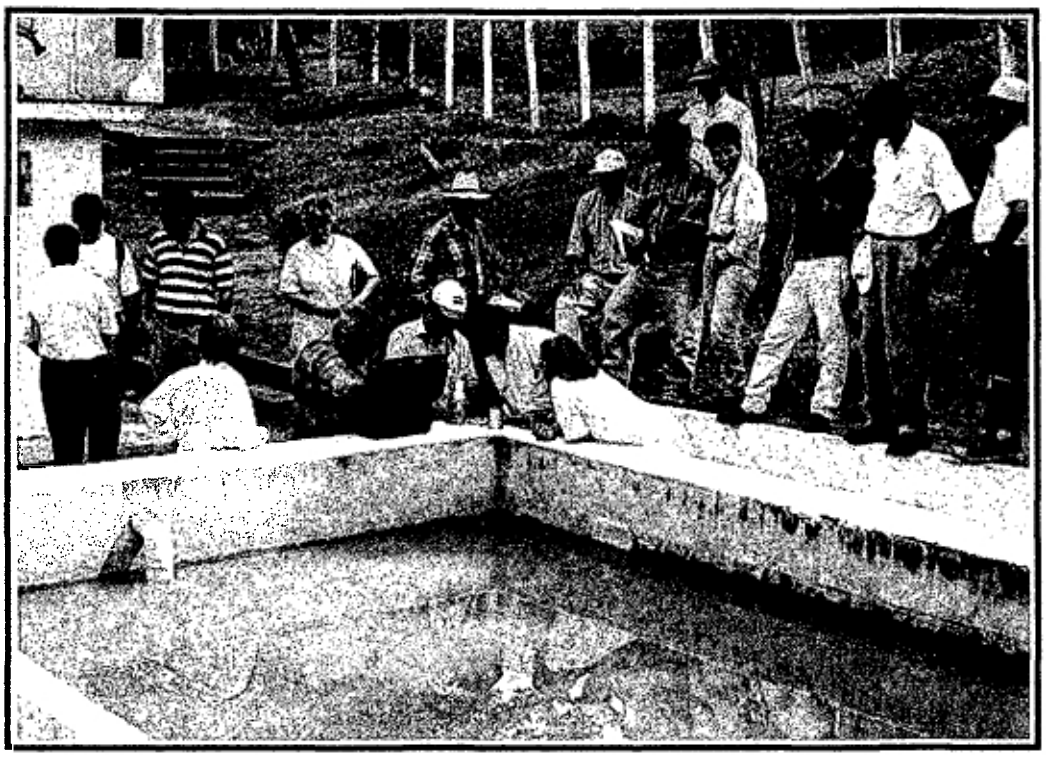
Working on the Pocket Chart. Institutional Group and Caretaker Showing the Different Uses of Water Resources



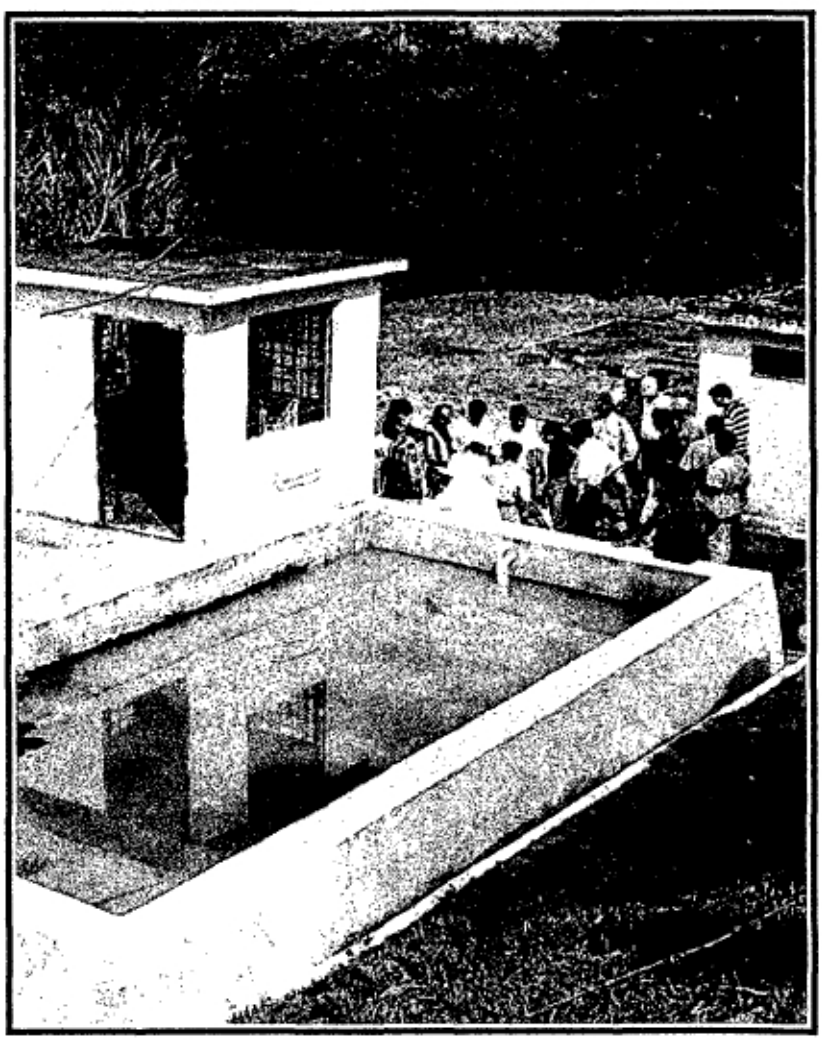
Learning How to Use the Technique



Institutions Presenting the Results



Workfield Gathering Information With the Water Supply Association (JAA)



Workfield