A.I.D. EVALUATION SUMMARY PART I

(BEFORE FILLING OUT THIS FORM, READ THE ATTACHED INSTRUCTIONS) PD-ABB-589

IDENTIFICATION DATA

A. REPORTING A.I.D. UNIT: USAID/Guatemala (Mission or AID/W Office)

(ES# 90-06)

B. WAS EVALUATION SCHEDULED IN CURRENT FY ANNUAL EVALUATION PLAN? yes [X] slipped [ ] ad hoc [ ]

Eval. Plan Submission Date: FY 90 Q 1st.

C. EVALUATION TIMING interim [X] final [ ] ex post [ ] other [ ]

D. ACTIVITY OR ACTIVITIES EVALUATED (List the following information for project(s) or program(s) evaluated; if not applicable, list title and date of the evaluation report)

Project #	Project/Program Title (or title & date of evaluation report)	First PROAG or equivalent (FY)	Most recent PACD (mo/yr)	Planned LOP Cost ('000)	Amount Obligated to Date ('000)
520-0336	Rural Water Project	1985	12/91	1.5	1.5

ACTIONS

E. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

Action(s) Required	Name of officer responsible for Action	Date Action to be Completed
1. USAID to work with CARE staff to accomplish the following:		
a. CARE to contract a supervisory engineer.	Víctor Dardón Patrick Sayer	10/90
b. Increase training of promoters on water related problems by periodic workshops.	Víctor Dardón Patrick Sayer	7/90
c. Assign two additional promoters to increase the frequency of health education contacts participants receive.	Víctor Dardón Patrick Sayer	6/90

(Attach extra sheet if necessary)

APPROVALS

F. DATE OF MISSION OR AID/W OFFICE REVIEW OF EVALUATION: mo 2 day 12 yr 90

G. APPROVALS OF EVALUATION SUMMARY AND ACTION DECISIONS:

	Project/Program Officer	Representative of Borrower/Grantee	Evaluation Officer	Mission or AID/W Office Director
Signature Typed Name	Víctor Dardón	James Coberly	T. Kellerman: PRM	T. Brown: DIR
Date:	8/16/90	8/20/90	8/23/90	8/27/90

S.V.

H. EVALUATION ABSTRACT (do not exceed the space provided)

The project is to improve environmental sanitation in approximately 47 rural communities of Guatemala. Cooperative for American Relief Everywhere (CARE) through Unidad Ejecutora del Programa de Acueductos Rurales (UNEPAR) a GOG institution, is responsible for the implementation of the project. This mid-term evaluation was conducted by Dan O'Brien, a CARE specialist on the health education component and by the private firm Cordón y Mérida, Ings., on the engineering component, on the basis of a review of project documents, visits to fourteen communitites and interviews with project personnel. The purpose was to evaluate and compare the implementation and achievement of the project purpose and assess the progress of the project of its four components: water supplies, family latrines, health education and tariff systems operated through water committees, with an eye to improving implementation, specifically on the health education component, to clarify uncertainties about its implementation. Also to determine if the goal of serving piped water to 28,625 inhabitants is going to be achieved by PACD.

Main Recommendations

- CARE should assign an engineer to periodically supervise construction activities in all projects.
- As build drawings should be provided and copies given to all water committees for their records.
- Water committees should be monitored during a period after completion of the systems.
- Implementation of the health extension component is highly recommended.

Findings and Conclusions

- The project should attain all objectives by its PACD, December 31, 1991.
- The evaluation revealed that CARE, in spite of the setbacks with its counterparts, managed to bring implementation of the project back to normal.
- In spite of the initial problems with the former implementation unit (Desarrollo de la Comunidad), the program at the time of this evaluation has achieved the revised targets of 47 water systems.

Lessons Learned

- The main lesson learned is to involve community water committees more in problem solving and decision making, in order to increase their effectiveness in the program.
- Before construction activities are implemented a number of people in selected communities do not wish to participate because they are pessimistic regarding the actual implementation of a water system. However, once the project becomes a fact many wish to be considered for inclusion in the service. It was recommended that in the design stage these houses be included as future users. This would avoid unexpected and unplanned project extensions.

ABSTRACT

I. EVALUATION COSTS

1. Evaluation Team

Name	Affiliation	Contract Number OR TDY Person Days	Contract Cost OR TDY Cost (US$)	Source of Funds
Dan O'Brien	Cordón y Mérida, Ings.	Paid by CARE 520-0000-0-00-9833-00	24,000	CARE PD&S

2. Mission/Office Professional Staff Person-Days (estimate) _____

3. Borrower/Grantee Professional Staff Person-Days (estimate) _____

COSTS

A.I.D. EVALUATION SUMMARY PART II

J. SUMMARY OF EVALUATION FINDINGS, CONCLUSIONS AND RECOMMENDATIONS (Try not to exceed the 3 pages provided)
Address the following items:

- Purpose of activity(ies) evaluated
- Purpose of evaluation and Methodology used
- Findings and conclusions (relate to questions)
- Principal recommendations
- Lessons learned

Mission or Office: USAID/GUATEMALA

Date this summary prepared: April 9, 1990

Title and Date of Full Evaluation Report: A Mid Term Evaluation of USAID/Financed Project to CARE, March 1989, January 1990

1. Purpose of the activity or activities evaluated.

In Guatemala, more than 70 percent of the rural population is still without adequate potable water coverage. Infections and intestinal diseases, many water related, are the major causes of infant morbidity and mortality has a rate of 79 deaths per 1,000 born alive, more than 50% of reported deaths in 1985 were children under 4 years of age.

The goal of the Project is to improve the health and nutrition status and overall welfare of the rural poor in the target area.

The purpose of the Project is to improve the environmental sanitation in approximately 47 rural communities in Guatemala who currently do not have access to potable water and sanitary service by providing potable water systems and latrines.

2. Purpose of The Evaluation and Methodology Used.

The purpose of the evaluation is (a) to evaluate the effectiveness, efficiency and significance of the Water and Sanitation Project of the private, voluntary organizations (PVO) - CARE - with respect to the following project elements: methodology, technical, managerial and financial practices, health education, environmental impacts, and benefits to the users.

Dan O'Brien was contracted by CARE with their own funds to evaluate the health education component.

Cordón y Mérida, Ingenieros, was contracted by AID to perform an evaluation from the engineering standpoint followed by field visits to the construction sites. At the end, debriefings were held between the evaluators CARE and AID representatives, and later the final reports were submitted to AID.

Effectiveness and impact were assessed based on physical observations and interviews made during the visits to the sites.

SUMMARY

Findings and Conclusions

CARE faced managerial problems which prevented them from completing the project within the original PACD June 30, 1988, and required an extension of the PACD to December 31, 1989.

Desarrollo de la Comunidad, the first CARE implementing unit was integrated into the Ministry of Urban and Rural Development. Negotiations to continue implementation of the project by this Ministry failed. After lengthy negociations, CARE finally signed agreement with UNEPAR, a GOG institution, to implement the project. As a result of these negotiations, considerable delays in implementation were suffered by the program. Two of the project's components, latrine construction and health education, had a late start, but at the time of the evaluation the two components were fully implemented. Evaluation revealed the need for a trained ground water development specialist intervening in all phases of the project.

CARE should take steps to improve efficiency of the implementation as follows:

- To strengthen health education messages, CARE should emphasize the proper handling and use of the drinking water and disposal of used water. They should also reduce the number of messages per session.
- The use of tighter parameters at the design stage of the water systems would lower construction cost and improve performance.
- An engineer for construction supervision should be assigned. UNEPAR supervisors should be requiered to visit systems under construction more frequently.

The main lesson learned is that community water committees should be involved much more in problem solving and decision making in order to increase their effectiveness in the program.

Principal Recommendations

- CARE should assign an engineer for periodic supervision of construction activities in projects.
- UNEPAR masons and CARE supervisors should be provided with a construction manual with typical drawings and details.
- Population growth estimates in future projects should be carefully evaluated.
- To reduce construction costs, designs should be based on the real carrying capacity of pipe.
- The intervention of a trained specialist in ground water development.
- Use of dry pit latrine should be encourage.
- Accomodate construction programs to the availability of labor decreases during period August to December.
- Monitor water committees after completion of the systems.
- Implementation of Health Extension component of the program is highly recommended.

ATTACHMENTS

K. ATTACHMENTS (List attachments submitted with this Evaluation Summary; always attach copy of full evaluation report, even if one was submitted earlier)

Copies of the Evaluation Reports.

L. COMMENTS BY MISSION, AID/W OFFICE AND BORROWER/GRANTEE

MISSION COMMENTS ON FULL REPORT

COMMENTS BY MISSION

Evaluation reports were well received by both CARE and AID. The conclusions and recommendations are realistic and, generally, the evaluations met the demands of the scope of work. The time dedicated to the task by the teams was sufficient to cover all items.

In future evaluations of similar projects, the overall volume of water per unit time needs to be carefully assessed.

This Mission considers that this was a fruitful exercise.

AID Evaluation Summary
520-0336 Water Project

COMMENTS BY CARE

A generally accurate representation of the health and technical evaluations. CARE would briefly like to make mention of the following points:

1. The recommendation regarding the use of a ground water specialist needs further elaboration. The project presently uses surface water sources, principally springs, to construct gravity fed water systems. the substantial cost of contracting a ground water specialist, along with the fact that the evaluation did not determine specific outputs, or results expected from the services of such a consultant, makes further analysis a pre-requisite to the use of such a specialist.

2. The results of the evaluation were known several months after the outset of the revised OPG grant, (520-0336). Several of the recommendations made require pre-project planning and sufficient financial resources. (Examples: use of ground water specialist, monitoring of Water Committees after the completion of a water system.)

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DRAFTER **DATE**

PDSO/Eng. VDardon 5/30/90

CLEARANCES

PDSO/PDO:JEyre (in draft) Date 5/28/90

DC/PDSO:RSteelman (in draft) Date 4/20/90

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AID / CARE/ UNEPAR

EVALUATION OF THE IMPLEMENTATION AND ACHIEVEMENTS OF RURAL WATER PROJECT 520-0336

Prepared for USAID Mission to Guatemala
Under Purchase Order 520-0000-0-00-9833-00

by

Cordón y Mérida, Ings.
Guatemala City, C. A.

January 1990

ACRONYMS

CARE	Cooperative for American Relief Everywhere.
DESCOM	Desarrollo de la Comunidad, a GOG agency that worked in the development of rural areas. It is was absorbed by Ministerio de Desarrollo.
GOG	Government of Guatemala.
GPM	Gallons per minute
INCAP	Instituto de Nutrición de Centroamerica y Panamá.
Lps	Liters per second.
NGO	Non Governmental Organization.
PACD	Project Assistance Completion Date.
PIL	Project Implementation Letter.
psi	pounds per square inch.
TOR	Terms of Reference.
UNEPAR	Unidad Ejecutora del Programa de Acueductos Rurales, a GOG agency in charge of the development of rural water supply and sanitation systems.
USAID	United States Agency for International Development.

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EXECUTIVE SUMMARY

The USAID Mission in Guatemala City contracted Cordón y Mérida, Ings. to evaluate the implementation and achievements of the Rural Water Project, as it reaches its completion date (PACD) of December 31, 1989. The objective was to evaluate and compare the implementation and achievements of the Project as defined in the Grant Agreement.

The Agreement was signed by AID and CARE in March 27, 1985, as a program to increase the standard of living of Guatemala's rural population providing them with improved health conditions. The original plan called for the construction of water supply and sanitation systems in 60 communities, serving 54,000 inhabitants. Four components were listed in the agreement: i) Water supplies with house connections, ii) Family latrines, iii) Health extension workshops and iv) Tariff systems operated through water committees.

CARE was granted $1.0 million to administer the program and initially choose DESCOM as the GOG executing agency. Difficulties during the first year, forced CARE to change the executing agency (with AID approval) to UNEPAR. Since late 1987 the program has been working regularly achieving at the time of this evaluation 100% of the revised targets of 47 water systems and 91.2% of beneficiaries (4667 house connections and latrines).

The systems built are spring fed, gravity systems with a tap in the yard and a dry pit latrine at each participating home. Actual costs during 1989 are in the range of 200 to 530 US $ per home. As the health extension component was not a part of CyM evaluation, our findings and recommendations are related to the other program components, and are as follows:

1. Systems are adequately built and serving about 4667 homes.

2. Some improvements can be achieved through minor design changes whose net effect will be a cost decrease or better performance.

   Changes that affect cost include: a) a lower per capita assignment of between 40 to 60 Lit/day; b) revised population growth rates near 2.7%; c) use of the real hydraulic carrying capacity of pipes by using real diameters.

   Changes that improve performance include: a) Indication in the construction drawings of any pressure allowance during design; b) Use of adequate minimum pipe diameters in clusters of homes at dead ends; c) Preparation of as-built plans.

3. The need of a trained ground water development specialist intervening in all phases of the project. Spring boxes visited had several deficiencies that will affect, in the long run, water quality or quantity.

4. CARE should assign an engineer for construction supervision. UNEPAR supervisors should be required to visit systems under construction more frequently.

5. Organization and training of the Water Committees to face operation and maintenance in the long run is still lacking. Since the systems are relatively new, no major problems in these areas have appeared yet. CARE should help UNEPAR to strengthen its Operations Department.

CORDON Y MERIDA INGENIEROS
6 Avenida 6-94 Zona 9

PROJECT IDENTIFICATION DATA SHEET

Project Title: Rural Water Project (OPG) 520-0336

Total Amount,	Authorized		Obligated	
		$ 1,500,000		$ 1,300,000
	3/27/85	$ 1,000,000	3/27/85	$ 1,000,000
	7/31/89	$ 500,000	7/31/89	$ 300,000

PACD initial :	6/30/88
PACD :	12/31/89 (at time of evaluation)
PACD :	12/31/91

Implementation Agency: CARE

Project Purpose: Provide support for the construction and use of potable water and sanitary systems for rural inhabitants.

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C O N T E N T S

- Acronyms
- Executive Summary
- Project Identification Data Sheet
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1. INTRODUCTION

1.1 Purpose and Scope of the Evaluation

This report presents the findings and recommendations of the evaluation of Rural Water Project 520-0336, as defined in the Grant Agreement and later amended by PIL No. 10 in September 13, 1988. The evaluation was carried by Cordón y Mérida, Ings., a guatemalan consulting engineering firm contracted by USAID Mission in Guatemala under Order No. 520-0000-0-00-9833-00.

CARE Guatemala was granted $1,000,000 by the USAID Mission in Guatemala to provide support for the construction and use of potable water and sanitary systems in rural communities of western Guatemala. CARE with DESCOM (later changed to UNEPAR) as executing agency of the government of Guatemala and extensive community participation were to build the water and sanitation systems.

1.2 Project Background

The project agreement was signed March 27, 1985 by both AID and CARE, thus setting the initiation period that originally had as end date, June 30, 1988 (PACD).

The Grant made by AID to CARE has as its goal to increase the standard of living of Guatemala's rural inhabitants and the purpose is to provide these rural people with improved health conditions.

The original plan called to achieve this goal for about 54,000 rural inhabitants of 60 villages in the Departamentos of Huehuetenango, San Marcos, Quetzaltenango, Sololá, El Quiché, Totonicapan and Baja Verapaz, during a 3 year implementation period by providing them with:

a) Improved water supplies and house connections,

b) improved waste disposal systems with use of family latrines.

c) improved family health by reaching village women through health extension workshops, and

d) established maintenance tariff systems through functioning community water committees.

Detailed description of the above mentioned program components is as follows:

a) **Component I**

The 60 water systems were to be built in 3 years; they had to be gravity flow systems, tapping perennial flow springs of safe quality drinking water and a house connection in the yard at the house of every member of the community that participated in the program.

A capacity of 70 liters per person per day for each house connection had to be provided.

DESCOM the government of Guatemala executing agency, was to design the systems and provide technical assistance and supervision during construction of the works.

The participating community members had to provide unskilled labor to build the systems.

b) **Component II**

Family latrines to each house provided with water were to be installed. The original plan called for dry compost latrines in lieu of the traditional dry pit latrines.

To achieve this component DESCOM was to provide technical supervision and some construction materials; CARE, cement and roofing sheets and the participants labor and local materials.

c) **Component III**

Health extension workshops as called under this component were to be carried by INCAP and Educación Extra-Escolar of the Ministry of Education, working with small groups of women in the participating communities. CARE was to provide support and technical assistance, training materials, equipment and curriculum development.

d) **Component IV**

Each project site had to met certain community and technical criteria before its inclusion in the program. DESCOM had to ensure the quality and feasibility of the water source to provide adequate service, its land title and right of way to install the transmission pipe and build a tank. Village interest was to be manifested by arranging the legal aspects of the last three items.

The committee had to be integrated by five community members, one of them functioning as president and other two as secretary and treasurer. This last two members were to be able to read and write (in Spanish).

The organization of a Committee, according to government regulations to collect tariffs, administer and operate the systems was another criteria that had to be implemented before the community was to be included in the program.

A monthly tariff of Q1.00 per house with a water connection had to be established and collected by the committee. Twenty centavos of this amount had to be set aside for operation and maintenance of the system. The remaining amount can be used to finance future expansion or other community projects related to improve the role of woman and health in general. DESCOM was to review and approve all community requests to use those funds.

The Grant amount was established in $1,000,000 to be provided by AID to CARE. Supplementary funds provided by DESCOM and the beneficiaries were to fund the rest of the program.

DESCOM was to provide approximately 31% of the total project cost consisting in non-local construction materials and the necessary technical, administrative and health education personnel.

CARE was to provide through the OPG up to 42% of the program costs that were to include non-local construction materials, project promotion, supervision and direct support of health extension workshops.

The community and municipality were to provide the remaining program cost of 27%, and their input was to include unskilled labor and local materials.

In September 22, 1987, PIL No. 5 was issued, in which recognition of the need to change the implementation agency is described. Also due to delays caused by this change, AID approved a time extension of one year. Thus the implementation agency was changed to UNEPAR a Ministry of Health unit, and the PACD was changed to June 30, 1989.

By PIL No. 6 an exception of the approved departments was issued, accepting work in Chahal Viejo, Alta Verapaz; Jocotales, El Progreso and El Aguacate, Jutiapa.

Recognizing the fact that the Quetzal (guatemalan currency) devaluation resulted in a sharp decrease in UNEPAR contribution, PIL No. 10 was issued, and the program outputs revised to 47 water systems, serving 28625 beneficiaries.

Also PACD was changed by PIL No. 11, to December 31, 1989.

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1.3 Current Status

Since the evaluation reported was carried in November 1989, only a month is available to reach the revised PACD. Of the four program components described earlier, this evaluation was directed to Components I, II and IV, as directed by AID Contract with Cordón y Mérida Ings. (CyM). This recognizes the fact that work on Health Extension (Component III) has recently been organized by CARE and is in the process of being implemented.

Systems built during the program life and population served are as follows:

Year	Number of Systems	Pop. Served	No. Houses	GOG Executing Agency
86	15	9310	1607	DESCOM
87	4	3951	691	UNEPAR
88	15	7877	1354	UNEPAR
89	13	5071	1015	UNEPAR
Totals	47	26209	4667	
% of target	100	91.6		

Each participating house has been provided with a tap in the yard and a dry pit latrine.

Systems listed in 1989 are almost completed.

1.4 Political, Economical and Social Context of the Project

Guatemala is the most populated country of Central America, with nearly 8.5 million inhabitants. About 60% of its population is rural. Rural population is distributed in about 18,000 communities. About 90% of them have populations of less than 500, a few have more than 1000.

Rural communities are integrated by indigenous populations, living in extreme poverty marginated from the monetary economy and aislated by language barriers. (23 different languages are spoken in the country). Public health conditions are deficient. Infant mortality has a rate of 79 deaths per 1000 born alive. More than half of the notified defunctions in 1985 were of children less than 4 years of age. Principal causes of death in all age groups are diarrhoea and parasitary diseases.

Illiteracy is high, about 83% of the population do not read or write.

Water supply and sanitation systems in the rural areas are scarce. Around 30% of the rural population has access to water supply, a smaller percentage has house connections and latrines.

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In the rural areas, the Ministry of Public Health has assumed the responsibility to provide the water and sanitation services in Guatemala. Two agencies work under its jurisdiction. One of them, UNEPAR has the responsibility for communities larger than 500 inhabitants. By law Water Committees can be organized in each community to operate and administer the systems and collect tariffs. NGO's as CARE function actively supporting UNEPAR's activities.

2. STUDY APPROACH AND METHODOLOGY

2.1 Introduction

Cordón y Mérida, Ings. (CyM), assigned five engineers to work in the evaluation. Each conducted investigations according to his experience and availability. Before initiating the assignment a Work Plan was developed and submitted to USAID for its approval. While some professionals of the team were in the field, others were in Guatemala City studying the documents and interviewing UNEPAR personnel. Extensive discussions were had with USAID Mission and CARE personnel.

It was decided unnecessary to interview Ministerio de Desarrollo, the GOG agency that absorbed DESCOM responsibilities, since having changed all their personnel, interest in the program is non existent and data unavailable.

2.2. Meetings with USAID

During meetings with USAID personnel a good perspective of the objectives of the evaluation was obtained. Some documents related to the project were also studied at their offices.

2.3 Interviews with CARE

CARE personnel in charge of the program were available and gave lengthy descriptions of their project and help to study their files.

CARE personnel accompanied the CyM teams in their interviews with UNEPAR and during their field work.

The construction documents (drawings, tariff, cost estimates and design reports) from almost every community in the program were available to CyM for their study at CARE Central Office in Guatemala City.

2.4 Interviews with UNEPAR

Two interviews were carried with UNEPAR personnel. One with the Chief Engineer and another with the design personnel. In both, their perspective of the CARE program was evaluated. They also provided detailed information with regards to the design and construction procedures.

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2.5 CARE correspondence files study

Access to their correspondence files of this program was provided by CARE. Several hours were devoted by the CyM team to review the files and analyze available information.

2.6 Review of Designs

About fifteen design files were studied in detail. This files were made available to CyM by CARE from their files. CyM was permitted to study them at their office to perform check calculations.

Another eighteen files were studied at CARE offices to obtain information for the expected costs study of this report.

2.7 Cost studies

With the actualized cost reports from CARE and other relevant technical data a cost study was carried out. Information on thirty three communities was available for this study.

2.8 Field Visits

2.8.1 General

Most of the tasks required by USAID in the Terms of Reference (TOR) of this Evaluation are based on information collected at the communities of this program. Also the TOR called for a fifteen per cent evaluation (seven) of the total number of communities.

2.8.2 Sites Selection

Since the program includes projects in different departamentos, of different sizes and built by two GOG agencies during the four years of execution, selection of the communities to be visited was carefully implemented. Eight communities (17%) were screened from the original thirteen selected from a list studied jointly with CARE. The thirteen candidate communities, for a field study are listed in Table 2.1, their location in the country is shown in Figure 2.1.

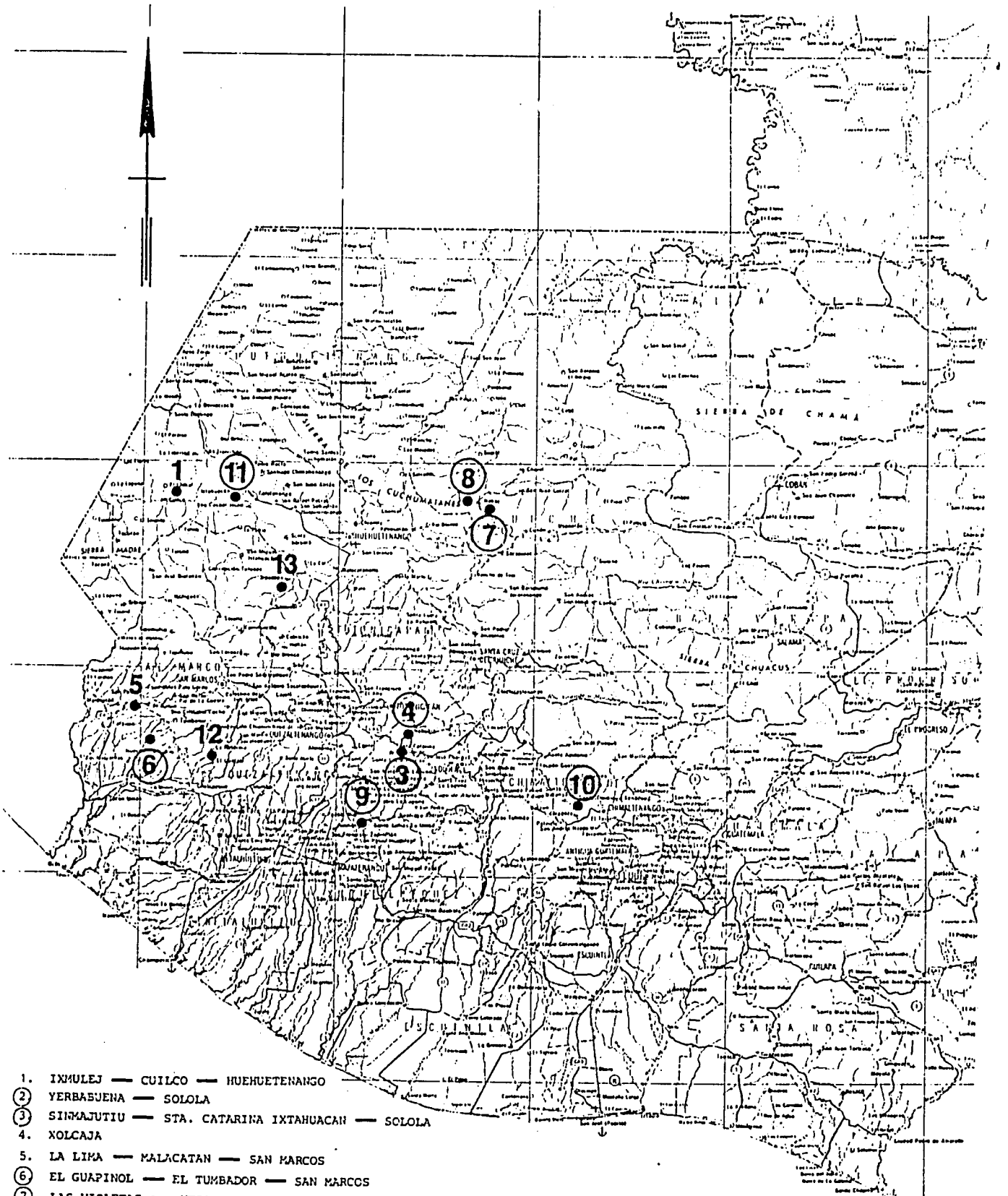
The program of field visits was delayed due to the continuation of the heavy raining season through early November, that difficulted access to some of the sites.

TABLE 2.1

CHARACTERISTICS OF THE COMMUNITIES
CONSIDERED TO BE VISITED DURING THE EVALUATION

COMMUNITY	Distribution Length mt mt. (2)	Number of Conn. (2)	Distance to source mt. (2)	elevation of source (3)	Estimated Cost	
YEAR: 1986						
1. Ixmulej	4700	100	1700	433	Q. 28,285.00	
2. Yerbabuena	4080	92	2600	*	Q. 30,190.00	
3. Simajutiu	2394	62	1272	35	Q. 13,697.83	(1)
4. Xolcaja	2226	83	2360	40	Q. 21,957.46	(1)
YEAR: 1987						
5. La Lima	4532	135	5233	246	Q. 128,367.00	
6. El Guapinol	4800	149	2696	81	Q. 89,400.00	(1)
YEAR: 1988						
7. Las Violetas	2800	157	4745	405	Q. 83,975.18	(1)
8. El Campo	3995	160	1490	180	Q. 67,890.78	(1)
9. Cerro Partido	1958	75	988	45	Q. 55,858.00	(1)
10. Joya Grande/Rincón	7295	258	5795	45	Q. 199,065.56	(1)
YEAR: 1989						
11. Cerro El Arenal	3282	63	3500	230	Q. 89,750.00	(1)
12. Los Cipreses	1638	89	854	86	Q. 46,108.99	
13. Xeabaj	7297	86	3928	70	Q. 82,026.34	

Note: * No information available.
(1) Selected and visited. (Joya Grande and Rincón Chiquito although supplied from the same source are two different communities).
(2) From UNEPAR's plans.
(3) Estimated elevation of source above center of town in meters.



1. IXMULEJ — CUILCO — HUEHUETENANGO
2. YERBABUENA — SOLOLA
3. SIMAJUTIU — STA. CATARINA IXTAHUACAN — SOLOLA
4. XOLCAJA
5. LA LIMA — MALACATAN — SAN MARCOS
6. EL GUAPINOL — EL TUMBADOR — SAN MARCOS
7. LAS VIOLETAS — NEBAJ — QUICHE
8. EL CAMPO — NEBAJ — QUICHE
9. CERRO PARTIDO/TORONJALES — SAN PABLO JOCOPILAS — SHUCHITEPEQUEZ
10. JOYA GRANDE/RINCON CHIQUITO — ZARAGOZA — CHIMALTENANGO
11. CERRO EL ARENAL — IXTAHUACAN — HUEHUETENANGO
12. LOS CIPRESES — EL QUETZAL — SAN MARCOS
13. XEABAJ — SIPACAPA — SAN MARCOS

PROYECTO DE AGUA RURAL 520-0336

RURAL WATER PROJECT 520-0336

COMUNIDADES CON CIRCULO FUERON VISITADAS

COMMUNITIES WITH CIRCLE WERE VISITED

CORDON Y MERIDA, INGS.
GUATEMALA, C.A.

NOVIEMBRE 1989

FIGURA No. 2.1

FIGURE No. 2.1

Criteria for the selection of communities to be visited, were:

1. At least one from each year of construction.

2. Different sizes as defined by the budgeted cost or population served.

3. A good spatial distribution within the program departamentos.

4. Easy accessibility.

2.8.3 Questionnaires Design

In order to obtain the necessary information during the field visits, three questionnaires were designed. A copy of each is presented as Appendix A.

Questionnaire I was to collect information regarding the water system per se.

To evaluate the latrine component Questionnaire II was prepared. It served to collect information at each household interviewed. Five houses with water connection were visited and studied at each community. This number represents between eight and ten percent of the houses at each community visited.

Finally Questionnaire III was used to collect information from the Water Committee, its organization, activities and performance.

2.8.4 Actual Visits

A team of two CyM engineers visited each of the eight Communities selected to perform the field evaluation. The team was accompanied by one CARE staff member. Roberto Lemus and Henry Avila from CARE, guided the CyM teams during the field visits, their collaboration was invaluable. A USAID staff engineer joined the field team on the first two days of field work.

In Annex B a summary of the field activities, their dates, participating personnel and water committee members interviewed are listed. Results of the field data are summarized for each of the eight communities in Annex C. A qualitative analysis of all the data is synthesized in Table 2.2. Also in Annex E, a selected group of photos is presented to underline some of the comments and findings.

2.8.5 Water Quality Studies

Water samples for laboratory analysis were collected at each community and transported to Guatemala city.

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TABLE 2.2

QUALITATIVE ANALYSIS OF FIELD INFORMATION

COMMUNITY

	XOLCAJA	SIMAJUTIU	CERRO PARTIDO Y TORONJALES	EL GUAPINOL	LAS VIOLETAS	EL CAMPO XEBAC Y VICHACALA	CERRO EL ARENAL	JOYA GRANDE Y RINCON CHIQUITO
CONSTRUCTIVE ASPECTS.								
SOURCE	D	D	A	D	D	D	A	A
TRANSMISSION LINE	A	A	A	D	D	A	A	A
PRESSURE REDUCING BOXES	N.E.	N.E.	A	N.E.	A	D	D	N.E.
DISTRIBUTION TANK	A	A	A	A	A	A	A	A
DISTRIBUTION SYSTEM	D	A	A	A	A	D	A	A
PUBLIC FOUNTAINS	A	A	N.E.	N.E.	A	N.E.	N.E.	A
HOUSE CONNECTIONS	D	D	A	A	D	D	A	A
SYSTEM CAPACITY	A	A	A	A	A	D	A	A
ADMINISTRATION								
COMMITTEES FUNTIONING	A	A	A	A	A	A	A	A
FUNDS MANAGEMENT	A	D	A	A	A	A	A	A
LATRINES								
USE	A	A	D	A	A	A	N.A.	A
MAINTENANCE	D	A	D	D	A	D	N.A.	D
LOCALIZATION	D	D	A	A	A	A	A	A
ORIENTATION AND TRAINING TO USE SYSTEMS (WATER AND SANITATION)								
DURING CONSTRUCTION	A	A	A	A	A	A	A	A
AFTER CONSTRUCTION	D	D	D	D	D	D	N.A.	D
COMMUNITY CONTRIBUTION	A	A	A	A	A	A	A	A

SIMBOLOGY

A : acceptable
D : deficient
N.A. : non applicable
N.E. : non existent

OBSERVATIONS

- Project in Cerro El Arenal was under construction; latrine program was partially evaluated. Committee is Pro-Introduccion de Agua

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Bottles previously prepared were used for bacteriological sampling. Taps carefully flamed and water kept running before actual sampling.

Samples for chemical analysis were also taken in plastic bottles. Both samples were taken at the house tap nearer to the distribution tank and transported in ice.

Bacteriological analysis (preparation of sampling bottles and essays) were madé in the city by LABQUIMICAS. Chemical analysis were made by CyM in our laboratory.

2.8.6 Pressure and Flow Measurements

Pressure and flow measurements were taken in at least two taps of each community. Taps at the most remote house connection were selected or very near the distribution tank.

The Procedure followed was:

1. Entrance valve closed.
2. Tap removed.
3. Installation of a pressure gage and a ball valve.
4. Entrance valve opened (system in operation).
5. Ball valve opened and flow collected in a 5 gallon drum. Pressure and time recorded.
6. Ball valve closed.
7. Open tap at a house in vicinity, usually at a lower elevation. Pressure at the house investigated recorded.
8. Entrance valve closed. Investigation apparatus removed and house connection arranged as originally found.

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3. FINDINGS AND CONCLUSIONS

3.1 Achievement of Results

3.1.1 Program Achievements

As determined from CARE reports the target goals of number of communities and population served have been reached in 100% and 91.6% respectively. Nevertheless this last number does not reflect the fact that in all communities there are still houses without service. A small effort in this direction will improve the statistics. In Xolcaja and El Campo several people approached the CyM team to ask how they could pay to get connected. It is necessary to train the committees on the procedures of application and payment of new costumers to broaden the systems coverage.

The three program components that CyM was required to evaluate have been achieved:

COMPONENT I	Improved water supplies and house connection.
COMPONENT II	Family latrines in each house served with water.
COMPONENT IV	Functioning Water Committees collecting monthly charges.

A monthly tariff has been established in each community and diligently collected (Only in Simajutiú was not). In general this tariff is between Q.0.50 to Q.0.70 per month, less than the Q.1.00 per month called in the Grant Agreement. No evidence was found that the Q.0.20 per month established in the Grant has been set aside for operation and maintenance. Nevertheless in older systems when money was needed for repairs, it has been available. Surplus money is often employed in Committee activities to develop other projects that the communities need.

The change from DESCOM and Ministerio de Desarrollo, the original GOG executing agency, to UNEPAR made a positive impact in the achievements of the program.

A substantial improvement in the quality of designs and systems built is easily recognized. Observations during the office studies and field visits to systems built by both organizations support this comment.

3.1.2 Technical Adequacy of Program Components

The quality of the water systems built is very good and in general the system components have been built in accordance to designs, and local engineering practice.

Latrines, built by each family with materials supplied through the program are being used and their functioning is acceptable.

Designs respond to the community needs and topographical reality.

3.2 Technical and Administrative Procedures

3.2.1 Procedures

Technical procedures to select the communities and administrative procedures for their inclusion in the Program are sound. A clear protocol has been established between CARE and UNEPAR by which communities to be served by the Program are selected.

Communities to be included are selected during the previous year. UNEPAR staff prepares a profile of the project that submits to CARE. Visits by CARE staff to candidate communities are carried out to verify findings of UNEPAR.

Once the project satisfies the Program requirements it is scheduled for construction the following year.

Additionally the community has to submit its legal rights to the source of water and the necessary rights of way for the ancillary works.

Every month a meeting is scheduled at UNEPAR with the presence of CARE staff to review problems encountered previously and solutions are found.

UNEPAR assigns a mason to live in the community during the construction period. He acts as foreman directing all the construction activities in the field and personally performs all the skilled work (pipe laying and masonry construction). A UNEPAR engineer from the region (UNEPAR has the country divided in regions) is assigned to periodically supervise the works.

A CARE staff member visits frequently the project under construction, checking for availability of materials and organizing the man-power input from the community, establishing a liason with the local Water Committee. The mason assigned by UNEPAR is the team leader that organizes the community and directs all the work.

CARE buys all imported materials in the market of Guatemala city and transports it to the site. This procedure ensures a fluid supply of materials. UNEPAR is also responsible for making sure the necessary materials are available.

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During the field visit to Cerro El Arenal, Ixtahuacan which was under construction, problems with technical supervision were found. Visits from UNEPAR Supervisor were reported as sparse and since CARE's personnel lacks engineering training, solution to a technical problem encountered is inadequate. In this case a problem in the location of a pressure reducing box appeared. The solution implemented was to eliminate the box, causing in the line it feds extremely high pressures. It was not possible to obtain a reading because when a manometer was installed, the existing pressure exceeded the gauge capacity (100 psi).

3.2.2 Design Procedures

Design procedures followed by UNEPAR adhere to their standards which are in general adequate to local conditions. In Table 3.1 a list of selected communities is presented; their design reports were evaluated and the most relevant design parameters are listed in Table 3.2.

UNEPAR has an established internal protocol to select, design and build water systems which is followed. For each project a design report with all the necessary information is produced.

Typical contents of the reports are:

1. List of personnel that collaborated
2. General information of the community
3. System description
4. Community participation
5. Tariff calculations
6. Bill of Materials
7. Detailed Cost Estimate
8. Set of construction drawings

The report thus contains all the elements for the system construction and its management and supervision.

The following comments, if implemented, can enhance the design and/or lower the construction costs.

a) **Per capita consumption**

The Grant Agreement establishes a per capita allowance of 70 Lit/day. Design standards in use by UNEPAR have a similar figure permitting larger numbers. Actual design allowances (See Table 3.1) range from 80 to 100 Lit/cap/day. It is our opinion that this figure is rather high solely for human consumption in rural areas. Water demand studies conducted in eight towns by the Facultad de Ingenieria of the Universidad de San Carlos in similar communities to the ones included in the program, report smaller numbers. Consumption range reported in these studies was from 16 to 47 Lit/cap/day (See Table 3.3), for the first and third quartile.
Technical Paper No. 18, "Small Community Water Supplies"

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published by the International Reference Centre for Community Water Supply and Sanitation, a WHO Collaborating Centre, lists as typical domestic water usage in communities with a yard connection, 40 Lit/cap/day, with a range of 20 to 80 Lit/cap/day.

It should be borne in mind that water sources are scarce and competition for their use will be augmented in the future.

A rough comparison of two projects costs at two levels of water assignment is shown in Table 3.4. Sizing of the projects is preliminary and based on the design parameters used by UNEPAR. Transmission line was sized with a velocity of 1 m/sec. and distribution lines with 2 m/sec. One house service for every 25 meters of distribution line was also assumed. Costs include materials, labor and indirect costs. Total cost is comparative since it excludes other items.

Costs as calculated in Table 3.4 show that for a 100 houses project doubling the water allowance from 40 to 80 Lit/cap/day increases the project cost by 29.%. For a 200 houses project, cost increases by 21%. Although the cost comparison is based on a rather rough sizing of the elements, it indicates a cost increment when the water allowance in Lit/cap/day is doubled. The cost reduction might prove important in order to include more projects in the program.

A per capita assignment of between 40 to 60 Liter per day may still serve the rural inhabitants needs and reduce project costs.

TABLE 3.1

PRINCIPAL DESIGN DATA OF SELECTED COMMUNITIES

Community	Census Pop.	Census year	Initial year	Population Start	Population Future	Growth Rate Initial	Growth Rate Future	Conn.	Hab./ conn	Lit/cap day	Mean Flow Q (lps)
LA LIMA. S. Marcos	627	84	88	700	1275	2.8	3.0	135	5.19	100	1.48
XEABAJ. S. Marcos	312	87	89	331	604	3.0	3.1	86	3.85	85	0.59
LOS CIPRECES. S. Marcos	203	88	88	203	367	3.0	3.0	39	5.21	100	0.42
EL GUAPINOL. S. Marcos	750	85	87	784	1211	2.2	2.2	[illegible]	6.22	80	1.12
EL CAMPO-XEBAC, Quiche	581	87	89	620	1200	3.3	3.4	119	5.21	80	1.11
CERRO PARTIDO. Suchi.	384	86	87	395	700	2.9	2.9	72	5.49	90	0.73
JOYA GRANDE. Chimalt.	1139	87	88	1172	2063	2.9	2.9	216	5.43	90	2.15
CERRO EL ARENAL. Huehue.	324	87	89	346	675	3.3	3.4	63	5.49	90	0.70
LAS VIOLETAS. Quiche	642	87	87	642	1200		3.2	142	4.52	90	1.25

TABLE 3.2

DESIGN PARAMETERS OF SELECTED COMMUNITIES OF THE PROGRAM

Community	Population Initial	Population Future	Conn.	Hab/conn	Lit/cap day	Q max day	Q max hour	Factor max day	Factor max hour	Design Flow	Tank Vol. M3	% Storage
LA LIMA. S. Marcos	700	1275	135	5.19	100	2.68	5.00	1.82	3.39	2.68	50	39.2
XEABAJ. S. Marcos	331	604	86	3.85	85	0.89	1.49	1.50	2.51	0.89	15	29.2
LOS CIPRECES, S. Marcos	203	367	39	5.21	100	0.63	1.05	1.48	2.47	0.63	15	40.9
EL GUAPINOL, S. Marcos	784	1211	126	6.22	80	1.14	3.50	1.02	3.12	1.14	40	41.3
EL CAMPO-XEBAC, Quiche	620	1200	119	5.21	80	1.44	2.78	1.30	2.50	1.44	30	31.3
CERRO PARTIDO, Suchi.	395	700	72	5.49	90	0.88	2.19	1.21	3.00	0.88	20	31.7
JOYA GRANDE, Chimalt.	1172	2063	216	5.43	90	2.58	6.45	1.20	3.00	2.58	75	40.4
CERRO EL ARENAL, Huehue.	346	675	63	5.49	90	1.05	2.10	1.49	2.99	1.05	20	32.9
LAS VIOLETAS, Quiche	642	1200	142	4.52	90	1.62	1.89	1.30	1.51	1.62	30	27.8

Q = flow in lps

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TABLE 3.3

Data from Water Demand Studies published as

grade thesis at Universidad de San Carlos, Facultad de Ingeniería

Community	Departament	No. of hab.	L/cap/day	Thesis by	Date	Observations
San Luis P.N.	Sacatepéquez	69	9	Lepe, D.	Nov. 72	
Chimazat	Chimaltenango	43	2	Lepe, D.	Nov. 72	Intermittent supply
La Concordia	Totonicapan	441	16	Montoya, H.	Mar. 70	
Sacsiguan	Sololá	312	54	Montoya, H.	Mar. 70	
La Ceiba	Sololá	429	47	Morales, C.	Nov. 73	
Pochol	Sololá	261	40	Morales, C.	Nov. 73	
Argueta I	Sololá	517	30	Celis, E.	Feb. 73	
Argueta II	Sololá	220	88	Celis, E.	Feb. 73	Urban barrio of cabecera

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TABLE 3.4

COMPARISON OF TWO PROJECTS AT TWO DIFFERENT SUPPLY LEVELS

	Project 100 houses (with 5.5 pers/house)		Project 200 houses (with 5.5 pers/house)	
SIZING				
Supply Lit/cap/day	40	80	40	80
Demand m3/day	22	44	44	88
Tank m3 (33%)	7.5	14.5	14.5	29
Q max day lps	[illegible]	[illegible]	[illegible]	[illegible]
Q max hour	0.76	1.53	1.53	3.05
Transmission diam inches (1m/sec)	1	1 1/4	1 1/4	1 1/2
Distribution diam inches (at 2m/sec)	1	1 1/4	1 1/4	1 1/2
ELEMENTS COST (1)				
Tank	Q 1,730	Q 2,100	Q 2,100	Q 3,600
2000 m Transmission	2000 m 1" x Q5.0/ml = Q 10,000	2000 m 1 1/4" x Q6.47/ml = 12,940	2000 m 1 1/4" x Q6.47/ml = Q 12,940	200 m 1 1/2" x Q7.69/ml = Q. 15,380
Distribution 25 ml/house	2500 m 0 1" x Q5.0/ml = Q 12.500	2500 m 1 1/4" x Q6.47/ml = Q 16,175	5000 m 1" x Q6.47/ml = Q 32,350	5000 m 1 1/2" x Q7.69/ml = Q 38,450
Total Direct Cost	Q 24,230	Q 31,215	Q 47,390	Q 57,430
Cost per house	Q 242.30	Q 312.15	Q 236.95	Q 287.15

(1) Unit prices do not include contingencies, administration nor transportation.

b) **Population Growth**

Total population growth according to Instituto Nacional de Estadistica (INE) on a national basis is estimated at 2.88% per year. Their growth estimates for urban areas is 3.4% and for rural areas is 2.66% per year. Estimates for urban areas is easier since more information is available.

The 2.66% per year rate in a 20 year design horizon represents a growth of 1.69 times of the present population. Values used by UNEPAR (see Table 3.1) of 3.2% and 3.4% represent a population growth of 1.88 and 1.95 during a 20 year span. A careful review of population growth estimates will lower the numbers of design population with the consequent decrement in cost. Nevertheless is should be recognized the difficulties to obtain reliable (if any) data on population growth of small rural communities. Also growth in rural areas near the urban cabeceras municipales might be similar to them.

c) **Real diameters versus nominal diameters**

It has been a standard practice in water supply engineering to use nominal diameters to calculate the hydraulics of water supply systems.

This practice, probably developed for use in urban areas where the resulting diameters are rather large seems inappropriate in rural communities, specially when using plastic pipe.
It should be remembered that flow is directly proportional to the area available of pipe and area is a product of a constant (0.785) times the diameter squared. A review of Table 3.5 will underline this remarks.

In small diameters the ratio of real area over nominal area is large. In pipes smaller than 1 1/4" this ratio is larger than 1.5, which means a real flow capacity one and a half times the nominal. As the pipe diameters increase the real and nominal diameters are about the same producing a very small increase in area and the flow capacity.

The use of real diameters in hydraulic calculations will result in smaller pipe sizes and produce substantial savings in the overall costs of the systems.

TABLE 3.5

Nominal Diam inch	Nominal Diam mm	SDR 26 (160 psi) Int Diam (real) mm (3)	Areas in $M^2 * 10^{-4}$ Nom.	Areas in $M^2 * 10^{-4}$ Real	Ratio Area real/ Area nom.
1/2	12	18.20 (1)	1.13	2.6	2.3
3/4	18	23.53 (2)	2.54	4.35	1.71
1	25	30.36	4.91	7.24	1.47
1 1/4	31	38.90	7.54	11.87	1.57
1 1/2	38	44.56	11.33	15.59	1.37
2	50	55.71	19.62	24.36	1.24
2 1/2	62	67.45	30.17	35.72	1.24
3	75	82.04	44.16	52.83	1.20
4	100	105.30	78.50	87.04	1.10

(1) SDR 13.5

(2) SDR 17

(3) From SUBTINSA catalog.

d) **Pulsating Flow**

In several parts of some of the transmission lines visited, pulsating flow was observed.

When checking the design reports an excess of water carrying capacity in those lines was found. CyM calculations with real and nominal diameters and available topographic information indicated this.

Investigations at UNEPAR design office, revealed also an allowance of between 2 to 5 meters at each pressure reducing box during design, to be dissipated by mechanical means (globe valve, or float valve).

The two approaches (use of nominal diameters and pressure allowance) induce a larger carrying capacity of the lines and the lowering of the piezometric grade lines. As a result pulsating flow is produced by air entrainment when the piezometric line approaches the pipe.

Careful instruction of the Water Committees and field supervisors to regulate the valves is lacking and should be implemented.

As stated in the preceding paragraph the use of real diameters is nearer to the hydraulic reality.

e) **Dead Ends**

As a general approach, line design flow is calculated by multiplying the number of houses (or persons), times the Lit/cap/day allowance, times a peak factor (between 2.5 and 3.0 - see Table 3.2 -).

This practice when designing dead end lines serving a cluster of few houses should be revised. It has to be recognized that flow through a water tap depends on its diameter and the pressure available. Three or four taps at a dead end line opened simultaneous will demand between 15 to 25 GPM which is larger than the flow calculated by the method presently in use (0.6 - 1.2 GPM). In other words, flow through a tap depends on the hydraulic conditions, pressure and tap size, not on the values assigned by the designer (unless special hydraulic provisions are taken).

Since the development of a sound methodology to evaluate the flow or probability of various taps working simultaneously is rather difficult and beyond the scope of the present report, no further effort was made in this direction. Nevertheless some engineering decisions can be made as explained in the following paragraph.

Pipe velocity is a design parameter, which according to standard practice, for plastic pipes should be between 1.8 to 2.4 m/sec (5.9 to 7.9 fps). Table 3.6 shows required diameters for different flows (a 1/2 tap is estimated to produce 5 GPM at a 2 meter head). By using the numbers in Table 3.4, some engineering decisions can be made. If only three (actual and future) houses are expected to be connected, a 1/2" line is enough. In the case of four houses, a 3/4" line should be used. For a number of houses larger than four, the use of 1" should be mandatory. In any case the hydraulics of the system should be checked, distributing the flow by any method, that accounts for the fact that not all the taps are going to be used simultaneously, verifying the absence of negative pressures.

TABLE 3.6

SIZE OF PIPE NEEDED TO SERVE A GIVEN NUMBER OF TAPS

Q		using 2 m/sec		using 3m/sec	
gpm (1)	lps	diam. mm	use pipe inches	diam. mm	use pipe
5	0.32	12.6	1/2		
10	0.63	20.0	1/2		
15	0.94	24.5	3/4	20	1/2
20	1.26	28.3	1	23	3/4
25	1.58	31.7	1	26	1

(1) It is estimated that a 1/2" water tap produces a 5 GPM flow with 2 meters (6.3 feet) pressure. There is only one tap at each house in the program.

With the type of tap presently used, flow measured at different pressures is around 5 to 7 GPM.

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3.2.3 Construction Practices

As stated earlier the quality of the systems constructed is very good. And the works found in the field adhere to the design drawings.

To avoid difficulties as the one reported in Cerro El Arenal, the need of engineering Supervision was felt.

A set of construction details, typical drawings and construction instructions photocopied in a 8 1/2" x 11" format could also help the mason and supervisors to implement the design and remove some uncertainties.

3.2.4 Sequence of Construction

The sequence in use seems appropriate, as no major difficulties were reported nor found.

3.3 Selection of Water Sources

The process to select water sources is as follows: prospective beneficiaries locate a source and report it to UNEPAR, a team is sent to evaluate the source and visit the site.

Evaluation is carried out by a technician or a civil engineer. During this evaluation flow measurements and water samples are taken. Source elevation is checked in relation to the community, to sustain gravity flow.

Afterwards and previous to include the community in the program, CARE staff members visit the site and evaluate the source.

Neither CARE or UNEPAR assign hydrogeologists or technicians trained in ground water development to the project.

All the sources of water in the systems visited (and in most of the projects) were springs to which a simple concrete box was built. All boxes examined had deficiencies but all were working.

In many cases their location was inadequate since they were built near the flow of surface waters, as the case found in El Guapinol (see photo in annex E). Heavy rains that produce large flows can destroy, the box and contaminate the spring. Same case was found in Simajutiú and Las Violetas.

In Las Violetas and El Campo a grazing plot is located in the vicinity at a higher elevation, thus increasing the possibility of source contamination. Animal manure was present in this plot.

In El Campo and Xolcaja, water was flowing from all sides of the box. Clearly the overflow is insufficient. This later deficiency is common although not so evident in every case; the overflow pipe is very small or located at an elevation that

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drowns the spring. Drowning submerges the free flow of water, forcing it to flow elsewhere and can reduce the capacity of the spring.

Optimization of the use of ground water sources is becoming of great importance. All communities are competing for them. Thus the participation of technical personnel trained in groundwater development techniques has become essential.
This professionals (hydrogeologists) can implement the use of techniques of groundwater development that are not being used actually. Also new sources can be developed in areas where there is little or no evidence of groundwater. Deficiencies can be minimized.

CARE could hire on a part time basis an expert in this area and make him available to UNEPAR. his expertise can enhance the designs and prevent possible contamination.

3.4 Water Quality

Samples taken from the eight communities visited were analyzed and the results are reported in Table 3.7.

Chemical analysis were made by CyM employing a portable Hach laboratory. Turbidity was measured with a Hach Turbidimeter Model 1860A and Conductivity with a YSI Meter model 33.

Bacteriological analysis were made at LABQUIMICAS of Guatemala City.

Quality of water from a chemical stand point is acceptable; Turbidity is rather low as is the Iron presence. Water Hardness in El Arenal and El Campo is very high, in both cases greater than 100 mg./lit, but less than 500 mg./lit, the maximum permissible level according to the International Standards published by the World Health Organization (WHO).

Quality of water from a bacteriological stand point is fairly acceptable. Although repeated samples are desirable to produce better results. one sample as used in this case is adequate for the evaluation needs. NMP values reported are rather high, but they are a product of the number of dilutions employed. Note that only in two instances (Cerro Partido and Las Violetas) was found a positive in the 1 ml. dilution. The number obtained from the Standard Methods Tables for this condition is 3.6 and has to be multiplied by 10 to obtain the results for the dilutions used. In the case of three negatives a value of less than 3 is obtained from the table, and when multiplied by 10 a NMP Value of less than 30 is reported. No faecal coliforms were detected in all samples analyzed. To acertain that waters meet the International Standards a larger number of samples is required.

But to respond the question asked in the TR, water is pure and adequate for human consumption, as found in the majority of cases where all dilutions were negative. The two positives found in the higher dilutions can only be interpreted with more sampling.

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TABLE 3.7

Bacteriological Analysis

Community	Dilution	Negative or Positive Results Confirmative Test 1.	0.1	0.01	Faecal Test 1.	0.1	0.01	MPN/100 ml (1) Coliforms	Faecal
Xolcaja		-	-	-	-	-	-	<30	<30
Sizajutiú		-	-	-	-	-	-	<30	<30
Cerro Partido		+	-	-	-	-	-	36	<30
El Guapinol		-	-	-	-	-	-	<30	<30
Las Violetas		+	-	-	-	-	-	36	<30
El Campo		-	-	-	-	-	-	<30	<30
El Arenal		-	-	-	-	-	-	<30	<30
Joya Grande		-	-	-	-	-	-	<30	<30

(1) From Standard Methods Table multiplied by 10.

Chemical Analysis

Community	Turbidity JTU	pH	Conductivity Umhos	Iron mg/l	Alk mg/lit	Hardness Ca	mg/lit Total
Xolcaja	0.8	7	145	0.05	80	50	80
Sizajutiú	0.2	7	90	0.01	60	30	50
Cerro Partido	5	6.5	100	0.01	80	30	60
El Guapinol	0.35	7	80	0	50	25	40
Las Violetas	1.4	7.5	300	0	180	130	170
El Campo	0.25	8	300	0	170	160	200
El Arenal	0.2	7	370	0	230	140	230
Joya Grande	0.25	7	110	0	40	20	40

JTU Jackson Turbidity units
Umhos micromhos
Alc. Total Alcalinity
Ca Calcium

3.5 Adequacy of Labor Contribution

Present practice requires that communities contribute with local materials and unskilled labor.

Local materials are: sand, gravel, stone and lumber. At each community there is abundance of some materials and lack of others.

CARE has been flexible to support the communities with transportation of materials from distant sources when they are locally unavailable. Each home that is a prospective water user has to contribute with labor to build the water system. In all cases the Water Committee guided by the CARE staff induces beneficiaries to contribute the necessary quantity of labor to achieve completion of the system.

It is difficult to asses if the community contribution is adequate in relation to the project cost, because the economic capacity of the beneficiaries varies from each community.

In the highlands and bocacosta, the communities visited are located near a large urban town, their economic capacity seems high. In the first area their income source is from handicrafts that are sold in the urban cities and in the latter their income is from agriculture, mainly coffee and cardamomo, of their own.

But in the more remote areas where even the people from urban towns are very poor, the rural communities are extremely poor. In areas of social unrest where people have been displaced to this new rural settlements conditions are worst. (Las Violetas).

CARE's approach in a case by case, seems to be adequate, since in some communities people have to migrate temporary to obtain some money for their subsistence.

3.6 Seasonal Availability of Labor

In almost all of the communities where their members have to supplement their income by migrating from August to December to work at coffee plantations or sugar cane fields, there is a constraint of labor availability.

Only in the communities where people are more affluent as in the case of El Guapinol and Cerro Partido, when people were unable to work for the system, they were able to pay some one else to substitute them.

In the communities where people have a more advanced economy, (their source of income is not from working as unskilled laborers), labor is available most of the year, nevertheless the poorer members of the community have the need to migrate seasonally.

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It should be taken into account that in all cases, the contribution of unskilled labor will be lowered during the August-December period. This situation has a direct effect on the construction programs.

3.7 Latrine Program Evaluation

At every house that has been provided with a tap in the yard by this program, a latrine has been built (a total of 4667).

Materials and the molds are provided to each household for them to build their concrete slab and seat. The hole is dug by the beneficiaries and once the slab is set in place the enclosure is built. Roofing is made of corrugated sheets provided by the program.

It is reported, and in all the communities visited was the case, that latrines were built during the construction of the water system. Thus both systems, water and sanitation, were provided simultaneously.

Surveys of latrines use and construction were carried out during the field visits to eight communities and are summarized in Table 2.2. From this data an answer to each of the questions posed in the TOR is presented. It should be pointed that the evaluation is one of qualitative nature.

a) **Are the latrines adequately used?**

In six communities it was found that they were adequately used.
In Cerro El Arenal they were under construction.
In Cerro Partido, of five homes visited, one had no latrines built, one had no siding or roof. The other three had no pit; they had connected drainage from the pila to flush the latrine then discharging to the nearest possible point thus contaminating the environment. This practice should be discouraged since it defeats the purpose of the dry pit latrine (a clean environment). Flush waters should be disposed at least in an absorption pit.

b) **Are they adequately maintained**

In five of the communities they appeared unclean, and a few flies were observed.

Physically the latrines are adequately maintained. A lack of information and health education on their use and cleaning is evident.

c) Is the type of latrine the most suitable?

All the homes visited had a dry pit latrine. In some cases they were provided with slabs and seats by another program, so double latrines were built. Their use was one for women and the other for men.
The small presence of flies or foul odors suggest that the type of latrine is adequate. One may question the wisdom to recommend a ventilation pipe (with the extra cost) at this stage of the program if not enough health education is provided.

As no communities with a high water table have been incorporated to the program, the use of compost latrines has not been necessary.

The use of dry pit latrines without ventilation seems to be an adequate solution.

d) Latrine site selection

In general latrine sites were adequately selected. Beneficiaries tend to be sufficiently intelligent to select the site with the CARE/UNEPAR staff orientation. In two communities it appeared that their location was inadequate in relation to the predominant winds. This situation was forced by the size of the land plots.

3.8 Water Committees Evaluation

Committees are functioning at each community participating in the program. They are organized at an early stage, when the community presents their request to UNEPAR. Once the community is included in the program, CARE works closely with them. Committees are elected by all members of the community at a general meeting assigning them different posts. The person elected as President is a community leader and the Secretary and Teasurer are literate. In all the communities visited at least these three people speak spanish besides their own language.

In Xolcaja and Simajutiú, once the systems were built and in operation, a new committee was elected its main task was to develop new projects for the community. This will probably be a general tendency at other communities since new committee members have the drive to impulse new projects, that the community feels are in need.

UNEPAR has a legally established system to bill and collect tariffs from the users. The "Reglamento para la Administración, Operación y Mantenimiento de los Sistemas Rurales de Agua Potable" was legally published as Acuerdo Gubernativo No. 293-82 in Sept 30, 1982. Vouchers and an accounting book

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authorized by Gobernación Departamental are used, payments are monthly (or quarterly) and all revenues and expenditures written down. Quarterly, the treasurer travels to Gobernación where the book is audited.

Beneficiaries pay diligently their tariffs and very seldom they are in arrears. Expenditures made by the committee are for the development of other projects. Some of the money is used for repairs in the systems (materials or payment to the fontanero). Legally funds used for other projects can be used only with permission granted by UNEPAR.

All the committees in the communities visited worked. In Simajutiú the committee was recently reorganized with very young members of the community. This community was the only one where tariffs are not being collected. Nevertheless they collect fees from their neighbors to finance development of new projects.

Answer to specific questions in the TOR are as follows:

a) Tasks of the Committee members:

- Assigned tasks are: president that directs the group; Secretary that writes proceedings and notes; treasurer that guards the funds and the accounting system; and the rest of the members that collaborate.

- Tasks are assigned by the President.

- In general it can be said that members understand their roles.

- They perform the tasks assigned to them.

In El Campo while the President was unavailable to attend the visiting team and the treasurer was out of town, there were committee members to substitute them.

b) Tariff management

- Members of the committees have in general the knowledge to manage the funds collected.

- Fees are collected on a monthly or quarterly basis, in general at a community meeting. The treasurer with the help of another committee member, visits each home in some cases.

- There is a system authorized by the Central Government to collect tariffs and account the expenditures. Each committee has to submit at the Gobernación Departamental on a quarterly basis their book for an audit.

- Decisions as to how disburse funds are made in general by the President, but at the community meeting, the committee is given directions.

- No committee interviewed knows the Grant requirement that funds disbursements have to be made with DESCOM/UNEPAR approval.

- Tariffs are lower than Q. 1.00/month. indicated in the Grant Agreement.

Since there is a legally established obligation that the Water Committee (by Acuerdo 293-82) has to operate, mantain and administer the systems in its community, and since the Acuerdo establishes, UNEPAR's obligation to instruct, advise and prepare, the committees to operate their systems, an excellent contribution of this Program can be that CARE provides UNEPAR with the help to achieve fully this obligation.

A consultant could be hired to prepare a training program and develop an Operations Manual for the systems. Both should be geared to the committees members, taking into account their cultural background.

Besides the necessary training in accounting to the treasurer and other committee members, a periodic monitoring of the systems should be performed. Training the Fontanero in how to: clean the spring box and distribution tank; and conduct minor pipe repairs and taps sustitution, is also needed.

The committee should be advised in how to promote and physically connect new water users.

Adding a female member to the committee will help the implentation of Component III of this program.

3.9 Systems Actual and Future Costs

Systems costs are accounted by CARE. From their data base, costs of thirty three projects were obtained. This cost, include expenditures by CARE in materials and transportation and costs as calculated and presented by UNEPAR in their design reports, from the community (unskilled labor and local materials) and from UNEPAR, (topography, engineering, supervision and some materials). No overhead from CARE is included. It was reported that conversion of quetzales to US $ was made at the prevalent rate during the year of the expenditure. This costs in US $ combined with other parameters obtained from the design report are presented in Table 3.8.

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It was expected that a combination of population, number of houses, length of transmission line, and length of distribution network, could be used to predict cost of future projects. Since the Q costs were converted to $ no inflation variable was introduced in the analysis.

A multiple regression analysis was performed with the available data of Table 3.6. Results of the analysis are presented in Annex D. The cost function thus obtained to predict cost of future projects, is as follows:

$$\text{Cost} = 1868.61 + 21.45\ P + 2.88\ C + 2.33\ R$$

Where = Cost = estimated cost of new project in US $.

P = population to be served.

C = Length of transmission line in meters.

R = Length of distribution line in meters.

The cost predicted with the formula includes the same factors mentioned earlier.

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TABLE 3.8

COST AND OTHER PARAMETER OF PROJECTS

PROJECT: CARE - UNEPAR PROGRAM OPG No. 520-0336

No.	COMMUNITY	YEAR BUILT	NUMBER CONNECTIONS	POPULATION SERVED	TRASMIS. LENGHT	DIST. LENGHT	TOTAL COST	HAB/ VIV	TRANS L/ CONN.	DISTR L/ CONN	$/CONN	$/PERSON
1	IXMULEJ	86	100	632	1701.9	4703.1	13651	6.32	17.02	47.03	136.51	21.92
2	YERBABUENA	86	92	525	2647.4	4080.9	14451	5.71	28.78	44.36	157.08	27.53
3	XOLCAJA	86	83	500	2360.7	2226.5	10350	6.02	28.44	26.83	124.70	20.70
4	AC-TZUMBAL	87	280	1326	4227.3	7594.5	48174	4.74	15.10	27.12	172.05	36.33
5	SAN JOSE CHIBUJ	87	127	836	5056.9	6557.5	40542	6.58	39.82	51.63	319.23	48.50
6	LA LIMA	87	135	989	5233.8	4532.3	52228	7.33	38.77	33.57	392.06	53.52
7	EL GUAPINOL	87	149	800	2696.2	4800.7	51365	5.37	18.10	32.22	349.76	64.96
8	LOS RAMIREZ	88	46	330	664.9	2720.6	17695	7.17	14.45	59.14	384.67	53.62
9	CANMOX-CANTETAJ	88	102	566	5215.5	3623.4	38265	5.57	51.13	35.52	375.15	67.37
10	LAS VIOLETAS	88	157	642	4745.8	2806.0	33993	4.09	30.23	17.87	216.52	52.95
11	EL CAMPO	88	160	850	1488.4	3995.5	28401	5.31	9.30	24.97	177.51	33.41
12	ASICH	88	50	250	872.3	579.8	17070	5.00	17.45	11.60	341.40	68.28
13	CHOCABJ/TONINA	88	97	674	1006.5	10278.5	47387	6.95	10.38	105.96	488.53	70.31
14	EL MALACATE	88	64	360	555.1	6569.7	19840	5.63	8.67	102.65	310.00	55.11
15	CHABAL VIEJO	88	42	758	805.2	9857.6	49915	18.05	19.17	234.70	1,188.45	65.85
16	C. PARTIDO/TOBON	88	75	395	988.2	1958.1	21580	5.27	13.18	26.11	287.73	54.63
17	JOCOTALES	88	73	625	2360.7	2665.7	31150	8.56	32.34	36.52	426.71	49.84
18	PACACAY	88	110	585			38811	5.32	0.00	0.00	352.83	66.34
19	J. GRANDE-B.CHIQ	88	258	1172	5795.0	7295.6	81586	4.54	22.46	28.28	316.22	69.61
20	EL AGUACATE	88	120	668	884.5	6337.9	25547	5.57	7.37	52.82	212.89	38.24
21	CERRO EL ARENAL	89	63	346	3507.5	3281.8	32343	5.49	55.67	52.09	513.38	93.48
22	YOLAQUITAC	89	115	602	518.5	3391.6	25794	5.23	4.51	29.49	224.30	42.85
23	XONCA	89	50	250	1281.0	1787.3	16224	5.00	25.62	35.75	324.48	64.90
24	EL CARACOL	89	60	324	0.0	2263.1	17237	5.40	0.00	37.72	287.28	53.20
25	CHIJAN I - II	89	49	258	0.0	2116.7	13262	5.27	0.00	43.20	270.65	51.40
26	CHONCHOLA-BATZUL	89	94	476	140.3	1561.6	18264	5.06	1.49	16.61	194.30	38.37
27	EL PERICON	89	100	418	1018.7	9430.6	38872	4.18	10.19	94.31	388.72	93.00
28	LOS CIPRESES	89	89	367	854.0	1683.6	19683	4.12	9.60	18.92	221.16	53.63
29	VEINTE DE NOV.	89	79	562	1738.5	2269.2	23117	7.11	22.01	28.72	292.62	41.13
30	CABIXMAY	89	37	250	2299.7	2385.1	19363	6.76	62.15	64.46	523.32	77.45
31	TIBANCUCHE	89	37	250	1012.6	2208.2	21046	6.76	27.37	59.68	568.81	84.18
32	XEABAJ	89	86	350	3928.4	7972.7	35843	4.07	45.68	92.71	416.78	102.41
33	LAGUNA GRANDE	89	112	618	61.0	5605.9	32426	5.52	0.54	50.05	289.52	52.47

Notes:
- Transmission and distribution length in meters from plans.
- Transmission length per connection (Trans. L/conn) and
- Distribution length per connection (Distr. L/conn) in meters.
- Total Cost in US $.

3.10 Pressure and Flow Measurements

The most relevant findings of the pressure and flow measurements made during the field visits are shown in Table 3.9. From this data it can be seen that pressure available at the taps is more than sufficient, producing flows between 5 to 7 gallons per minute.

Measurements were also made at taps at a disadvantageous position (pressure wise) opening other taps in their vicinity to observe the decrease in pressure or flow. Very little can be inferred from this data because being the systems relatively new, the number of house connections is one half the expected total (design numbers are double the actual values because of population estimates). Overflows at spring boxes, distribution tanks and pressure reducing boxes was common at all communities visited.

TABLE 3.9

RESULTS OF PRESSURE AND FLOW MEASUREMENTS

	HOUSE CONNECTION MEASURED	MEASURED PRESSURE (m.w.c.)	MEASURED FLOW GPM
Community			
XOLCAJA	Near the end of branch No. 4	10	----
SIMAJUTIU	At lower branch	30	5.55
CERRO PARTIDO Y TORONJALES	At highest point in system	19-21	3.96
EL GUAPINOL	Heavy rain impeded work	-----	----
LAS VIOLETAS	(At highest point in system)		
	house 1	70	5.23
	house 2	42	7.93
EL CAMPO, XEBAC Y VICHACALA	(highest point of system)		
	house at El Campo	40	5.71*
	house at Xebac	41	7.29*
CERRO EL ARENAL	at lowest point in El Arenal	**	----
JOYA GRANDE Y RINCON CHIQUITO	(at highest point of system)		
	house 1	11-14	----
	house 2	14-20	6.18

Symbology

m.w.c. : meters column of water.
GPM : gallons per minute.
* : faucets were 3/4".
** : measurement could not be performed, since pressure exceeded the manometer range (100 psi).

4. RECOMMENDATIONS

a) CARE should assign an engineer for periodic construction supervision of all projects.

b) UNEPAR masons and CARE supervisors should be provided with a construction manual with typical drawings and details.

c) A lower figure of per capita assignment of 40 to 60 Lit/day should be considered in designs.

d) Population growth estimates in future projects should be carefully evaluated. Either to reflect INE estimates or a more realistic growth for the specific community.

e) To reduce construction cost, designs should be based on the real carrying capacity of pipe (i.e. real diameters).

f) If an allowance of head loss is provided at the entrance of pressure reducing boxes or distribution tanks, it should be clearly stated in the construction drawings and a valve installed to regulate flow. An operations manual of the system will also help.

g) Pipes with a minimum diameter of one inch should be used in dead end lines if more than four houses are connected. Pressure at all house connections in the line should be checked to avoid negative values.

h) "As-built" drawings with a copy in the files of the Water Committee, CARE and UNEPAR can be of great help in the future.

i) The intervention of trained specialists in ground water development in all phases of the project is recommended. CARE could hire on a part time basis a specialist to advise the program.

j) The dry pit latrine in use has proven a good solution and its use should be encouraged, except in cases where the water table is high.

k) The open discharge of flush waters should be discouraged.

l) Since the availability of labor decreases during the period August thru December, construction programs have to be accommodated to this fact.

m) Water Committees should be monitored during a period after completion of the systems. This will produce better maintenance and operation and encourage connections from new costumers.

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n) CARE should help UNEPAR to strengthen its Operations Department in order to fulfill its obligations to supervise and instruct the Water Committees.

o) Implementation of the Health Extension component of the program is highly recommended.

p) If possible, it will be of great impact to the health of rural communities of [illegible]

q) If the program continues, UNEPAR should be the choice for its implementation.

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ANEXO A
ANNEX A

CUESTIONARIO PARA EVALUAR EL SISTEMA DE AGUA

Nombre de la Comunidad _____

Entrevistador _____ Fecha _____

Comparar los sistemas construídos con lo diseñado.

Poner B = buena; R = regular; M = mala; anotar observaciones personales.

a) Captación _____

_____

b) Línea de conducción _____

_____

c) Cajas rompepresión _____

_____

d) Tanques de Distribución _____

_____

e) Red _____

_____

f) Chorros Públicos _____

_____

g) Conexión domiciliar _____

_____

____Tienen drenaje; se forman charcos? _____si _____no.

Aforo: entrada al tanque _____

_____

en chorro _____

_____

Fotos en _____

Muestras de Agua en _____

CUESTIONARIO SOBRE LETRINAS (Entrevistar unas 5 casas en cada Comunidad).

Con traductor si_____ no _____

Nombre de la Comunidad_____

Entrevistador_____Fecha_____

a) Trabajó alguien de la familia en la construcción del acueducto?

_____si _____no.

b) Trabaja alguien de la familia en la costa? _____si _____no.

c) Cuántos meses al año_____

d) Cuándo no están en la costa, en qué trabajan?_____

e) Donde queda su chorro?_____

f) Tiene drenaje _____si _____no; se forman charcos _____ si _____no.

g) Donde queda su letrina?_____

Con las respuestas anteriores dibujar un croquis de la ubicación de la casa (con norte).

h) Cuando construyeron letrina? _____antes del chorro _____después del chorro; cuanto tiempo_____

i) Puedo visitar su letrina?_____

j) Usan su letrina _____si _____no.

k) En caso no la usan, por qué no?_____
donde defecan?_____

l) Ver si está bien construida si_____ no _____

m) Está bien mantenida?_____si_____ no

hay moscas?_____ si_____ no

hay mal olor_____ si_____ no

n) Han recibido alguna instrucción relacionada con

uso del agua _____ si _____ no

uso de letrina_____ si _____ no.

Comunidad _____

ñ) Está bien ubicada?_____si _____no.

Por qué no lo está?_____

_____

Mencione algunos factores que podrían mejorar la ubicación_____

_____

_____

o) Cree Ud. que es importante utilizar la letrina _____si_____no.

Por qué? (explicar)_____

_____

III CUESTIONARIO PARA EL COMITE DE AGUA

01. Nombre de la Comunidad _____

02. Entrevistador _____ Fecha _____

03. Miembros del Comité (nombres), indicar a quien entrevistaron

Presidente: _____

Vicepresidente: _____

Secretario: _____ lee y escribe _____ si _____ no

Tesorero: _____ lee y escribe _____ si _____ no

Vocal: _____

Vocal: _____

Vocal: _____

04. Se reunen los miembros del Comité? _____ si _____ no

cada cuánto? (frecuencia) _____

05. Qué obligaciones o tareas tiene asignadas cada miembro del Comité:

Presidente: _____

Vicepresidente: _____

Secretario: _____

Tesorero: _____

Vocal: _____

Vocal: _____

Vocal: _____

06. Cómo se asignaron las tareas: _____

07. Qué es lo que realmente hace cada miembro del Comité:

Presidente: _____

Vicepresidente: _____

Secretario: _____

Tesorero: _____

Vocal: _____

Vocal: _____

Vocal: _____

08. Pregunte a cada miembro si entienden sus responsabilidades y evalue sus respuestas:

Presidente: _____ si _____ no; Porque: _____

Vicepresidente: _____ si _____ no; Porque: _____

Secretario: _____ si _____ no; Porque: _____

Tesorero: _____ si _____ no; Porque: _____

Vocal: _____ si _____ no; Porque: _____

Vocal: _____ si _____ no; Porque: _____

Vocal: _____ si _____ no; Porque: _____

09. En qué fecha se inició la construcción del sistema _____

10. En qué fecha se inauguró el sistema _____

11. Cuantos miembros de la Comunidad trabajaron en la construcción _____

12. Van a trabajar a la costa algunas personas de la Comunidad?

_____ si _____ no

Cuántos? _____ pocos _____ muchos _____ todos.

En qué epoca? de _____ a _____ (meses)

13. Quién es el encargado de cobrar las tarifas

(nombre) _____

14. Cual es la tarifa por mes: Q. _____ Cuantos servicios hay _____

15. Puede mostrarnos los libros de cuentas

estarán bien llevados los Libros _____ si _____ no

están al día _____ si _____ no

(Observaciones) (Como llevan las Cuentas) _____

Cuánto colectan al mes Q. _____

Cuánto tienen guardado Q. _____

Cuánto hay en mora Q. _____

16. Como se colectan las tarifas

la gente viene a pagar _____

les cobran en su casa _____

pagan mensualmente _____

al año _____

otro período _____

17. Quién (o quienes) toma la decisión de hacer un gasto

_____

_____

_____

18. Quién es el encargado de mantenimiento (fontanero)

(nombre) _____

Cuánto le pagan Q. _____

19. Hace el fontanero, la limpieza y reparaciones necesarias

_____ si _____ no

20. Qué otras actividades hace el Comité _____

_____

21. (Al investigador) Cree Ud. que éste Comité funciona:

_____ bien _____ mal.

Saben sus obligaciones _____ si _____ no

Otras Observaciones _____

_____

_____

_____

_____

22. Creen que usar las letrinas es importante _____ si _____ no

por qué (explicar): _____

_____

Cordón y Mérida, Ings.

SUMARIO DE ACTIVIDADES DE CAMPO DESARROLLADAS POR EL PERSONAL DE CORDON Y MERIDA, INGS

Proyecto	Departamento	Fecha de Terminación Proyecto	Dia de Visita a Proyecto	Personal de CyM	Personal de AID - CARE acompaño	Miembros del Comité de Agua Entrevistados
Xolcajá	Sololá	01/87	23/10/89	Ing. Octavio Cordón Ing. Mario García	Ing. Victor Dardón Sr. Roberto Lémus	Pres. Diego Perechú, Comité y Comité Pro mejoram.
Simajutiú	Sololá	/86	24/10/89	Ing. Octavio Cordón Ing. Mario García	Ing. Victor Dardón Sr. Roberto Lémus	Pres. Juan Tambriz y Comité
Cerro Partido y Toronjales	Suchitepéquez	06/87	06/11/89	Ing. Mario García Ing. Flavio Velásquez	Sr. Henry Avila	Pres. Everdo. Vàsquez y Comité
El Guepinol	San Marcos	12/88	07/11/89	Ing. Mario García Ing. Flavio Velásquez	Sr. Henry Avila	Pres. Carlos López y Comité
Las Violetas	El Quiché	08/89	07/11/89	Ing. Octavio Cordón Ing. Luis Navas	Sr. Roberto Lémus	Pres. Benito Pérez y Comité
El Campo, Xebàc y Vichacalá	El Quiché	08/89	08/11/89	Ing. Octavio Cordón Ing. Luis Navas	Sr. Roberto Lémus	Pres. Jcto. Santiago y Comité
El Arenal	Huehuetenango	E.C.	08/11/89	Ing. Mario García Ing. Flavio Velásquez	Sr. Henry Avila	Pres. Miguel Sales y Comité
Joya Grande y Rincón Chiquito	Chimaltenango	12/88	10/11/89	Ing. Luis Navas Ing. Flavio Velásquez	Sr. Henry Avila	Pres. Pedro Patzán y Comité

E.C. = en construcción

ANNEX C

This annex presents a summary of the information obtained in the field investigation performed during the evaluation. Being reference material written originally in spanish it was considered unnecessary its translation to english.

Cordón y Mérida, Ings.

ANEXO C
ANNEX C

COMUNIDAD: XOLCAJA

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE EVALUACION DE CAMPO OCT. 89

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la población
Municipio: Nahualá.
Departamento: Sololá.

1.2. Actividades Económicas
Agricultura. Granos básicos, consumo doméstico.
Carpintería, tejidos y comercio.

2. EVALUACION DEL SISTEMA DE AGUA

2.1. Aspectos Constructivos

2.1.1. Captacion
-Localización adecuada.
-La posición del rebalse ahoga el nacimiento.

2.1.2. Línea de Conducción
-Buen estado.
-Flujo constante.

2.1.3. Cajas Rompepresión
-No existen en el sistema

2.1.4. Tanque de Distribución
-Buen estado.
-Capacidad es el doble de lo planificado.
-Está enterrado y ello afecta a los usuarios más próximos.

2.1.5. Red de Distribución
-Viviendas próximas al tanque de distribución cuentan con poca presión.
-Se hizo prueba de presión cerca del final del ramal no. 4. Al abrir el chorro en la última casa del ramal la presión bajo a 10 mca.

2.1.6. Chorros Públicos
-Uno en la escuela.

2.1.7. Conexiones Domiciliares
-El sistema actual presta 87 servicios.
-Las llaves de paso enterradas no tienen ninguna protección.
-Algunos chorros están mal ubicados.

2.2. Capacidad del Sistema
-Según la información del Comité, no ha existido problema de escasez de agua.

2.3. Calidad del Agua
-Muestras para anàlisis bacteriológico y químico # 46, tomadas en la casa más próxima al tanque de distribución.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-Existen dos comités: Pro Mantenimiento del Sistema de Agua y Pro Mejoramiento de la aldea.

2.4.2. Integración del Comité
-El Comité Pro Manteninmiento consta de 7 personas: Presidente, Secretario, Prosecretario, Tesorero y 3 Vocales.
-El Comité Pro Mejoramiento de la aldea consta de 9 personas: Presidente, Vicepresidente, Secretario, Prosecretario, Tesorero y cuatro Vocales.

2.4.3. Funcionamiento de los Comités
-El Comité Pro Mantenimiento del Agua fue electo por la comunidad. Originalmente fue Comité Pro Introducción. Sesionan cada 15 días.
-El Comité Pro Mejoramiento también fue electo por la comunidad. Su campo de acción es más amplio.

2.4.4. Administración de Fondos
-El Comité Pro Mantenimiento del Agua maneja una caja chica dada por el otro comité.
-El Comité Pro Mejoramiento maneja las finanzas. Tienen los libros contables al día. Ellos toman las decisiones sobre los gastos. La comunidad realiza los pagos mensualmente en el salón comunal.

2.4.5. Actividades del Fontanero
-Existen dos fontaneros. Cobran Q. 2.00 por hacer reparaciones en las conexiones domiciliares.

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes
-Antes de la letrinización, los pobladores defecaban en el campo.

3.2. Uso de las Letrinas
-Informan que las utilizan.

3.3. Mantenimiento de las Letrinas
-Se observaron sucias.

3.4. Tipo de Letrina
-Construcción de caseta de caña de milpa y cubierta de lamina.

3.5. Ubicación de la Letrina
-Buena ubicación con respecto a la casa.
-Ubicación inadecuada, con respecto a la dirección del viento.

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Cordón y Mérida, Ings.

COMUNIDAD: XOLCAJA

4. ORIENTACION Y EDUCACION PARA USO DEL SISTEMA AGUA POTABLE-LETRINAS
-Durante la construcción CARE proporciono instrucción al Tesorero, Secretario y Fontanero.
-Después de la construcción no han recibido orientaciones.

[illegible] DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS
-Todos los beneficiados aportaron mano de obra.

6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO
-Los vecinos permanecen todo el año en su comunidad; muy pocos viajan a la costa.

7. OBSERVACIONES
-Las tareas de limpieza del sistema de agua las realizan los vecinos cada 4 meses.

Cordón y Mérida, Ings.

COMUNIDAD: SIMAJUTIU

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE EVALUACION DE CAMPO OCT. 89

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la población
Municipio: Santa Catarina Ixtahuacán.
Departamento: Sololá.

1.2. Actividades Económicas
Agricultura. Granos básicos para consumo doméstico.

2. EVALUACION DEL SISTEMA DE AGUA
Proyecto inaugurado el 28/01/87.

2.1. Aspectos Constructivos

2.1.1. Captación
-Ubicación inapropiada de la caja recolectora de caudales, ya que sobre ella pasa el cauce de corriente de invierno.

2.1.2. Línea de Conducción
-Buen estado.
-Flujo constante.

2.1.3. Cajas Rompepresión
-No existen en el sistema.

2.1.4. Tanque de Distribución
-Falta cerco perimetral.
-El respiradero no tiene malla de protección.
-Su capacidad es el doble de lo planificado.

2.1.5. Red de Distribución
-Buen estado.

2.1.6. Chorros Públicos
-Existen 2 (escuela y salón municipal).

2.1.7. Conexiones Domiciliares
-Llaves de paso enterradas sin ninguna protección.
-Existen 65 conexiones.
-Presión medida en conexión, en ramal más bajo: 30 mca, con un caudal de 0.35 l/s (5.55 gal/min).

2.2. Capacidad del Sistema
-Aforo en la entrada del tanque: no se efectuó por falta de llaves. Según la información del Comité, el tanque no se ha vaciado en ningún momento.

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COMUNIDAD: SIMAJUTIU

2.3. Calidad del Agua
-Muestras para análisis bacteriológico y químico # 150, tomadas en el chorro de la escuela, que es el primer servicio en la red.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-Pro Mejoramiento del caserío de Simajutiu.

2.4.2. Integración del Comité
-Está integrado por Presidente, Vicepresidente, Secretario, Tesorero y 5 Vocales.

2.4.3. Funcionamiento del Comité
-Electos por la comunidad.
-Reuniones los días sábado.

2.4.4. Administración de los fondos
-No cobran por el servicio de agua.

2.4.5. Actividades del Fontanero
-Lorenzo Xocoy. No cobra por el servicio.

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes
-Antes de las letrinas, defecaban en el campo.

3.2. Uso de Letrinas
-Aseguran hacer uso de la misma.
-En las visitadas, no se detectó mal olor o moscas.

3.3. Mantenimiento de las Letrinas
-Se observan limpias.

3.4. Tipo de Letrina
-Paredes de caña, cubierta de lámina.

3.5. Ubicación de Letrina
-Bien ubicadas con respecto a la vivienda.
-Ubicación inadecuada, en función de la dirección del viento.

4. ORIENTACION Y EDUCACION PARA USO DEL SISTEMA AGUA POTABLE-LETRINAS
-CARE instruyó en seminarios al Tesorero, Secretario y Fontanero, durante la construcción del sistema.

5. EVALUACION DE LA CONTRIBUCION DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS
-En la construcción participaron todos los beneficiados, con mano de obra.

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6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO

-De octubre a noviembre, un 20 % de la población se desplaza a la boca costa, para emplearse como mozos en el corte del café.

7. OBSERVACIONES

-Las tareas de limpieza del sistema las realizan cada 3 meses.
-En el Comité no participan mujeres.
-Los miembros del comité son jóvenes de edades entre 18 a 28 años.

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Cordón y Mérida, Ings.

COMUNIDAD: CERRO PARTIDO Y TORONJALES

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE LA EVALUACION DE CAMPO NOV 89

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la población
Municipio: San Pablo Jocopilas.
Departamento: Suchitepéquez.
Distancia a la capital: 156 km.
Altitud aproximada: 830 m. SNM

1.2. Actividades Económicas
-Agricultura. Parcelas de café.

2. EVALUACION DEL SISTEMA DE AGUA
Proyecto inaugurado el 10/06/87.

2.1. Aspectos Constructivos

2.1.1. Captación
-Construidas según diseño. Existen 3 captaciones.
-Falta tapadera.

2.1.2. Línea de Conducción
-Profundizada a 1 m.

2.1.3. Cajas Rompepresión
-Bien construidas.
-Candados son aceitados cada 3 meses.

2.1.4. Tanque de Distribución
-Bien cercado.
-Construido según diseño.
-Tubo de ventilación sin protección.
-Limpieza cada 3 meses.

2.1.5. Red de Distribución
-Cajas de valvulas visibles, bién construidas.

2.1.6. Chorros Públicos
-No existen.

2.1.7. Conexiones Domiciliares
-Existen 75 servicios.
-Construidas según diseño.
-Se midió la presión en la casa más elevada. Resultado: 19-21 mca (0.25 l/s) (3.96 gal/min).
Nota: se instaló llave de bola de 1/4" para aforar.

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2.2. Capacidad del Sistema
-El sistema funciona según lo planificado y el agua es suficiente.

2.3. Calidad del agua
-Muestras para análisis químico y bacteriológico fueron tomadas en primera casa de la red. Muestras # 97.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-Pro Administración, Operación y Mantenimiento del Sistema de Agua.

2.4.2. Integración del Comité
-El comité está integrado por 5 personas: Presidente, Secretario, Tesorero y dos Vocales que son mujeres.

2.4.3. Funcionamiento del Comité
-Fue electo por la comunidad.
-Sesionan cuando es necesario.
-Participan en otras actividades como reforestación y parque infantil.

2.4.4. Administración de los Fondos
-Las cuentas las lleva el Tesorero. Realiza los cobros.
-El cobro de las tarifas es trimestral. Q. 0.75 mensual.
-En la actualidad tienen una reserva de Q. 690.08
-Los libros son bien llevados.
-Las decisiones de efectuar gastos se toman en el comité.

2.4.5. Actividades del Fontanero
-Es el Tesorero, no cobra, es voluntario.

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes
-Antes de la letrinización defecaban en el campo.

3.2. Uso de Letrinas
-De cinco viviendas visitadas, una no tenía construida la letrina.
-De las restantes cuatro, una no tenía construida la caseta.
-Dos letrinas no tienen pozo, sino que tienen conexión del drenaje de la pila y de allí a un zanjón, el cual contaminan.

3.3. Mantenimiento de Letrinas
-De las cinco letrinas visitadas, sólo una tenía buen mantenimiento en cuanto al aseo.
-En las letrinas visitadas, no se detectaron malos olores.
-Existen zancudos en los pozos.

3.4. Tipo de Letrina
-Los pozos tienen una profundidad promedio de 6 metros.
-Construcción sencilla con cubierta de lámina.
-Existen las variantes que no usan pozo.

COMUNIDAD: CERRO PARTIDO Y TORONJALES

3.5. Ubicación de la Letrina
-Bién ubicadas.
-CARE recomendo la ubicación.

4. ORIENTACION Y EDUCACION PARA EL USO DEL SISTEMA AGUA POTABLE-LETRINAS
-CARE oriento a los beneficiados con charlas con promotores de salud, sobre el uso del agua y las letrinas durante la construcción.
-Se instruyó al Secretario y Tesorero sobre la operación y administración del sistema antes de entrar en operación.
-Después de la inauguración del sistema el seguimiento de la educación no ha sido continuo.

5. EVALUACION DE LA CONTRIBUCION DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS
-Participaron todos los beneficiados, aportando en mano de obra 30 jornales cada familia.

6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO
-La comunidad trabaja en parcelas de café que quedan en los alrededores de la comunidad. Sin embargo tuvieron problemas para aportar mano de obra en la época de cosecha.

Cordón y Mérida, Ings.

COMUNIDAD: EL GUAPINOL

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE EVALUACION DE CAMPO NOV 89

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la Población
Municipio: El Tumbador.
Departamento: San Marcos.
Distancia a la capital: 256 km.
Altitud aproximada: 560 m. SNM

1.2. Actividades Económicas
Agricultura. Parcelas de café

2. EVALUACION DEL SISTEMA DE AGUA
Proyecto inaugurado el 28/12/88.

2.1. Aspectos Constructivos

2.1.1. Captación
-UNEPAR decidió no utilizar la fuente del plano original.
-La captación está ubicada en una rivera. Si se produjera crecida, correria peligro.
-Existe rebalse activo.
-No se pudo quitar candado por estar oxidado.

2.1.2. Línea de Conducción
-En la salida de la captación los vecinos hicieron un cambio en el paso por el río, posteriormente a la construcción. El tramo está inseguro.
-Hay tramos de PVC descubierto.
-Tiene pocas llaves de control.
-Por el tipo de terreno, no se profundizó la línea y en algunos tramos es casi superficial.

2.1.4. Tanque de Distribución
-Bién construido, según diseño.
-Limpieza mensual.
-Los escalones interiores presentan oxidación.
-El rebalse desagua directamente al camino, sin protección.

2.1.5. Red de Distribución
-Presta el servicio proyectado.
-No hay deficiencia en el servicio.

2.1.6. Chorros Públicos
-No existen.

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Cordón y Mérida, Ings.

COMUNIDAD: EL GUAPINOL

2.1.7. Conexiones Domiciliares
-Existen 138 servicios.
-En algunas conexiones no se pusieron llaves de paso por decisión del albañil.
-En muchas casas despulpan café, utilizando el agua del sistema en el proceso.

2.2. Capacidad del Sistema
-Aforo en la entrada del tanque: 4.62 l/s.
-Caudal máximo diário de diseño: 1.14 l/s.

2.3. Calidad del Agua
-Muestras para anàlisis bacteriológico y químico # 110 tomadas en el tanque de distribución.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-Operación, Mantenimiento y Administración del Agua.

2.4.2. Integración del Comité
-Está integrado por Presidente, Secretario, Tesorero y dos Vocales que son mujeres.

2.4.3. Funcionamiento del Comité
-Electo por la comunidad.
-Sesionan mensualmente.

2.4.4. Administración de los Fondos
-Son administrados por el Tesorero.
-Libros bien llevados.
-Cobros semestrales en las viviendas.
-Tarifa Q. 0.60/mes.
-Los gastos se deciden en sesión de comité.
-Tienen reserva de Q. 176.80

2.4.5. Actividades del Fontanero
-Realizadas por el Comité voluntariamente.

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes
-Según la información del Comité y las visitas realizadas, se determinó que antes de la construcción del sistema, aproximadamente el 25 % de las viviendas tenían letrina. El resto de la comunidad defecaba en el campo.

3.2. Uso de las Letrinas
-Son utilizadas.

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Cordón y Mérida, Ings.

COMUNIDAD: EL GUAPINOL

3.3. Mantenimiento de las Letrinas
-De 4 viviendas encuestadas 2 letrinas estaban mal mantenidas en relación al aseo y mal olor.

3.4. Tipo de Letrina
-Construcción sencilla, cubierta de lámina.

3.5. Ubicación de Letrina
-Bién ubicadas respecto a la vivienda y el viento.
-Ubicación recomendada por CARE.

4. ORIENTACION Y EDUCACION PARA EL USO DEL SISTEMA AGUA POTABLE-LETRINAS
-Durante la construcción se dió orientación al comité para el desempeño de sus funciones y fontanería.
-Previo a la inauguración se dió orientación general a la comunidad por parte de promotores de CARE.

5. EVALUACION DE LA CONTRIBUCION DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS
-Todos los beneficiados aportaron 35 jornales por familia.

6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO
-El tiempo de la cosecha del café interfirio con la construcción (nov-ene).

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Cordon y Mérida, Ings.

COMUNIDAD: LAS VIOLETAS

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE EVALUACION DE CAMPO NOV 89

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la Población
Municipio: Nebáj.
Departamento: El Quiché.
Distancia a la capital: 240 km.
Altitud aproximada: 1875 m. SNM

1.2. Actividades Económicas
Agricultura principalmente. Además lana y tejidos.

2. EVALUACION DEL SISTEMA DE AGUA
Proyecto inaugurado el 15/08/89.

2.1. Aspectos Constructivos

2.1.1. Captación
-Bien construida.
-Se aforo el rebalse, dando 9.46 l/s.
-Nacimiento trabaja ahogado.
-Contiguo a la captación existe un potrero de ganado vacuno y caballar. una corriente de agua pasa por el potrero y desagua encima de la caja recolectora, pudiendo contaminar la fuente.

2.1.2. Línea de Conducción
-Flujo es pulsante en algunos tramos.

2.1.3. Cajas Rompepresión
-Bién construidas.
-Válvulas marca NIBCO (USA).
-Drenaje de la carretera de terraceria desagua sobre caja E-17.
-En caja E-17 no existe carga de agua, el paso es casi directo.

2.1.4. Tanque de Distribución
-Bien construido, según diseño.
-En la entrada hay flujo pulsante.

2.1.5. Red de Distribución
-Circuito cerrado.
-Llaves de paso para conexiones domiciliares no tienen protección; varias están totalmente enterradas.

2.1.6. Chorros Públicos
-Existen 2 unidades: uno en la escuela y otro en casa del donante del terreno para ubicar el tanque de distribución.

COMUNIDAD: LAS VIOLETAS

2.1.7. Conexiones Domiciliares
-Existen 157 servicios.
-No tienen drenaje y se forman charcos.
-Llaves de chorro marca MANFIELD (USA).
-Medida de presión:
casa 1: cerrado/70 mca. abierto/18 mca. (0.33 l/s) (5.23 gal/min)
casa 2: cerrado/42 mca. abierto/15 mca. (0.50 l/s) (7.93 gal/min)
Nota: se instaló llave de bola de 1/4" para aforar.

2.2. Capacidad del Sistema
-Aforo en entrada del tanque de distribución: 1.42 l/s con flujo pulsante.
-Caudal día máximo de diseño: 1.44 l/s.

2.3. Calidad del Agua
-Muestras para análisis bacteriológico y químico tomadas en primera casa de la red.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-Pro Administracion y Funcionamiento del Sistema de Agua y Letrinas.

2.4.2. Integración del Comité
-Está integrado por: Presidente, Secretario, Tesorero y Vocal.

2.4.3. Funcionamiento del Comité
-Electos por la comunidad para un período de un año.
-Se reunen eventualmente, casi cada mes.
-Entienden sus funciones.

2.4.4. Administración de los Fondos
-Cuotas trimestralmente cobradas. Q. 0.80/mes
-Libros bién llevados.
-Los gastos los hace el Tesorero cuando el Comité lo considera.
-Pagos en casa del Tesorero.

2.4.5. Actividades del Fontanero
-Las realiza el Presidente y le pagan Q. 3.50/día.

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes
-Antes de contar con letrinas las personas defecaban en el campo.

3.2. Uso de las Letrinas
-Todas las letrinas visitadas (5) son utilizadas.

3.3. Mantenimiento de las Letrinas
-4 de las 5 letrinas visitadas están bién mantenidas en el aspecto de aseo.
-En dos letrinas se encontró moscas y mal olor.

COMUNIDAD: LAS VIOLETAS

3.4. Tipo de Letrina
-8 metros es la profundidad promedio de los pozos.
-En las visitadas, caseta hecha de bajareque y techo de lámina.

3.5. Ubicación de la Letrina
-Todas las visitadas se encuentran al lado sur y al fondo del sitio.
-Ubicación recomendada por CARE.

4. ORIENTACION Y EDUCACION PARA EL USO DEL SISTEMA AGUA POTABLE-LETRINAS
-Durante la construcción fue dada por promotores sociales de CARE y UNEPAR, por lo menos tres veces.
-Después de la inauguración ha habido una visita de una promotora social de CARE.

5. EVALUACION DE LA CONTRIBUCION DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS
-Todos los beneficiados aportaron 15 jornales cada uno.

6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO
-En los meses de agosto a noviembre el 80 % de la población viaja a la costa a trabajar.

Cordón y Mérida, Ings.

COMUNIDAD: EL CAMPO, XEBAC Y VICHACALA

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE EVALUACION DE CAMPO NOV 89

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la Población
Municipio: Nebáj.
Departamento: El Quiché.
Distancia a la capital: 257 km.

1.2. Actividades Económicas
Agricultura es la principal. También tejidos.

2. EVALUACION DEL SISTEMA DE AGUA
Proyecto inaugurado el 17/08/89.

2.1. Aspectos Constructivos

2.1.1. Captación
-Bien construida.
-Totalmente cercada. Falta contracuneta.
-Rebalsa por todos lados.
-La posición del rebalse ahoga el nacimiento.

2.1.2. Linea de Conducción
-Bién construida, conforme diseño.

2.1.3. Cajas Rompepresión
-La unidad E-11 visitada, está bién construida.
-La caja distribuidora de caudales reparte igual caudal para ambos sistemas. El número de servicios es sensiblemente mayor en El Campo, lo cual origina que la caja de este ramal se encuentre vacía, mientras la otra rebalse continuamente.

2.1.4. Tanque de Distribución
-Bién construido.

2.1.5. Red de Distribución
-En partes altas hay flujo pulsante (entre E-23 y E-29).
-A algunas viviendas no llega agua.

2.1.6. Chorros Públicos
-No existen.

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2.1.7. Conexiones Domiciliares
-Existen 151 servicios.
-Las llaves de paso están enterradas.
-Llaves de chorro marca MANFIELD (USA).
-De 6 viviendas visitadas, dos de las llaves de chorro no cierran bién y tienen fugas.
-De 6 conexiones inspeccionadas 5 no tienen drenaje y se forman charcos.
-Medida de presión:
El Campo: cerrado/40 mca. abierto/2 mca. (0.36 l/s) (5.71 gal/min)
Xebac: cerrado/41 mca. abierto/3 mca. (0.46 l/s) (7.29 gal/min)
Nota: se instaló llave de bola de 1/4" para aforar.

2.3. Calidad del Agua
-Muestra para análisis bacteriológico y químico tomada en chorro domiciliar en E-20.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-Comité de Funcionamiento del Sistema de Agua.

2.4.2. Integración del Comité
-Está integrado por Presidente, Secretario, Tesorero y dos Vocales.

2.4.3. Funcionamiento del Comité
-Electos en asamblea.
-Se reunen mensualmente.
-En la evaluación sólo estuvieron presentes el Presidente y el Secretario.

2.4.4. Administración de los Fondos
-La tarifa es de Q. 0.80/mes.
-Cobro trimestral por el tesorero.
-Libros, aún no se llevan.
-Los gastos son autorizados por el Presidente o por el Tesorero.

2.4.5. Actividades del Fontanero
-Cobra Q. 3.50/día trabajado.
-Pertenece al Comité.

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes
-De las 6 viviendas visitadas, una cuenta con letrina anterior a la construcción del sistema, mientras que el resto defecaban en el campo.

3.2. Uso de las letrinas
-Existen 151 unidades construidas.
-Son utilizadas.

COMUNIDAD: EL CAMPO, XEBAC Y VICHACALA

3.3. Mantenimiento de las letrinas
-4 de 6 letrinas visitadas tienen mal mantenimiento con respecto al aseo.

3.4. Tipo de Letrina
-Profundidad promedio de los pozos: 8 m.
-Construcción sencilla con techo de lámina.

3.5. Ubicación de la letrina
-De la muestra visitada (6), dos están mal ubicadas con respecto al viento y muy cerca de la casa.

4. ORIENTACION Y EDUCACION PARA EL USO DEL SISTEMA AGUA POTABLE-LETRINAS
-Durante la construcción, personal de CARE paso 3 veces a càda vivienda.
-Después de la inauguración pasaron una vez.

5. EVALUACION DE LA CONTRIBUCION DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS
-El 80 % de la comunidad fue beneficiado con el servicio.
-Todos los beneficiados aportaron mano de obra.

6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO
-De septiembre a diciembre se paralizó el proyecto en un 70 % ya que la mayoría de la población viaja a la costa a trabajar.

COMUNIDAD: CERRO EL ARENAL

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE EVALUACION DE CAMPO NOV 89

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la población
Municipio: Ixtahuacan.
Departamento: Huehuetenango.
Distancia a la capital: 299 km.
Elevación aproximada: 1750 m. SNM

1. Actividades Económicas
Agricultura.

2. EVALUACION DEL SISTEMA DE AGUA
Proyecto en construcción, desde enero 89. Próximo a finalizar.

2.1. Aspectos Constructivos

2.1.1. Captación
-Bien construida, según el diseño.
-Salida de la conducción está asentada sobre roca, susceptible de ser arrastrada por crecida, provocando una situación insegura.
-En la misma dirección del nacimiento, hacia arriba, existe una fuente que pertenece a otra comunidad (El Platanar). Su uso sin coordinación podría influenciar negativamente la producción de la fuente de el Arenal.

2.1.2. Línea de Conducción
-Según información del comité, durante la construcción la presión rompió parte del acueducto, que hubo que reponer y reparar.
-Según información del albañil encargado de la construcción, una válvula en la línea de conducción da problemas por la presión (caja E-46)
-Los detalles constructivos fueron definidos por el albañil (UNEPAR), según lo informó.
-El tramo recorrido está bien construido.

2.1.3. Cajas rompepresión
-En la red de distribución se eliminó la E-108, lo cual ocasiona una sobrepresión en el extremo de línea de El Arenal.

2.1.4. Tanque de Distribución
-Bién construido, según diseño.
-Falta terminar respiradero.
-Existía rebalse (1.02 l/s), aunque en parte porque habían cortado el fluido a un sector de la comunidad, por reparaciones.

COMUNIDAD: CERRO EL ARENAL

2.1.5. Red de Distribución
-Se verificó la presión máxima en el último sector de El Arenal. El rango del manómetro (100 psi) fue excedido y no se pudo medirla.
-Cajas bién construidas.
-Hay fuga en válvula de flote, provocando desperdicio (E-103).
-Llaves de paso marca NIBCO (USA).

2.1.6. Chorros Públicos
-No existen.

2.1.7. Conexiones Domiciliares
-Existen 61 conexiones domiciliares.
-El comité informa que todas funcionan normal.
-No ha habido inauguración oficial, pero ya está funcionando el sistema.

2.2. Capacidad del Sistema
-Aforo en la entrada del tanque: no se efectuó por falta de llave del candado. Según la información del comité, el tanque no se ha vaciado en ningun momento.

2.3. Calidad del Agua
-Muestras para análisis bacteriológico y químico # 127 tomadas en vivienda donde fue medida la presión.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-El comité que está funcionando es el de construcción, pues el proyecto no ha entrado a operar.

2.4.2. Integración del Comité
Está integrado por Presidente, Secretario, Tesorero y 2 Vocales.

2.4.3. Funcionamiento del Comité
-Su función es la de introducción del agua.
-Colabora con ellos el Comité Pro-Mejoramiento de la comunidad.
-Las tareas se asignan por consenso.
-En la evaluación estuvieron presentes, el Presidente, el Secretario y el Tesorero, así como miembros del Comité Pro Mejoramiento de la comunidad.

2.4.4. Administración de los Fondos
-El Comité considera que la tarifa será de Q. 1.00, pero todavía no ha comenzado a funcionar.
-Cuando se hacen gastos, el comité toma la decisión.

2.4.5. Actividades del Fontanero
-Herman Laines, vecino que está aprendiendo.
-Le ayuda el albañil de UNEPAR.
-No tiene remuneración.

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COMUNIDAD: CERRO EL ARENAL

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes
-Antes defecaban en el campo ó en un riachuelo que pasa por la comunidad.

3.2. Uso de Letrinas
-Alrededor de 10 viviendas visitadas tienen en construcción su letrina, sin inaugurar.

3.4. Tipo de Letrina
-El suelo es sumamente duro. Un pozo fue posible excavarlo sólo a una profundidad de un metro.
-Promedio de profundidad que se pudo dar a los pozos es de 2.5 m.

3.5. Ubicación de la letrina
-Todas las visitadas estaban bien ubicadas con respecto a vivienda y viento.

4. ORIENTACION Y EDUCACION PARA EL USO DEL SISTEMA AGUA POTABLE-LETRINAS
-Se han impartido charlas por parte de un promotor de salud (CARE).

5. EVALUACION DE LA CONTRIBUCION DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS
-Todos los beneficiados contribuyeron con 100 jornales cada uno.
-Aportaron arena y piedrín del río.
-Compraron tubos de HG para reposición parcial de los que rompió la presión.

6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO
-De cinco familias visitadas, una va a trabajar a la costa.
-El comité manifestó que hubo problemas por las actividades agrícolas y la construcción simultánea del sistema. Quienes no podían asistir enviaban jornalero. Todavía deben jornales.

7. OBSERVACIONES
-La decisión tomada por el albañil de eliminar la caja rompepresión E-108, por no contar con supervisión técnica, ocasionó un exceso de presión en el último sector de la red de El Arenal.

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Cordón y Mérida, Ings.

COMUNIDAD: JOYA GRANDE Y RINCON CHIQUITO

PROYECTO RURAL DE AGUA 520-0336
RESULTADOS DE EVALUACION DE CAMPO NOV 1989

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1. DESCRIPCION DE LA COMUNIDAD

1.1. Localización de la Población
Municipio: Zaragoza.
Departamento: Chimaltenango.
Distancia a la capital: 65 km.
elev. aprox.: 2040 m. SNM

1.2. Actividades Económicas
Agricultura (hortalizas, maíz). Minifundio.

2. EVALUACION DEL SISTEMA DE AGUA
Proyecto inaugurado el 01/12/88.
Existía un sistema anterior con chorros públicos que era alimentado por otra fuente de calidad y cantidad no apropiada. Al entrar en operación el sistema se abandonó el anterior, destinándolo para riego.

2.1. Aspectos Constructivos

2.1.1. Captación
-Caja unificadora quedo enterrada para protección. No se pudo quitar tapadera.
-Problemas de posesión de la fuente.
-Rebalse mal ubicado, produce erosión.

2.1.2. Línea de Conducción
-Actualmente funciona sin problemas. Flujo constante.
-Problemas juridiccionales por atravesar otro municipio.
-Vecino de otro municipio se conectó diréctamente y sin autorización a la línea.

2.1.3. Cajas Rompepresión
-No existen en el sistema.

2.1.4. Tanque de Distribución

-Bien construido, de acuerdo a las dimensiones de diseño.
-Rebalse daña un camino vecinal.

-En 11 meses de operación no ha sido efectuada limpieza del mismo.

2.1.5. Red de Distribución
-Funcionamiento normal, según servicio proyectado.
-Cajas de válvulas bien construidas, candados en buen estado.
-Válvulas marca NIBCO (USA).

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2.1.6. Chorros Públicos
-Existen 2 en las escuelas y 1 en salón comunal.

2.1.7. Conexiones Domiciliares
-Existen 154 en Joya Grande y 71 en Rincon Chiquito, total: 225
-Conexiones visitadas de diámetro 1/2", llave Manfield (USA).
-Pruebas de presión en la parte más alta de la red.
-Casa (1): 11-14 mca.
-Casa (2): 14-20 mca. Se detectó golpe de ariete. Al abrir chorros vecinos la presión se estabilizó en 24 psi (aforo: 0.39 lts/seg). Nota: se instaló llave de bola de 1/4" para aforar.
-En conexión de Salón Comunal se detectó golpe de ariete.

2.2. Capacidad del Sistema
-Aforo en entrada al tanque de distribución: 3.38 lts/seg.
-Consumo máximo diario de diseño: 2.58 lts/seg.
-Aforos de la fuente: abril 85: 3.88 l/s.
abril 86: 4.07 l/s.
abril 87: 3.90 l/s.

2.3. Calidad del Agua
-Muestra para análisis bacteriológico y químico # 118 tomadas en primera vivienda del sistema.

2.4. Funcionamiento Administrativo

2.4.1. Nombre del Comité
-Pro Operación, Mantenimiento y Administración del Agua.

2.4.2. Integración del Comité
-Está integrado por: Presidente, Secretario, Tesorero y 2 Vocales.
-Los Vocales son de Rincón Chiquito y el resto del comité es de Joya Grande.

2.4.3. Funcionamiento del Comité
-Tiene el sistema de agua como función específica.
-En la evaluación estuvo presente todo el Comité.
-Tareas por consenso, con orientación de UNEPAR.
-Se reunen cada mes o cuando se requiere.

2.4.4. Administración de los Fondos
-El Tesorero cobra mensualmente en el centro comunal.
-Tarifa de Q. 1.00
-Casi todos al día en sus pagos.
-Actualmente tienen reserva de 1800.00
-Libros bien llevados. Vecino , Perito Contador, oriento al Tesorero.
-Las decisiones de hacer gastos las toma el comité.

2.4.5. Actividades del Fontanero
-No hay fontanero. Las actividades son realizadas por el comité en forma voluntaria.

COMUNIDAD: JOYA GRANDE Y RINCON CHIQUITO

3. EVALUACION DE LA LETRINIZACION

3.1. Antecedentes

-En dos de las viviendas visitadas se detectó existencia de letrinas anteriores a la implementación del sistema. Los otros defecaban en el campo. (cinco visitadas).

3.2. Uso de Letrinas

-Todas las viviendas visitadas tienen letrina (5 de muestra).
-Todas las letrinas son utilizadas. Hay costumbre de hacerlo.
-Hay muestras de poca higiene en todas de la muestra (papeles y olotes sucios).
-Según la muestra, la mitad presenta malos olores.
-No existen moscas.

3.3. Mantenimiento de las Letrinas

-Las letrinas visitadas no tienen mantenimiento con respecto al aseo.

3.4. Tipo de Letrina

-Las letrinas visitadas son de construcción sencilla, cubierta de lámina.

3.5. Ubicación de la Letrina

-Todas las letrinas visitadas están bien ubicadas con respecto a distancia a la vivienda y posicion respecto al viento.

4. ORIENTACION Y EDUCACION PARA EL USO DEL SISTEMA AGUA POTABLE-LETRINAS

-Durante la construcción recibieron orientación (charlas).
-Durante la operación del sistema no ha habido seguimiento.

5. EVALUACION DE LA CONTRIBUCION DE LA COMUNIDAD A LA CONSTRUCCION DEL SISTEMA AGUA POTABLE-LETRINAS

-En la entrevista con el comité se determino que todas los beneficiados con el proyecto aportaron 26-27 jornales para la construcción, además de la adquisición de la fuente de agua.

6. EVALUACION DE LA CAPACIDAD DE APORTE DE MANO DE OBRA DE LA COMUNIDAD SEGUN LA ESTACION DEL AÑO

-No bajan a trabajar a la costa.
-Construcción dió problemas cuando se traslapó con época de siembra o cosecha.

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Proyecto CARE-UNEPAR OPG:520-0336 Analizado por CyM, Ings. 21/12/89

ANNEX D

Stepwise Multiple Regression

Stepwise Regression to Predict: Costo Total del Proyecto

Variable List - Descriptive Statistics

Var.	Variable label	Mean	Standard Dev.
DV8	Costo Total del Proyecto	29942.6250	15614.8148
V5	Poblacion Servida	561.5938	269.9429
V6	Longitud de Conduccion	2052.0781	1756.3434
V7	Longitud de Red	4348.1656	2651.7785

Regression Statistics

Coefficient of multiple determination = 0.7322 (Corrected = 0.7035)
Coefficient of multiple correlation = 0.8557 (Corrected = 0.8387)
Standard error of multiple estimate = 8502.5518
(Corrected = 8946.4580)

F-Ratio = 25.5177
Degrees of freedom = 3 & 28
Probability of chance = 0.0000

Number of valid cases = 32
Number of missing cases = 1
Response percent = 96.97 %

Regression coefficients

Constant = 1868.6156

Var.	Coeff.	Beta	F-ratio	Prob.	Std. Error
V5	21.4516	0.3708	7.5835	0.0102	7.7898
V6	2.8794	0.3239	7.4158	0.0110	1.0574
V7	2.3270	0.3952	12.0642	0.0017	0.6700

Simple correlation matrix

	DV8	V5	V6
V5	I 0.7510		
V6	I 0.6118	0.5615	
V7	I 0.6466	0.5018	0.2018

Proyecto CARE-UNEPAR OPG:520-0336 Analizado por CyM, Ings.

Stepwise Multiple Regression (Continued)

Analysis of residuals

Rec.	Observed	Expected	Residual	Standard	3 2 1 0 1 2 3
1	13851.0000	31270.5589	-17419.5589	-2.0487	
2	14451.0000	30249.9043	-15798.9043	-1.8581	
3	10350.0000	24572.9357	-14222.9357	-1.6728	
4	48174.0000	60157.9435	-11983.9435	-1.4095	
5	40542.0000	49622.3609	-9080.3609	-1.0680	
6	52928.0000	48701.2432	4226.7568	0.4971	
7	51965.0000	37964.5738	14000.4262	1.6466	
8	17695.0000	17192.9598	502.0402	0.0590	
9	38265.0000	37502.4289	762.5711	0.0897	
10	33993.0000	35835.3058	-1842.3058	-0.2167	
11	28401.0000	33685.6844	-5284.6844	-0.6215	
12	17070.0000	11092.4387	5977.5613	0.7030	
13	47387.0000	43142.9779	4244.0221	0.4991	
14	19840.0000	26477.1042	-6637.1042	-0.7806	
15	49915.0000	43385.8588	6529.1412	0.7679	
16	21580.0000	17743.9207	3836.0793	0.4512	
17	31150.0000	28276.3958	2873.6042	0.3380	
19	81586.0000	60672.9625	20913.0375	2.4596	
20	25547.0000	33493.2995	-7946.2995	-0.9346	
21	32343.0000	27027.1867	5315.8133	0.6252	
22	25794.0000	24167.6508	1626.3492	0.1913	
23	16224.0000	15079.0888	1144.9112	0.1347	
24	17237.0000	14085.1179	3151.8821	0.3707	
25	13262.0000	12328.6417	933.3583	0.1098	
26	18264.0000	16117.3775	2146.6225	0.2525	
27	38872.0000	35713.4498	3158.5502	0.3715	
28	19683.0000	16118.0995	3564.9005	0.4193	
29	23117.0000	24210.7091	-1093.7091	-0.1286	
30	19363.0000	19403.4422	-40.4422	-0.0048	
31	21046.0000	15285.6702	5760.3298	0.6775	
32	35843.0000	39240.5563	-3397.5563	-0.3996	
33	32426.0000	28346.1521	4079.8479	0.4798	

Durbin-Watson statistic = 1.2240

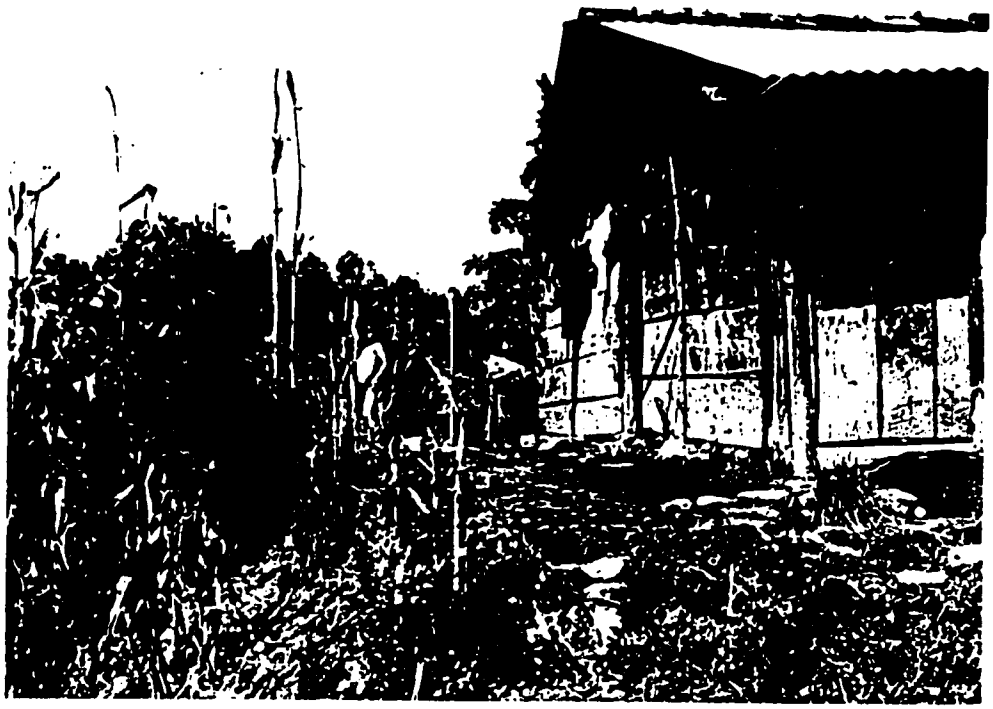
Proyecto CARE-UNEPAR OPG:520-0336 Analizado por CyM, Ings.

Stepwise Multiple Regression (Continued)

Analysis of residuals

Rec.	Observed	Expected	Residual	Standard	3 2 1 0 1 2 3
1	13851.0000	20024.8253	-6173.8253	-0.8654	
2	14451.0000	18317.0152	-3866.0152	-0.5419	
3	10350.0000	12871.8142	-2521.8142	-0.3535	
4	48174.0000	60198.5225	-12024.5225	-1.6855	
5	40542.0000	48834.6959	-8292.6959	-1.1624	
6	52928.0000	50726.3185	2201.6815	0.3086	
7	51965.0000	34539.2852	17425.7148	2.4425	
8	17695.0000	13850.7102	3844.2898	0.5388	
9	38265.0000	38430.3132	-165.3132	-0.0232	
10	33993.0000	35531.5058	-1538.5058	-0.2157	
11	28401.0000	34351.4145	-5950.4145	-0.8341	
12	17070.0000	6890.6311	10179.3689	1.4268	
13	47387.0000	41754.2276	5632.7724	0.7895	
14	19840.0000	21865.3190	-2025.3190	-0.2839	
15	49915.0000	45735.5017	4179.4983	0.5858	
16	21580.0000	14632.1972	6947.8028	0.9739	
17	31150.0000	29801.9628	1348.0372	0.1890	
19	81586.0000	64473.4726	17112.5274	2.3986	
20	25547.0000	31886.6434	-6339.6434	-0.8886	
21	32343.0000	31860.2724	482.7276	0.0677	
22	25794.0000	29098.6796	-3304.6796	-0.4632	
23	16224.0000	17799.1970	-1575.1970	-0.2208	
24	17237.0000	16675.3536	561.6464	0.0787	
25	13262.0000	14324.4342	-1062.4342	-0.1489	
26	18264.0000	20044.3194	-1780.3194	-0.2495	
27	38872.0000	37082.5935	1789.4065	0.2508	
28	19683.0000	18867.7280	815.2720	0.1143	
29	23117.0000	31073.1843	-7956.1843	-1.1152	
30	19363.0000	23191.5455	-3828.5455	-0.5366	
31	21046.0000	18290.8667	2755.1333	0.3862	
32	35843.0000	42292.7072	-6449.7072	-0.9040	
33	32426.0000	32846.7428	-420.7428	-0.0590	

Durbin-Watson statistic = 1.6884



Las Violetas, Nebaj

Children using their house water service.

Niños utilizando el servicio de agua domiciliar.

Las Violetas, Nebaj

User being interviewed by Luis Navas (CyM) with a Commitee Member performing as interpreter.

Usuaria siendo entrevistada por Luis Navas de CyM con un Miembro del Comité actuando como intérprete.

Las Violetas, Nebaj

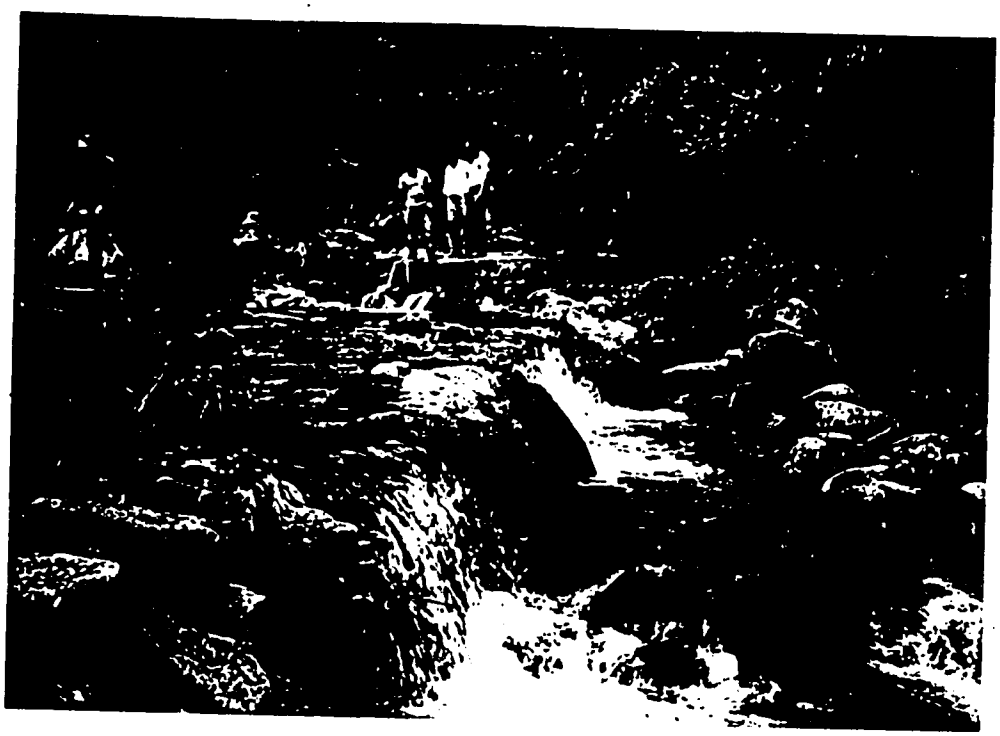
Roberto Lemus (CARE) and the treasurer of the commitee performing a pressure and flow test.

Roberto Lemus (CARE) y el tesorero del Comité efectuando una prueba de presión y caudal.

Las Violetas, Nebaj

Spring box with mud stains caused by rain overflow over it. Overflow crosses a pasture plot before reaching the box.

Caja de captación con manchas de lodo dejadas por el flujo de correntadas de invierno sobre ella. La correntada pasa por un potrero antes de llegar a la caja.



El Guapinol, El Tumbador

Spring box at river bank, exposed to contamination and/or destruction when heavy rains cause large river flows.

Caja de captación en Ribera del río, expuesta a contaminación y/o destrucción por las correntadas de invierno.

Cerro Partido y Toronjales, San Pablo Jocopilas

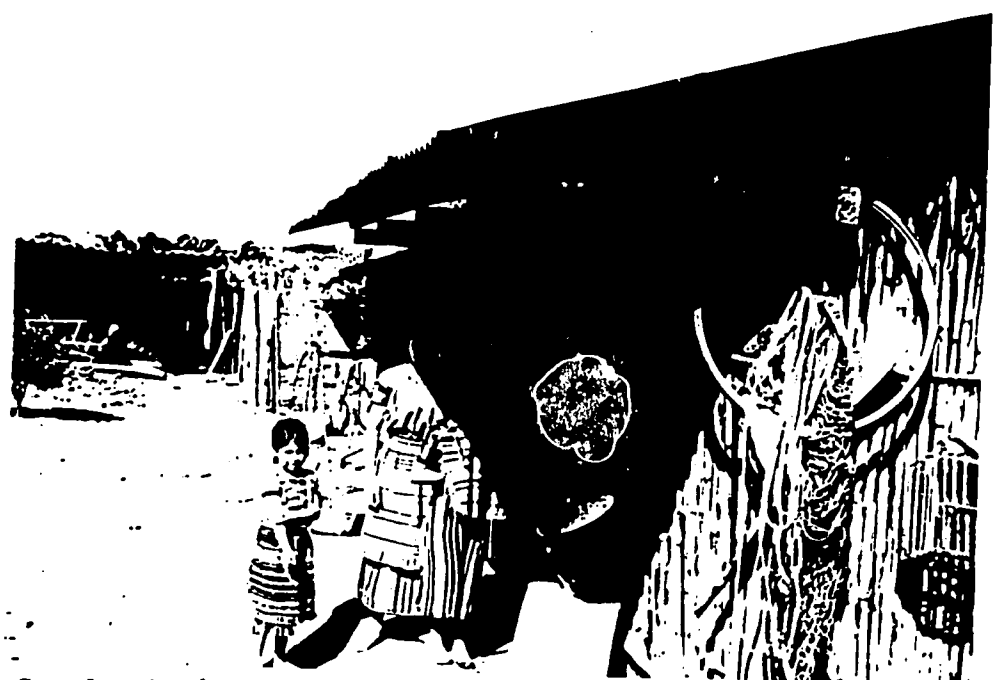
Henry Avila (CARE) performing a pressure and measurement test.

Henry Avila (CARE) efectuando una prueba de presión y flujo.

Joya Grande-Rincón Chiquito, Zaragoza

Spring box with great erosion caused by overflow location.

Caja de captación con gran erosión causada por localización del rebalse.



Joya Grande-Rincón Chiquito, Zaragoza

Typical view of a beneficiarys home. House construction is typical of Guatemala highlands.

Vista típica de la casa de un beneficiario. La construcción de casas es típica de el altiplano del país.

Rincón Chiquito, Zaragoza

Control valves at entrance of each house connection are buried with no indication of its position. Excavation was necessary to operate them during the field tests.

Las llaves de paso en cada conexión domiciliar están enterradas sin indicación alguna de su posición. Fué necesario desenterrarlas para accionarlas durante las pruebas de campo.

Rincón Chiquito

User filling her "pila". Note adequate flow.

Usuaria llenando su pila. Nótese que el flujo es adecuado.

Cerro El Arenal - Ixtahuacán

Distribution tank view. Overflow pipe is PVC without protection; tank has no ventilation.

Vista del tanque de distribución. La tubería del rebalse es de PVC sin protección, el tanque carece de ventilación.

Cerro El Arenal - Ixtahuacán

Children using their water connection. Note the ingenious shower.

Niños haciendo uso del agua en su casa. Nótese la ingeniosa ducha.

Cerro El Arenal, Ixtahuacán

Beneficiary performing his contribution excavating a ditch for a house connection.

Beneficiario haciendo su contribución construyendo una zanja para conexión domiciliar.

Cerro El Arenal, Ixtahuacán

Partial view of a latrine under construction. Note its location and distance from the house.

Vista parcial de una letrina en construcción. Nótese su localización y distancia de la casa.