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EVALUATI[illegible] OF THE CARE WATER SUPPLY AND SANITATION PROJECT IN THE DOMINICAN REPUBLIC

WASH

WATER AND SANITATION FOR HEALTH PROJECT

Operated by
CDM and Associates

Sponsored by the U.S. Agency for International Development

1611 N. Kent Street, Room 1001
Arlington, VA 22209-2111 USA

Telephone: (703) 243-8200
Fax (703) 525-9137
Telex WUI 64552
Cable Address WASHAID

WASH FIELD REPORT NO. 261

MAY 1989

Prepared for
USAID/Santo Domingo and CARE-Dominicana
WASH Activity No. 522

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EVALUATION OF THE CARE WATER SUPPLY AND SANITATION PROJECT IN THE DOMINICAN REPUBLIC

Prepared for USAID/Santo Domingo and CARE-Dominicana under WASH Activity No. 522

by

Homero Silva
Geri Marr Burdman
and
Peter Buijs

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ACRONYMS

CEA	*Consejo Estatal del Azucar* (State Sugar Council)
DR	Dominican Republic
FEDA	*Fondo Especializado para el Desarrollo Agropecuario* (Specialized Fund for the Development of Agriculture and Livestock)
FUNDASUR	*Fundacion de Apoyo al Suroeste* (Foundation for the Support of the Southwest)
GI	Galvanized Iron
GODR	Government of the Dominican Republic
GPCD	Gallons per Capita per Day
GPM	Gallons per Minute
INAPA	*Instituto Nacional de Aguas Potables y Alcantarillados* (National Institute of Potable Water and Sewerage)
INDRHI	*Instituto Nacional de Recursos Hidraulicos* (National Institute of Hydraulic Resources)
LPCD	Liters per Capita per Day
O&M	Operation and Maintenance
OPG	Operational Program Grant
ORT	Oral Rehydration Therapy
PACD	Project Activity Completion Date
pH	Potential Hydrogen
PSI	Pounds per Square Inch
PVC	Polyvinyl Chloride
SEEBAC	*Secretaria de Estado de Educacion, Bellas Artes y Cultura* (State Secretariat of Education, Fine Arts and Culture)
SESPAS	*Secretaria de Salud Publica y Asistencia Social* (State Secretariat of Public Health and Social Assistance)
SSID	*Servicio Social de Iglesias Dominicanas* (Social Service of Dominican Churches)
TDS	Total Dissolved Solids
USAID	United States Agency for International Development
WASH	Water and Sanitation for Health Project
WHO	World Health Organization
WS&S	Water Supply and Sanitation

ACKNOWLEDGMENTS

Grateful acknowledgment is expressed to the representatives of CARE and USAID and to each person contacted or interviewed during the course of this evaluation. The spirit of collaboration at all levels was very positive and greatly assisted the team in carrying out the assignment.

EXECUTIVE SUMMARY

This report presents the findings of an evaluation of the CARE Rural Water Project (517-0232) in the Dominican Republic authorized under WASH Activity No. 522 and carried out from January 26 to February 17, 1989, by a three-person team.

The project, funded by a $430,000 Operational Program Grant (OPG) from USAID in August 1985 and a $375,000 contribution from CARE, was intended to improve water and sanitation facilities for 33,000 to 41,000 people in 50 to 70 communities and to teach them proper use and maintenance. The OPG was amended in April 1988 to reduce the project area to 30 to 40 communities. The project activity completion date is August 31, 1989.

The purpose of the evaluation was to review the project in terms of implementation strategies, inputs, outputs, functioning, utilization, and selected socioeconomic effects; to identify lessons learned; and to make recommendations for future programming.

The evaluators gathered information from meetings with USAID, CARE, SESPAS, INAPA, the Peace Corps, CEA, and FUNDASUR, as well as with all project field staff. They reviewed implementation plans, reports, and other relevant data and, conducted engineering, household, and water committee surveys through questionnaires administered to a sample of the communities served by the project. The major findings and recommendations of the evaluation team follow.

Major Findings

Overall, the project has been a worthwhile activity and much progress has been made towards achieving its objectives. Valuable lessons have been learned and in many instances the acquired experience has been applied to improving implementation.

The change in project design, allowing for a choice of technology by project participants, has had a positive effect on performance at all levels.

Establishing an improved water supply has been more successful in communities where piped water distribution systems were installed than in those provided with handpumps, primarily because of greater popular interest and a more adequate operation and maintenance program.

The project promoted latrines but only two were constructed, suggesting that promotion alone is not enough in low-income areas.

The project did not allocate adequate resources for technical assistance or for health education and training materials.

The project health promoters have gained the trust of the communities and have made some progress in health education. There is evidence that the relationship between water and health is well understood, and that some health practices have improved. However, a health education strategy needs to be developed and much more education is required in all communities served.

The evaluation team found functioning water committees and water system caretakers who have received some training through the project. Most committees are active in overseeing the operation of the water supply systems and collecting funds for maintenance.

Communities are aware of the role and purpose of the committees and the foundation has been established for community-based maintenance programs.

In many instances, however, the communities will not be able to perform all maintenance tasks, and a comprehensive operation and maintenance program should be defined.

The initial project design had many weaknesses that created problems in project implementation. Most of these were ultimately overcome, albeit with difficulty at times.

Project management generally has been satisfactory. As a result of its own contributions, sound fiscal management, and the proper utilization of outside resources, CARE has achieved considerable results with limited USAID funds.

After initial difficulties with recruitment and performance, the field staff is now one of the project's greatest assets.

Recommendations

General

1. The project merits continuation beyond the current project activity completion date. CARE should develop a multiyear proposal for the next phase, avoiding some of the pitfalls of the original project design process.

2. This phase should build on the experience gained, strengthening those areas for which adequate resources were not available during the past three years. In particular, health education and information systems should be given greater attention. INAPA's design standards and WHO recommendations should be used in the future for the design of water and excreta disposal systems. Moreover, in areas with impermeable soils, drainage systems for waste water should be improved by using mound systems or evapotranspiration beds. Additionally, use of test wells to assist in the design of water wells before drilling should be seriously considered. Finally, a water quality monitoring program for water supply sources as well as for water containers at selected homes should be instituted.

3. The remainder of the current project should be devoted to the development of a comprehensive operation and maintenance program, especially for communities with handpumps.

Health Education and Community Participation

1 Any future water supply and sanitation projects, whether by CARE or other agencies, should permit a flexible approach to the choice of technology.

2. CARE should provide technical assistance in health education at the outset of projects such as this, and there should be followup for staff training, materials development, implementation, and evaluation. Health education strategists, if not available locally, should be drawn from other CARE projects. CARE should further refine its community selection and preparation strategies by developing a phased approach to community identification, project feasibility, and negotiation, particularly if more handpump systems are installed.

3. The contracts signed by CARE and the community should clearly spell out the responsibilities of each party. Communities should be fully prepared to make their own technology selection.

4. An assessment of community needs (KAP survey), clearly established goals, and adequate materials and resources are necessary if health education is to produce results.

5. The approach to health education should encompass the school, the community, and mass communication and social marketing.

6. The community outreach staff should be increased to match the scope of the program defined through the needs assessment. Community members should be involved in health education efforts from the inception of a project.

7. Twenty percent of present and future project funding should be allocated to health education.

8. CARE should provide technical assistance and funds to promote and construct latrines in interested communities.

Water Systems Development and Operation and Maintenance

1. For handpump systems, the community should be required to purchase enough tools and materials to last at least one year from the time of pump installation.

2. CARE should use INAPA design standards because by law all water systems in the Dominican Republic must be approved by INAPA.

3. Percolation trenches of suitable size should be constructed around standpipes to dispose of waste water. Where this is not possible, adequate surface channels should be provided.

4. Test wells should be drilled for the correct design of gravel pack and slot size, as well as to determine the quality and quantity of water available.

5. Professional assistance should be sought in deciding upon the range of slot most suited to the soils in the project area, and factory-made well screens should replace the improvised screens used at present.

6. A monitoring system should be established for the bacteriological analysis of at least one sample per quarter from each system. Where successive positive samples are obtained, a sanitary survey should be conducted to determine the sources of pollution.

7. CARE should develop a comprehensive O&M strategy, using WASH Technical Report 35, and decide which entity is responsible at each level.

Project Management and Design

1. CARE should conduct an in-depth training needs assessment for water committees and local technicians and use this to improve the current training programs for community members.

2. CARE should improve the coordination of the water project with other organizations, particularly INAPA and SESPAS, at the local and national levels.

3. During the next phase, CARE should establish a simple but comprehensive information system, and should seriously consider the use of short-term technical assistance for this purpose.

4. CARE should further develop its human resource base for the project in Barahona, and identify and budget for future training opportunities.

5. CARE should ensure that the skills and experience of the project design team include long-term experience with CARE project planning and implementation, as well as an excellent knowledge of the socioeconomic situation in the country and, if possible, the project area to be served. Any new water and sanitation project design exercises should also involve CARE-Dominicana's present project field staff.

Chapter 1

INTRODUCTION

1.1 Assignment and Scope of Work

In response to a request from USAID/Santo Domingo, the Water and Sanitation for Health (WASH) Project assigned a three-person team to conduct a final evaluation, authorized under WASH Activity No. 522, of the CARE Rural Water Project (517-0232), also referred to hereafter as the CARE-Dominicana WS&S Project.

The evaluators—two from WASH and one from CARE—combining skills in engineering, finance, project management, primary health care, child survival, health education, and community development, carried out their task from January 26 to February 17, 1989, under a scope of work that required them to:

- Determine if project objectives had been met
- Analyze the technology chosen for each community in relation to appropriateness, operation, maintenance, and sustainability
- Assess water quality and quantity
- Evaluate the economic, public health, convenience, and service level benefits to communities
- Determine the capital and recurrent costs per capita for each type of system installed
- Determine how well communities had been prepared to maintain their systems
- Assess the degree of community participation in project planning, implementation, operation, and maintenance
- Analyze the health education component of the project and its impact on the knowledge, attitudes, and practices of project beneficiaries
- Determine the role of women in the project
- Determine the potential linkages for water supply with child survival activities, given that WS&S provides the opportunity for community entry, community participation, and sustainability
- Review levels of collaboration between CARE, the host government, and USAID

- Examine prospects for project sustainability and lessons learned

- Make recommendations for a possible program extension

1.2 Project Background

In August 1985, USAID/Santo Domingo authorized a three-year Operational Program Grant (OPG) of $430,000 to CARE to improve water and sanitation facilities and provide health education for 50 to 70 communities with a population estimated at 33,000 to 41,000 in four southwestern provinces of the Dominican Republic (Figure 1).

The project, to which CARE agreed to contribute $300,000, was designed to increase the quality and quantity of water supplies; promote the use of family latrines; improve family health practices through trained health educators; and establish maintenance systems through active water committees.

During the first year, it became evident that conditions in the field were quite different from the assumptions underlying the original project proposal. Following the visit of a consultant in July 1987, a revised proposal with the following modifications was submitted to USAID:

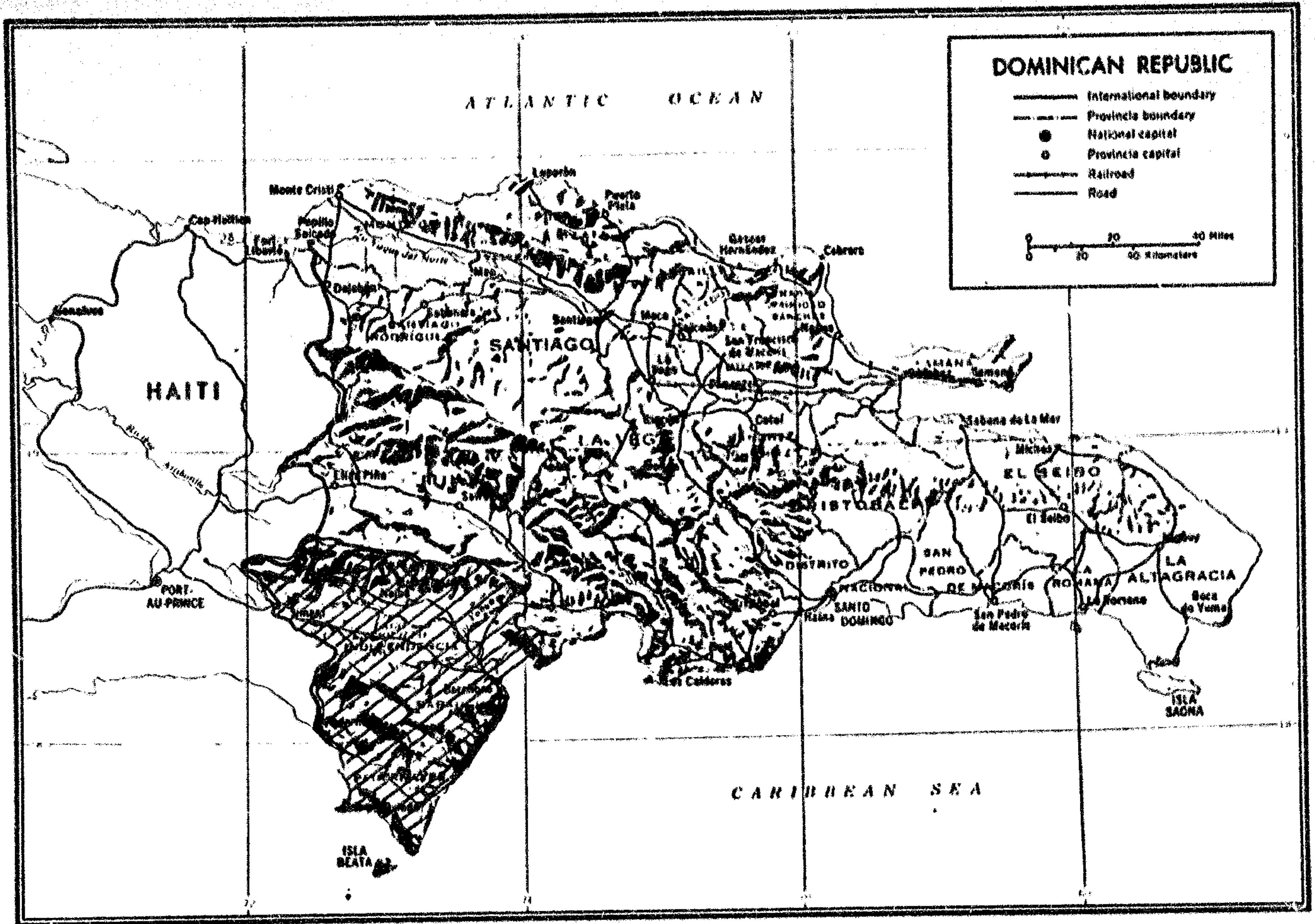
(1) The provision of water was to take into account community needs and desires and the availability of natural resources and appropriate technology.

(2) The number of communities under the project was reduced to 30 to 40 and the number of beneficiaries per water system was increased. However, the total number of beneficiaries remained the same.

(3) The project activity completion date (PACD) was extended from August 31, 1988 to August 31, 1989.

(4) CARE agreed to cover any additional costs by increasing its contribution to $375,000. No increase in USAID funding was requested.

In April 1988, USAID and CARE-Dominicana signed an OPG amendment reflecting these changes.



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1.3 <u>Reasons for Selecting Project Area</u>

The southwest region of the country was selected for the following reasons:

- Many of the communities were constantly plagued by water shortages, breakdowns, and maintenance problems.
- The Government of the Dominican Republic (GODR) did not have sufficient resources to meet the needs of the rural population. The CARE project was designed to complement existing programs such as PLANAP, INAPA, and SESPAS-USAID.
- Women and children walked up to 10 kilometers daily to collect water, often from sources that were unsafe for human consumption.
- The impoverished southwest contained the largest number of villagers living in small, ill-served communities in a geographic region that precluded easy availability of safe acceptable water supplies.
- The project area was logistically accessible and project activities could be sustained.

Chapter 2

EVALUATION METHODOLOGY

The proposal and the OPG agreement established several objectives and stipulated that both a midterm and a final evaluation would be conducted. The midterm evaluation, scheduled for July 1987, was not completed until January 1989. Since only seven months remained for the PACD, it was decided that the present evaluation should combine features of both the planned midterm and final evaluations.

2.1 Evaluation Model

The evaluation team adapted an evaluation model used successfully in earlier WASH assignments (Malawi 1984 and 1986, Burkina Faso 1986, Haiti 1987, Bolivia 1986). Emphasizing the sequential nature of linkages from initial project input to ultimate project outputs, utilization, and impacts, the model, shown in Figure 2, provides a basic framework for organizing evaluation activities.

Each level of Figure 2 represents an order of effects dependent upon all previous effects. The initial level of effectiveness consists of the immediate consequences of project development, which include all project inputs, operations, and physical outputs under the control of project implementation agencies. These consequences generally can be assessed in straightforward physical units. Given the formative nature of the evaluation, this report also documents the processes developed in the project operations section.

Figure 2

General Evaluation Model for Water and Sanitation Projects

PROJECT	PROJECT	ULTIMATE PROJECT
OPERATION	PERFORMANCE	CONSEQUENCES
INPUTS OPERATIONS OUTPUTS	USAGE	IMPACTS
EFFICIENCY LEVEL	EFFECTIVENESS LEVEL	IMPACT LEVEL

The second level of effectiveness involves the more complex consequences of project performance, or the use of project systems. This includes the water use and sanitation practices adopted by the project communities, as well as the types of health education and the maintenance support the communities give to the new systems. The project implementers cannot directly control these consequences; they can only hope to favorably influence behavioral patterns in the recipient communities. Because of the difficulties in measuring behavior, surrogate or proxy indicators often must be used.

The third and final level is the impact level, which includes the ultimate health, economic, and social consequences of the project. To the policy maker, these are the long-run benefits of water and sanitation projects and are dependent upon project outcomes at the earlier effectiveness levels. They are very difficult to measure, requiring a disciplined research approach with strict project controls if meaningful results are expected. The World Health Organization, in its Minimum Evaluation Procedure (WHO, 1983), advises against attempting to measure project impacts in operational field assessments.

The model in Figure 2 formed the basis for this project evaluation and encompassed the following five areas:

- Project input by USAID, CARE, the local community, and others
- Development and implementation of detailed project strategies and activities within the framework of the initial project design and subsequent amendments
- Project outputs of community water supply and sanitation schemes, management structures, and increased health knowledge
- Utilization of water and sanitation systems and the functioning of community support structures
- Preliminary impressions and participant perceptions of project effects and benefits

2.2 General Approach

The evaluation team used several methods to collect information. Team members met with representatives from USAID, CARE, SESPAS, INAPA, the Peace Corps, CEA, and FUNDASUR in Santo Domingo and Barahona. They conducted extensive interviews with project field staff in Barahona. They reviewed files, implementation plans, reports, and additional cost information provided by the CARE accounting department.

The team developed three instruments to assess project progress and performance in the field: an engineering survey, a questionnaire for water committees, and a household survey. These instruments were complemented by more informal discussions and observations in the project communities.

The team discussed its preliminary findings with USAID and CARE representatives and field staff in Barahona, then returned to Santo Domingo to complete the data analysis and prepare a draft report, revised to reflect the comments of USAID and CARE, prior to leaving the Dominican Republic.

The time frame for the evaluation exercise is included in Appendix A. Scope of Work.

2.3 Engineering Survey

Five water distribution systems and 15 handpump sites (10 functioning and 5 nonfunctioning) were visited to collect information on water quality and quantity.

A portable Hach One pH meter model 43800 was used to measure pH and temperature. a portable Hach Conductivity/TDS meter model 44600 was used to determine conductivity and total dissolved solids, and a Millipore portable incubator was used to determine total coliforms. A pressure gauge attached to a coupling was used to measure water pressure. One-gallon containers were used to determine the flow rate at taps and four-gallon containers were used at handpumps.

Caretakers (pump technicians and plumbers) were interviewed to assess their knowledge of operation and maintenance.

The following questions were asked of pump technicians:

- How does the handpump work?
- What are five tools needed to repair a pump?
- What are five parts of the pump?
- How is a leather cup replaced?
- Where is the foot valve located?
- How frequently should the chain be lubricated?

The following questions were asked of plumbers:

- How do you install PVC pipe?
- How do you make a bell?
- How do you replace valves?
- How are tanks disinfected?
- How frequently should you flush the distribution system?

2.4 Water Committee Survey

Nine communities were selected for this survey (four with water distribution systems and five with handpumps) to gather information on the management practices of the water committees established and trained under the project. Six of these were also selected for the household survey. A questionnaire prepared after project staff had provided a general overview of the project's community organization process was administered by a member of the evaluation team to all committee members available in the community at the time of the team visit. The data were analyzed in Barahona following the field work and the results discussed with project staff. A copy of the questionnaire appears in Appendix C.

2.5 Household Survey

The household survey was preceded by a review of questionnaires used in other WASH project evaluations and of project documents related to health education and community participation. CARE staff contributed their suggestions. A draft questionnaire prepared with the help of this information was field tested and then suitably revised for the final version. Four outside interviewers--all university graduates with some experience in surveying--were employed and thoroughly trained for the data-gathering phase. They were supervised by the evaluators and CARE staff.

The questionnaire, administered to 122 households randomly selected in six communities, sought information about:

- The use of water from handpumps or water systems installed by the project
- The storage of water inside the home in covered containers
- The use of latrines
- Hygiene habits affected by health education activities
- Community participation
- Perceived benefits of the water system
- The role of women in the project

Some details about the six communities surveyed appear below.

Community	Population	Water System	Number of Households Surveyed
Batey VIII	2,580	Solar	40
Las Clavellinas	2,900	Gravity	40
Vuelta Grande	750	Handpump	12
Uvillita	260	Handpump	8
Los Robles	550	Handpump	10
El Guabá	1,000	Handpump	12

Chapter 3

FINDINGS: PROJECT OPERATIONS

3.1 Inputs

3.1.1 USAID

Through an OPG, USAID has contributed $430,000 to cover expenditures incurred by CARE for national personnel, training, equipment, materials, and other project support costs.

3.1.2 CARE

CARE has provided $375,000 to cover expenditures related to international and national personnel, vehicles, equipment, materials, and other project support costs.

The project is managed by an international civil/sanitary engineer based in the main CARE office in Santo Domingo, with an assistant providing administrative support. In the field the project coordinator, a Dominican sociologist based in Barahona, supervises two community organizers and two health educators and coordinates project activities with the project engineer. The engineer, also based in Barahona, oversees the work of one engineering assistant, a plumber, a mason, and any contractors hired for construction activities. Administrative and logistical support staff in Santo Domingo and Barahona provide the necessary backstopping services. A high turnover of project personnel initially has yielded, over the past eight months, to a stable staffing situation, and the staff has become one of the project's best assets.

In early 1986, a suboffice was established in Barahona to serve as a base of operations for the project. It includes a small workshop and vehicle maintenance facilities.

The project has two Toyota jeeps, two Toyota pickups, a 2.5-ton truck, and three motorcycles for field activities and transportation of supplies. Basic maintenance is provided in the Barahona workshop, and few problems were reported. In 1986, a small rotary drilling rig was purchased, making the project more independent in its drilling operations.

Supplies and equipment, except for the drilling rig, the vehicles, and the solar pumping equipment, have been procured in the country. Only cement shortages have impeded project progress from time to time. The most serious procurement problem encountered recently was the lack of some spare parts for the Santo Domingo handpump. The exchange rate fluctuations appear to have had a beneficial effect on the project's cost effectiveness.

3.1.3 Communities

The communities have contributed labor, local materials, food for the workers, and time and money for operation and maintenance. They have also participated in planning and decision making. A more detailed description of community contributions is provided in section 3.2.4, Community Participation in Water System Construction, and section 3.4.5, Capital Costs.

3.1.4 Others

The project proposal identified several organizations as potential donors of time and service, but besides the Peace Corps, which provided two volunteers for a total of 17 person-months, none of these organizations made a contribution (see section 3.5, Project Management). However, two other agencies did provide assistance. The State Sugar Council (CEA) contributed materials, labor, and the equipment for the piped water distribution systems in the sugar estate settlements, the Bateys. The Social Service of Dominican Churches (SSID) made its percussion drilling rig available on several occasions. Also, the Governor of Independencia Province is arranging for the extension of the electrical grid to the pumping station in Las Baitoas.

3.2 Community Selection and Participation

3.2.1 Community Selection

CARE's proposal to USAID in August 1985 included a list of community selection criteria to be finalized by CARE, FUNDASUR, and community leaders with guidance from USAID, following a baseline data survey in the project area. While CARE eventually did not use the process suggested in the proposal, the original list did serve as a basis for selection. It included both typical selection criteria (e.g., community needs, willingness to participate, water resource availability, cost considerations) as well as strategies for community organization and development.

The conditions under which project activities were initiated in a given community were primarily the following:

- The community itself expressed an interest in participating in the project through a written request to CARE.
- It guaranteed water rights, title to land, and the right of way.
- There was a demonstrated need for water and the community was not currently participating in another water project.
- Sources which could supply water of acceptable quality in sufficient quantities and at reasonable cost were available, or, in the case of unexploited aquifers, were anticipated.

If it appeared during initial meetings that a community was not prepared to participate fully, project activities were slowed down or suspended. If technical studies showed that a water system or a well was not feasible because groundwater was either saline or at a depth not accessible with project equipment, the project did not proceed any further. In many instances, however, these decisions were made only after many months of community organization, well digging and/or drilling.

The project proposal also makes several references to the size of the communities on which the project would focus--primarily small communities with populations of 200 to 600. It is evident from Appendix III of the proposal, however, that about half of the needy communities surveyed by the project design team were larger than this. Accordingly, the project amendment signed in April 1988 explicitly approves the inclusion of larger communities.

In general, it appears that the project has handled the selection of communities quite well. All those visited showed an evident need for an improved water supply and environmental health education. Obviously, some of the first communities selected were approached by CARE, as it took time for people in the area to learn about the project and request participation. But the idea of letting the community take the first step appears to be sound now that the project is well known.

The only problem in the selection of communities appears to have been an overlap between sites selected by CARE and INAPA for their respective projects. It is not clear who selected these communities first, even though in many instances CARE was the first agency to install a water system (mostly handpumps). This issue is further discussed in section 3.5, Project Management.

3.2.2 Community Organization

CARE's community organization activities are carried out by two community organizers, assisted when required by two project health educators, under the direct supervision of the project coordinator. Social promoters from CEA have helped in communities living on CEA sugar plantations in the area.

Attachment 2 of the OPG agreement states the objective with regard to community organization: "Approximately 33,000 to 41,000 individuals will benefit from the project through: .....(d) established maintenance systems through functioning community water committees."

The project proposal does not provide any specific guidelines for community organization other than to state that:

- There has been a lack of community participation in decision making, site selection, construction, operation and maintenance, and management of the financing of previously constructed water supply systems in the area.

- As a result of community organization efforts, the community should be willing to participate in the activity with a limited amount of materials and/or cash.

- A water committee should be established to set up a fee system, collect the fees, and deposit them in a nearby bank.

- The community should be willing to learn how to identify and prioritize needs and mobilize and leverage its resources.

In the absence of well-defined community participation strategies in the project design documents, the project coordinator and his staff have largely devised the approach described in this chapter. It has been successful in the communities where water systems have been constructed and has yielded many lessons of use in improving the project.

The major challenge was to combat the attitude that services should be provided primarily by the government. Not many communities had been involved in any kind of self-help project before. It was quite evident from a reading of reports, from interviews, and from observations in the field that paternalism was perhaps the biggest obstacle in the communities selected.

No precise goals or objectives were set for community organization. The general approach, however, has been to prepare the community to assume responsibility for continuing project activities, in particular the management, operation, and maintenance of the water system. After a community has been selected, staff members conduct several preliminary meetings to provide some background on CARE and its development philosophy, explain the objectives of the project, and discuss community needs and interests and health and sanitation issues. In a two-way exchange of information, expectations are clarified and community members learn what responsibilities they will be required to fulfill.

3.2.3 Community Participation in Decision Making

Establishing Water Committees

The first significant decision making activity in which the community is involved is the election of a water committee. While CARE provides guidance, the committee members are freely elected by all adults in the community. In general, the evaluation team found that this process was well understood by both the water committees and the community at large. Respondents in the household survey were able to correctly name, on average, 2.8 (out of five) committee members. When asked why these people had been elected, 63 percent of the respondents stated that they were considered to be responsible and respected members of the community. In larger communities served by distribution systems, 74 percent of the respondents gave this reason. The project has established a total of 36 committees.

Project Planning and Implementation

During the first 18 months of the project, community members took little part in planning, principally because the decisions to be made at this stage mainly concerned hand-dug well construction, well drilling, and the installation of handpumps on successful wells. They decided where the wells would be located and selected the caretakers/pump mechanics who would be responsible for operation and maintenance. They were not always pleased with the level of service provided by handpumps, but went along with project implementation since the handpump was their only option.

After technology selection strategies were modified in late 1987, communities entered more fully into the decision making process. They could now choose a distribution system instead of a handpump, decide on the placement of public standpipes, and gear up for the community organization of construction, operation, and maintenance. Once it has selected the water system technology it favors, each community signs a short standard contract with CARE outlining the responsibilities of both parties. This standard contract is not very comprehensive, however, in spelling out the details of operation and maintenance, community participation, and health education.

In organizing the construction of distribution systems, the CARE technical staff submitted a weekly workplan to the water committee, which took responsibility for meeting the unskilled labor requirements and for arranging the preparation of food for the workers by community members. Food supplies were purchased with cash contributions from the community.

The major focus of community participation in operation and maintenance was on establishing a user fee system. The water committee decides on the amount and frequency of payment. From both the household and committee surveys, it appears that there is near uniformity in these two aspects. In communities where the surveys were conducted, 100 percent of the committee members and 97 percent of the household respondents indicated that the user fee was set at RD$0.50 per household per month.

The surveys also showed that most people know who is responsible for managing the money (the committee, 91 percent) and what it is to be used for (to purchase spare parts, 92 percent; to maintain the system, 63 percent), and that 63 percent of the committees recognized user fees as one of their responsibilities. This indicates that management of the system is very well understood--indeed a significant achievement. It also shows the success of the CARE community organizers in promoting the user fee idea.

3.2.4 Community Participation in Water System Construction

The evaluation team found a high degree of community participation in water system construction: 93 percent of the population indicated they had been involved in the construction of the distribution system, and 83 percent of the respondents in communities with handpumps indicated they had contributed to the project. The most frequently mentioned activity was excavating trenches (58 percent) or wells (33 percent). Other important contributions were money (19 percent) and food for the workers (17 percent).

The provision of labor varied with the type of system being constructed. In the case of hand-dug wells, people excavated the well, collected local materials, and helped to construct the filter, backfill the hole, construct the platform, and install the pump. They also built a fence around the well area. In most communities these activities lasted for several weeks as only a few people could work on the project each day. The total value of their contributions can be estimated at US$300 per well, or about US$1.47 per capita.

In the case of borehole wells, community participation was limited to assisting and providing food for the drilling crew, helping with platform construction and handpump installation, and building a fence. Usually this activity lasted only a couple of days and thus its impact on improving the community's ability to organize itself was limited. The total value of this effort has been estimated at US$150, or US$0.35 per capita.

In the case of piped water distribution systems, the construction phase is considerably longer, especially in those with a high pipeline length-to-beneficiary ratio. In general, these systems provide a good opportunity to test and develop the self-help capacity of participating communities. While the contributions may differ from one community to the next, it is estimated that on average the per capita contributions are US$1.45 for the solar-power systems in the Bateys and higher than that for the gravity-fed system in Las Clavellinas.

It is generally considered important to have community members participate in physical work as well as in decision making to create a feeling of ownership. People are more likely to care for the water system if they have helped to construct it. Of course, the feeling of ownership depends on other issues as well, such as previous attitudes, the degree to which the implementing agencies promote the idea of community ownership, and the extent of their involvement in organization and maintenance when the system is completed.

Interestingly enough, the household survey found that in communities where handpumps had been installed, most respondents believed that CARE owned the water system. In communities with a distribution system, both the community and CARE were considered system owners by half the respondents. This indicates that there is indeed a relationship between the feeling of ownership and the activities and approaches used to promote it.

3.2.5 Community Participation in Health Education

Community participation in health education has been primarily at the receiving end. While people have expressed strong interest in health education (see section 3.3), very little has been done to make them responsible for health education activities. Committee members should be involved in setting health education goals for the community as well as in testing and developing materials. A notable exception to the absence of community responsibility is user education on the importance of maintaining cleanliness at public standpipes and pump sites conducted by water committee members and some plumbers/pump technicians. Most of this education appeared to be well intentioned although couched in negative terms. Messages such as: "Don't bathe at the pump," "Don't do your laundry at the standpipe," and "Don't water your animals here" were often quoted.

3.2.6 Training

To fully prepare the community for its responsibilities, the project has initiated training for committee members and village technicians.

At first all committee training was conducted informally during meetings in the communities, chiefly to teach the committee how to manage community participation, establish the user fee system, and help with user education. Later, a one-day seminar was held primarily to train committee treasurers in simple bookkeeping techniques, but other subjects were included and the actual bookkeeping training lasted only two hours.

It appears that the formal management training provided is insufficient to adequately prepare the committees for their task. Training needs should be very carefully assessed as a function of both the management requirements (see sections 3.2.7 and 3.4.6) and the educational level of committee members. Only then can competency-based, task-oriented training with practical exercises be developed.

All committee members interviewed were aware that they had participated in training activities. The types of training most frequently mentioned were bookkeeping (100 percent), taking minutes at meetings (22 percent), hygiene education (22 percent), and water system O&M/management (56 percent). They were also aware that local plumbers and handpump technicians had been trained by CARE.

Each community selects three or four residents to be trained as water system technicians. These persons should be literate, possess some mechanical skills, and be willing to learn and apply handpump or water system maintenance techniques. The project trains them in three stages: first during construction and installation; next at a one-day workshop, either in the field or in Barahona; and finally on the job when CARE staff visit the field to perform preventive or corrective maintenance.

A total of 73 handpump technicians have participated in six workshops--three in Barahona and three in rural communities, and 20 plumbers from five communities have participated in a workshop on the operation and maintenance of piped water systems. There were plans for a three-day workshop with expanded content for these plumbers in March 1989.

The team believes the one-day course for handpump technicians should place less emphasis on groundwater and hydrogeology and more on preventive maintenance, record keeping, trouble shooting, and how to obtain spare parts. The course for plumbers correctly stresses the importance of the community plumber, and provides information about the different tools, materials, and PVC and GI supplies, as well as the mode of utilization. But more emphasis should be given to preventive maintenance, record keeping, and trouble shooting.

The content of both courses and other related materials are included in Appendix G.

3.2.7 Readiness for Management and Operation and Maintenance

The team found a good understanding of the purpose of the water committee and its responsibilities in committees managing piped distribution systems. All stated that their main purpose was to maintain the water system, while 75 percent also felt they had a function in general community development. The handpump committees were not as clear about their role: only 40 percent saw their purpose as maintaining the water system, while 40 percent considered helping CARE as their main purpose. Committee members most readily identified controlling system operation (89 percent), collecting user fees (56 percent), and maintaining the system (44 percent) as their principal responsibilities. All committees have established user fee systems, although few have set up an adequate administrative structure.

While committee members and technicians (89 percent) generally feel that the technical skills to operate and maintain the system or pump are available at the community level, there is also consensus (89 percent) that they do not have the tools to perform maintenance work. This is less an issue in communities served by water distribution systems because fewer tools are required and they usually can be borrowed if necessary.

About half the communities also feel that the current revenues will not be sufficient to cover operation and maintenance expenditures. When asked how they would handle this situation, 75 percent responded that first they would try to raise more money in the community, but 50 percent also indicated they would contact CARE.

When committee members were asked to whom they felt responsible, 100 percent said they were responsible to CARE although 22 percent also mentioned the community at large. This, along with findings reported in section 3.3, shows that the community continues to feel dependent on CARE for its water supply.

3.3 Health Education and Sanitation

3.3.1 Proposed Health Education Activities

According to the project proposal, the following baseline data were to be gathered by a part-time researcher who would be used as a resource person during the evaluations planned for the project. The health program was to be developed and coordinated with SESPAS and the Peace Corps.

- Number of houses, families, and individuals in the community

- Average time spent per person per day in fetching water

- Average distance travelled in fetching water by given family members

- Inventory of nutritional habits

- Frequency and types of water storage procedures and use of disinfectants

- Inventory of habits related to cleaning after defecation

- Inventory of habits related to hand washing after urination and defecation

- Hand washing frequency after urination/defecation prior to handling food and water for cooking

- Number and frequency of individuals wearing shoes in community areas infested by parasites

The health education component of the project proposal emphasized the following areas:

- Nature of fecal-oral transmission mechanism

- Health hazard of using contaminated water supplies

- Knowledge of ways in which existing water supplies are likely to be contaminated

- Importance of personal hygiene such as bathing and washing of hands before food preparation and meals and after defecation and urination

- Importance of protecting stored water

- Importance of removing human and animal fecal matter from the home environment and keeping houses and yards clean

- Importance of using and cleaning latrines

3.3.2 Needs Assessment

The baseline data were not gathered. A brief needs assessment was made prior to entry into the communities, and general descriptive information is kept in the field office. But this information is limited and of no value in measuring the impact due to health education interventions. In the initial stages of the project a CARE intern was assigned to health education and evaluation, but this person left after four months, and the health education and evaluation components have been seriously neglected.

3.3.3 Community Health Education Approaches

Two health educators and two community promoters are responsible for all health education and community participation activities. While their titles are different, they all are involved in promoting community participation in the project and in transmitting basic health messages related to water and sanitation. They are enthusiastic and highly motivated and are well respected in the communities.

Health education activities have been sporadic, however, because of a lack of resources and clearly established objectives. The expected collaboration between CARE, the Peace Corps, and SESPAS was not accomplished for reasons noted in section 3.5.4, Coordination of Project Activities. Five basic water and sanitation messages are transmitted from house to house through personal visits and small group meetings. The health educators have adapted five small posters with brief messages from the Haiti program and have spent many hours coloring them for distribution to the households, on whose walls they are often displayed. (Appendix E contains a sample of materials.)

The approach, however, has been to convey information rather than encourage participation. For example, the posters could have been colored by the children at home or in school as an exercise that would have made them receivers as well as transmitters of health messages. A good health education program must be active not passive, drawing the community members and children in as enthusiastic participants.

The health educators were at ease with community members of all ages, often sitting down to talk with householders about health related matters or to sing with the children. They were observed promoting good practices in areas such as breast feeding as well as water and sanitation.

In the household survey, 81 percent of those questioned said they had received some information about health, water, and latrines from the CARE health promoters. Nearly all of the respondents requested more information about sanitation, personal hygiene, diarrheal control, breast feeding, nutrition, and family planning.

3.3.4 School Health Education

Although the four health education and community participation workers clearly recognize the importance of teaching children about hygiene and health, they have not yet introduced materials into the schools nor devised specific learning activities for school-age children in the communities. CARE, however, has recently developed a proposal for school health, working with parent organizations at the community level.

3.3.5 Communications and Social Marketing

Fifty-four percent of those interviewed have radios and 27 percent have television sets. But they receive no health education messages through the mass media. Some excellent musical radio messages aired in the early phases of the project had to be discontinued for lack of funds. The need for varied approaches to health promotion is recognized. But a small staff with limited resources and training is not equipped to expand to a more comprehensive health education strategy that should include mass communications and social marketing as well as school and community health.

3.4 Water Systems Development

3.4.1 Technology Selection

The appropriate technology for a water project is one that is affordable by, and acceptable to, the community and can be operated and maintained by its members. Materials and supplies for operation and maintenance should be available locally, which means they can be acquired in less than 48 hours. The original proposal contemplated the use of drilled wells, equipped with Santo Domingo handpumps, and gravity systems to supply water to the communities. It was later amended to include other technologies such as solar pumps wind electrical generators, rain collectors, hydraulic rams, and electrical and mechanical pumps, as well as other locally available handpumps.

The team visited 19 communities with a total of 5 water supply systems and 28 handpumps (see Table 1).

By and large the technology used is appropriate. Materials, supplies, pipes and fixtures up to 6 in., gate valves up to 2 in., electrical pumps, cement, sand, and other construction materials are available in Barahona and other nearby cities. Larger pipes and valves, as well as solar panels, can be purchased in Santo Domingo.

Tools are available in the regional market, except for pipe cutters which are not for sale in local hardware stores or ironworks shops.

Casing is available for wells, and screens are usually made by making holes or vertical slots in the casing. Bentonite, used only during construction, is not available locally but can easily be imported by CARE.

In general, the handpump is accepted except in those communities where the pumps produce salty or sandy water, the people feel a better alternative could have been installed, or there are frequent pump breakdowns because of the depth of the water level.

Table 1

Water Supply Projects Installed

Community	Pop Size	Type	Taps or HP	Status	Start	Finish	Current Beneficiary
Las Clavellinas	2,900	Grav	26	W	May 86	May 87	2900
Batey [illegible]	4,106	Solar	26	W	Nov 87	Apr 88	4106
Batey 8	2,380	Solar	22	W	Nov 87	Apr 88	2380
Batey [illegible]	1,494	Sola	22	W	Jan 88	Jan 89	1494
Las Baitoas	0	Elec	15	W	Jul 88	Feb 89	0
La Costa(Saladillos)	100	HP	1	W	Mar 86	Apr 86	100
El Centro(Saladillos)	180	HP	1	W	Apr 85	Jul 86	180
El Cruce(Saladillos)	210	HP	1	NW	Apr 85	Jul 85	210
La Curva(Saladillos)	150	HP	1	W	Apr 86	Jul 86	150
Mama Ataje	650	HP	2	W	Aug 86	Aug 86	650
Arroyo Dulce	3,500	HP	2	W	Sep 86	Mar 87	3,500
Vuelta Grande	750	HP	2	NW	Oct 86	Oct 86	750
El Granado	1,100	HP	4	2W	Sep 86	Dec 86	1,100
Mercia	240	HP	1	W	Feb 87	Apr 87	240
Sumaranito	470	HP	1	W	Nov 86	Dec 86	470
Los Pozoles	550	HP	2	NW	Dec 86	Jan 87	550
Uvillita	260	HP	2	W	Feb 87	Feb 87	260
Selva Muerta	450	HP	1	NW	Feb 87	Mar 87	0
Barranca	700	HP	2	W	Oct 86	Dec 86	700
Batey 1	1,800	HP	1	NW	Feb 87	Mar 87	0
Tamayo (El Guaba)	1,000	HP	2	W	Jan 87	Jul 87	1,000
Tamayo (La Escuela)	260	HP	1	W	Jan 87	Apr 87	260
Tamayo (La Sombra)	350	HP	1	W	Jun 87	Jun 87	350
Tamayo (Bateicito)	1,080	HP	4	3W	Apr 87	May 87	1,080
Santa Maria (Tamayo)	1,000	HP	1	W	Jun 87	Jul 87	1,000
Batey 2	2,000	HP	3	NW	May 87	Aug 87	0
Monserrate	2,200	HP	5	W	Jun 87	Aug 87	2,200
El Palmar	1,600	HP	2	W	Jul 87	Jul 87	1,600
Tamayo (La Guaba)	1,000	HP	0	NW	Jan 88	Jan 88	0
El Panquito	161	HP	1	W	Oct 87	Oct 87	161
Batey 10	280	HP	1	NW	Oct 88	Oct 88	0
El Coquito (Neiba)	800	HP	1	NW	Jun 88	Jun 88	0
Batey Cortilla(Neiba)	600	Spr	1	-	Aug 88	-	0
TOTAL	34,450		162				27,591

CODE:
NW = No Working
W = Working
HP = Hand Pump
Spr= Spring

3.4.2 Design

By law, all water systems must meet INAPA's design standards. Some design parameters and CARE's design approach are discussed in the following paragraphs.

Source Requirement. INAPA recommends a source with a minimum capacity equal to or greater than the maximum day-demand. CARE looks more at the economic side than at meeting the water demand, and uses whatever water is available.

Per Capita Consumption. INAPA recommends a consumption, in liters per capita per day (lpcd), of:

	Range	Average
Public standpipes	24-48	36
Patio connections	72-120	96

CARE uses a factor of 15 gallons per capita per day (gpcd) for handpumps and standpipes. The evaluation team believes this is too high and that INAPA's average of 36 lpcd (9.5 gpcd) is more realistic.

Population Projections. In designing a water system, INAPA recommends a growth rate factor of 1.02 to 1.03 and the linear method to project future population size. CARE uses a growth rate factor of 2.6 percent and the same method.

Design Period. INAPA recommends a design period of 20 years. CARE designs systems for the present population instead of by INAPA standards, which are required by law. The team agrees with this approach for handpumps and certain components of piped water systems (e.g., solar pumps, standpipes). A 20-year system is designed to supply water to a nonexistent population, needlessly increasing the cost of the project and denying funds to other communities with a present need. CARE'S approach is supported by the findings of Donald Lauria at the University of North Carolina and research done at the University of El Salvador, which suggest that design periods of less than 10 years are more appropriate for developing countries than those recommended in the developed countries because of the rate of return, population growth, and inflation rates.

Average Day-Water Demand. This is estimated by multiplying the per capita consumption by the design population.

Maximum Day-Water Demand. INAPA recommends a peak day-water factor of 1.20. The maximum day-water demand, calculated by multiplying the average demand by this factor, is used to determine the adequacy of the water source and for sizing the transmission line. CARE uses a peak day-water factor of 2.0 to 3.0—2.0 in the case of gravity systems because it is assumed that consumption occurs during a period of 12 hours, 3.0 in the case of solar systems because the pump is assumed to work for 8 hours.

Peak Hour Water Demand. INAPA recommends a peak hour factor of 2.0, which is equivalent to CARE's use of a maximum velocity of 1.5 feet per second (fps) to size the distribution system. A velocity of 3.0 fps at peak flow is adequate.

Storage Requirements. INAPA calls for a storage capacity of 25 percent of average daily use. CARE uses whatever form of storage is available in the community. In Las Clavellinas no storage was provided, and in Bateys III, VII, and VIII old storage tanks were used. Only in one case, Las Baltoas, was the storage capacity increased. Regardless of this approach, all of the storage tanks installed meet the storage requirement.

Minimum Pressure. INAPA recommends a minimum pressure of 10 meters (approx. 33 feet). CARE does not have a fixed value. However, the pressure in the system is limited mainly by the lift provided by the solar panel. Storage tanks are usually 18 feet high. Field tests showed pressure values of 6.93 to 23 feet.

Number of People per Well. INAPA accepts the WHO recommendation of 200 persons per well. CARE's original proposal suggested a figure of 400 to 600, which is grossly inadequate. The handpump, with a design capacity of 4.0 gpm, could provide 56.8 lpcd (60 gpcd) for a population of 400 only by working 25 hours a day. The team recommends a design figure of 200 persons per well whenever possible, and recognizes that the placing of handpumps is an economic issue governed by the availability (depth, quantity, and quality) and location of water.

Maximum Distance to Well. INAPA does not have a standard for this parameter, but WHO recommends a maximum of 150 meters. CARE's proposal suggested a maximum of 500 meters. This distance has varied according to the population density of the community. The evaluation team believes that persons living more than 150 meters away can hardly be expected to benefit. In general, the maximum distance should not exceed 250 meters.

Disposal of Waste Water. Neither INAPA nor WHO has design guidelines for the proper disposal of waste water near standpipes. In several instances CARE made no provision for this, and the puddles that formed provide optimal conditions for mosquito breeding and increase the possibility of dengue and malaria epidemics.

The Hardy-Cross method used in the sizing of pipelines is fairly adequate, but it assumes fixed demands and elevations in the distribution systems. In flat areas this is not a problem, but in hilly areas low points receive more water than high points, as in Las Clavellinas. The use of Bernoulli equations and the Newton-Ramson method, which balance the water according to the topographic conditions in the system, is more appropriate.

The design of wells needs to be improved. The problem of silting could be avoided by redesigning the well screen and gravel pack. CARE drills wells and prepares the screen at site, an approach that works in coarse soils but not in the sandy soils prevalent in the Batey communities. The recommended procedure is to drill a test well to determine the stratigraphy of the soils, the water quality, and soil sizes. The stratigraphy helps in the location of productive aquifers and screens. Water quality tests identify the physical, chemical, and bacteriological characteristics of water and its potability and acceptability by the community. In Batey II the handpumps yielded water higher in salts than the traditional source and the community abandoned the well soon after its installation. Soil size tests help in selecting the right size of gravel pack and the slot size in the screen. The wrong size of gravel pack or slot screen either reduces the yield or produces sandy water.

3.4.3 Construction

The water installations are of two types: wells dug by hand or drilled, with handpumps; and distribution systems. A list of the installations constructed by this project is found in Table 1.

Dug wells are limited to depths of 35 feet, depending on soil stability, and were usually constructed by the community, although in a few instances professional diggers were hired to complete the work. They were paid by the community, and, where depths were excessive, partly by CARE. Of 26 hand-dug wells attempted, only 11 were successful.

Borehole wells were drilled with a portable rotary rig owned by CARE and two percussion rigs owned by SSID and FEDA. However, SSID left the Barahona area in June 1987.

The portable rig is capable of drilling 4 in. and 8 in. holes to a depth of 280 feet in fine soils. The percussion rigs have a drilling capacity of several hundred feet in any type of soil and a maximum borehole diameter of 14 in. Of 57 wells drilled, 38 were successful, all but one of these drilled with the portable rig.

The wells are packed with sand mined from nearby beaches. From observations it was evident that the pack and screen were not always suitable. The sand should have been of the same fineness as the sand found in the borehole. The screen was made during drilling by punching holes in the PVC pipe or by making vertical slots.

Five water distribution systems have been installed to date. One is a gravity system, three are systems with solar pumps, and one is a system with an electrical pump, which awaits the extension of the electrical line to become operational. Construction methods are adequate. Heavy construction equipment such as cranes has been used only in the installation of elevated storage tanks. Picks and shovels and a few tools like pipe cutters and pipe wrenches are sufficient otherwise.

Construction is supervised by CARE's engineer on regular visits to project sites. CARE assigns an engineering assistant to oversee daily progress and coordinate the work of a plumber and a mason. Because of personnel limitations, installations are undertaken one at a time.

Field observations showed that construction methods at river and canal crossings, in water intakes, in storage tanks, and at standpipes are satisfactory. Intakes, tanks, and distribution systems are chlorinated before each system is put into operation, but pipes are not pressure tested.

In general, materials are properly used. PVC pipe was rarely seen in exposed pipeline sections, and only once was the use of low-quality pipe reported. This was in Batey III, where the plumber reported that the 1-1/2 in. PVC pipe burst easily and many pipe joint problems were being experienced. These problems have been resolved and the system is now operating well. Plastic taps were observed in several standpipes. Plumbers reported a high breakdown rate for these and usually replaced them with brass taps.

In general, the systems have been well constructed ... few operation and maintenance problems should be expected.

3.4.4 Operation and Maintenance

This project encourages operation and maintenance by the community. A contract with CARE obligates the water committee to properly care for the water system, but does not outline the specific responsibilities of each party.

In the Batey communities, CEA, CARE, and the people each have a different perception. CARE believes that the community is responsible for O&M and that CEA should intervene only if there is a major breakdown. CEA thinks it is wholly responsible, and the community thinks it is responsible for O&M and CARE is responsible for major breakdowns. The community in Las Clavellinas thinks the same. In Las Baitoas the system is not yet in operation.

No preventive or other maintenance plans have been developed, and the project does not differentiate between above-ground and below-ground maintenance. But it appeared that all the communities have the technical and financial capability for above-ground maintenance, and that community technicians should be able to handle below-ground pump maintenance without special equipment as long as the cylinder is not installed more than 40 ft. deep. A tripod and winch would obviate the need for a regional O&M plan.

The communities are expected to buy the tools and supplies for handpump maintenance. Supplies in local hardware stores are limited to foot valves, pipes, reducers, couplings, and cement. Leather cups, which cause the most frequent problem, can be had neither in Barahona nor from the handpump manufacturers.

Spare parts for the water distribution systems were reported to have been left at some of the sites, and tools are always accessible to a member of the community. One important omission not yet corrected is a set of blueprints of the actual installation at each site to be given to the community and to INAPA's regional office.

3.4.5 Capital Costs

There are three ways that capital costs could be determined:

(1) Costs incurred for materials, equipment installed, and labor

(2) Costs of materials, equipment installed, and labor augmented by the costs of personnel, vehicles, and equipment directly assigned to the community where the water system was constructed

(3) Total costs incurred by all parties divided by the number of systems constructed

There are several limiting factors impinging on the cost calculations presented here, the most important of which are:

- No separate cost records have been maintained for each system.
- Various types of systems with different resource requirements have been constructed.
- The exchange rate of the RD peso has fluctuated significantly over the past few years and often materials were purchased when they were undervalued in U.S. dollars.
- Salaries and wages have lagged even more in U.S. dollars.

An effort has been made to take these factors into account to present a realistic cost analysis.

For cost option (1), average costs were determined for hand-dug and borehole wells, while actual costs were used for the gravity and solar pump systems.

For options (2) and (3), costs related to inputs other than the materials and equipment installed and labor were weighed according to relative resource requirements, annual expenditures, and the number of systems completed each year.

Table 2 provides an overview of these three options for each type of system completed to date.

3.4.6 Functioning of Water Systems

The functioning of water systems was evaluated according to four indicators: water quality, water quantity, reliability of supply, and accessibility or convenience of water points.

Table 2

Capital Costs

Type of System	Materials Installed (USAID/CARE/CEA)	Total Direct Costs (USAID/CARE/CEA)	Total Project Costs (USAID/CARE/CEA)	Total Project Costs (incl. community $)
A. Hand pumps on hand dug (shallow) wells				
Costs per system	$710.00	$2,387.00	$6,333.00	$6,643.00
Costs per capita (actual for project = 204)	$3.48	$11.70	$31.04	$32.56
Costs per capita (for 200 beneficiaries)	$3.55	$11.94	$31.67	$33.22
B. Hand pumps on borehole (deep) wells				
Costs per system	$2,745.00	$4,422.00	$8,368.00	$8,518.00
Costs per capita (actual for project = 250)	$10.98	$17.69	$33.47	$34.07
Costs per capita (for 200 beneficiaries)	$13.73	$22.11	$41.84	$42.59
C. Gravity-fed System (Clavellinas, pop. = 2900)				
Costs per system	$15,173.00	$27,304.00	$55,851.00	$62,730.00
Costs per capita	$5.23	$9.42	$19.26	$21.63
D. Solar pump-assisted System) (Batey VIII, pop. = 2580)				
Costs per system	$24,427.00	$42,788.00	$68,004.00	$72,708.00
Costs per capita	$9.47	$16.58	$26.36	$28.18

Water Quality

One of the objectives of this project was to provide safe water to local communities. Accordingly, the evaluation team chose five distribution systems and 14 handpump wells for chemical and bacteriological tests that measured pH, temperature, total dissolved solids, conductivity, and total coliforms. Wherever possible, tests on the alternative sources of supply were also conducted. The results of these tests are presented in Table 3, and are compared below with the WHO Drinking Water Guidelines.

Parameter	Recommended Limit	Percentage of Samples Meeting Limit
pH	6.5-8.0	100
TDS	1000	95
Total Coliforms	10	78

In general, the water provided by these systems is safe.

Water Quantity

The distribution systems have been sized to serve 80 persons per outlet and a per capita demand of 15 gpd, which means each outlet should be capable of delivering 2.5 gpm for a period of 8 hours. If INAPA's recommendation of 9.5 gpcd is followed, then each outlet should have a capacity of 1.6 gpm.

The evaluation team measured the water delivered in a number of taps in each water system (see Table 3) and concluded that most systems are properly sized to deliver 1.6 gpm per tap.

Las Clavellinas is the only system that has water shortage problems in one section because of the capacity of the spring and the design method employed.

In regard to wells, the water produced varied from 2.66 gpm to 4.61 gpm. Of the wells with handpumps, 33 percent produced more and 66 percent produced less than 4 gpm. The average flow rate was 3.49 gpm. There were no long lines at the wells, a sign of adequate supply although some wells serve up to 3,500 people.

Reliability

Water distribution systems appeared to function well. Only rarely have they been inoperable, and then for not more than a few hours. A downtime of two days was reported just once.

The picture is different for handpumps. Downtime can last from a few days to several months, depending on how soon CARE is notified. CARE usually responds immediately.

Table 3

Water Quality, Quantity, and Pressure in Water Systems

Community	Flow (GPM)	Pressure (PSI)	pH	Temp. (Celsius)	TDS (mg/l)	Conduct (µS/cm)	F. Coli (#/100ml)
[illegible] #1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2/2
#2	4.[illegible]	[illegible]					
#3	[illegible]	8.00					
#4	[illegible]	[illegible]					
#5	[illegible]	[illegible]					
#6	[illegible]	[illegible]					
#[illegible]	[illegible]	[illegible]					
#[illegible]	[illegible]	[illegible]					
#[illegible]	[illegible]	[illegible]					
#[illegible]	[illegible]						[illegible]/TNTC
[illegible] #1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
#[illegible]	[illegible]	[illegible]					
#[illegible]	[illegible]						
#[illegible]	[illegible]	[illegible]					
#4	[illegible]	[illegible]					
#[illegible]	[illegible]	[illegible]					
#5	[illegible]	7.00					
#6	3.[illegible]	10.0[illegible]					
#6	[illegible]	[illegible]					[illegible]
Las [illegible]			[illegible]	[illegible]	4[illegible]	370	9
Las [illegible]							
#1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
#[illegible]	[illegible]	[illegible]					
#[illegible]	[illegible]	[illegible]					
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#5	[illegible]	[illegible]					
Source	[illegible]		7.[illegible]7	[illegible]	[illegible]	4[illegible]	[illegible]
Proposed Source							TNTC
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#1	[illegible]	[illegible]	7.6[illegible]	[illegible]	[illegible]	65[illegible]	[illegible]/TNTC
#[illegible]	[illegible]	[illegible]					
#[illegible]	8.[illegible]7	12.00					
#3	[illegible].75	12.00					
#[illegible]	[illegible]	[illegible]					
#4	8.57	12.00					4/TNTC
Average	4.9[illegible]						

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Table 3 (Continued)

Water Quality, Quantity, and Pressure in Water Systems

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[illegible]			7.29	28.9	[illegible]	1450	[illegible]
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[illegible]		-	6.97	[illegible]	[illegible]	[illegible]	
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Accessibility

The original project design proposed a maximum distance of 500 meters between the user and the source of water, which the project manager realized would have little impact on health improvement. The distance was reduced whenever possible. In water distribution systems the maximum distance is 100 meters, and most people use one-gallon containers, an indication that standpipes are easily accessible. For handpumps four-gallon containers are used, which indicates that water is not as accessible as in distribution systems.

The household questionnaire asked if the new water source was closer, more distant, or the same distance as the traditional water source, and found that 80 percent of the respondents believe the new source was closer. In general, the team observed that the maximum distance is not more than 250 meters. Arroyo Dulce, which had only one pump in operation for a community of 3,500, was the single exception. A second handpump was temporarily out of service, and donkeys were used to transport water.

3.5 Project Management

Project management of funds, personnel, and logistics have already been adequately described in section 3.1, Inputs.

3.5.1 Financial Management (CARE)

CARE-Dominicana has used standard CARE financial management controls and procedures approved by A.I.D. An overview of project expenditures is provided in Table 4, Summary of Inputs and Outputs.

3.5.2 CARE's Information Systems for Planning and Monitoring Project Activities

CARE has submitted an annual implementation plan and quarterly progress reports to USAID as required by the grant agreement. This procedure has been useful in keeping the project on track in terms of its quantitative targets, e.g., the number of wells drilled and committees established. CARE-Dominicana also prepared annual implementation plans and four-monthly progress reports for CARE USA headquarters in New York. A summary of project inputs and outputs assembled from the two sets of implementation plans and reports is provided in section 3.6, Summary of Inputs and Outputs.

The implementation plans are very basic. The indicators are limited and the narrative reports are brief, providing little information about the project development process, lessons learned during project implementation, or the resulting changes in project strategy. This is unfortunate considering this is CARE's first water supply and sanitation project in the country. The reports appeared to meet the donors' requirements, however.

Table 4

Overview of Inputs and Outputs to Date

DESCRIPTION	Oct.'85- June'86	July'86- June'87	July'87- June'88	July'88- Dec.'88	TOTAL TO DATE	PLANNED L.O.P.*	COMMENTS
INPUTS							*- As per OPG amendment and implementation plans
Funds/In Kind Contributions							
1 Funds, USAID (US$)	$95,980	$129,735	$125,866	$20,860	$372,441	$430,000	
2 Funds, CARE (US$)	$121,000	$72,300	$57,290	$38,830	$289,420	$375,000	
3 Contributions, Communities(US$ Eq.)	$2,100	$15,764	$13,813	$4,539	$36,216	$10,000	
4 Contributions, CEA/Others (US$ Eq.)			$31,000	$12,000	$43,000	$0	
Total Funds/Contributions(US$ eq.)	$219,080	$217,799	$227,969	$76,229	$741,077	$815,000	
CARE Personnel (person months)							
5 Project Manager (SD)	7	12	12	6	37	45	
6 Project Coordinator (Bar)	5	12	12	6	35	44	
7 Community Organizers	9	18	20	12	59	88	
8 Health Promoters	4	12	13	12	41	44	
9 Engineer	8	10	9	6	33	44	
10 Technician/Plumber/Mason	2	26	33	18	79	132	
11 Drivers	12	24	24	12	72	88	
12 Administrative Assistant (SD)	6	12	12	6	36	44	
13 Other admin personnel	36	72	72	12	192	216	
14 Vehicles (months)	16	60	60	30	166	220	four vehicles, one truck
15 Drilling rig (months)		12	12	6	30	38	
OUTPUTS							
Community Organization/Health Education							
1 Preliminary visits	27	107	45	4	183	--	not specified
2 Base line data collection (sites)	30	20	30	0	80	55	
3 Communities selected	11	24	15	0	50	30	
4 Health education sessions conducted	32	108	134	49	323	450	
5 Committees established	11	12	12	1	36	30	
6 Village technicians trained	12	48	19	14	93	120	
Construction							
7 Hand dug wells completed	7	18	1	0	26	--	not specified
8 Borehole wells drilled	0	47	10	0	57	--	not specified
9 Hand pumps installed	6	29	13	1	49	55	
10 Gravity-fed systems completed	0	1	0	0	1	2	
11 Solar pump asst. systems completed	0	0	2	0	2	3	Batey VII completed at 90%
12 Other pump asst. systems completed	0	0	0	0	0	2	Las Baitoas completed at 90%
13 Hand pump repairs during period	0	26	38	4	68	--	not specified
General							
14 Number of communities served	2	17	10	1	30	30	excl. Batey VII, Las Baitoas
15 Number of beneficiaries	280	16,549	15,307	800	32,936	37,000	(Range : 33,000 - 41000)

In order to make project planning and monitoring more useful and effective, it is recommended that CARE-Dominicana consider developing one simple system acceptable to both USAID and CARE/NY. The resulting savings in time could be applied to improving the current implementation plans and reports.

Performance Monitoring and Evaluation

CARE has made little effort to establish a formal information system to monitor progress. The goals and objectives section was one of the weakest parts of the project proposal, and no attempt was made during project implementation to articulate these goals and objectives or to develop appropriate indicators. The project does not have baseline data for evaluation, nor was it able to develop and conduct surveys for the implementation of the health education and sanitation program. This is an area which will require more attention and resources during the next phase.

Project Decision Making

With limited formal information on the completion of project activities (what happened) and no information on project performance (how and why it happened), most decisions have been based on an informal but regular review of project activities and problems. This strategy has been successful only because the project is small and the project team cohesive.

The major area of concern addressed through this process was technology selection, described in section 3.4.1. The project team was assisted by a consultant hired by CARE in July 1987 who conducted a rapid assessment of the experience gained with well drilling, the Santo Domingo handpump, and the appropriateness of other technologies. The consultant's recommendations led to an amended project agreement proposal and the revised OPG signed in April 1988, since when project performance has improved significantly.

3.5.3 Project Management (USAID)

The Office for Health and Population is responsible for project monitoring and evaluation, mainly through review of CARE's quarterly progress reports and occasional field visits. USAID has also been represented at major public relations events, such as the inauguration of new water systems. In September 1987, USAID organized a meeting with SESPAS, CARE, the Santo Domingo handpump manufacturers, and a special consultant to discuss problems encountered with the Santo Domingo pump and recommendations for corrective action. USAID also agreed to amend the project after CARE submitted a proposal advocating a more flexible approach to technology selection.

3.5.4 Coordination of Project Activities

The project proposal identified INAPA, SESPAS, FUNDASUR and the Peace Corps as organizations which would assist CARE in project implementation. Their contributions were to be:

INAPA	-	technical assistance in the design, implementation, and monitoring of water systems construction
SESPAS	-	assistance in health education
FUNDASUR	-	rotary drilling rig and operators
Peace Corps	-	five volunteers specialized in well drilling, community organization, health education, civil engineering, and training

The project started with little cooperation from the first three for various reasons—difficulties in communication, different expectations, personnel turnover, and insufficient resources. While the project proposal listed the contributions they would make, their expectations were that the project would provide them with additional resources. The Peace Corps provided two technical volunteers, one of whom left after four months because of differences of opinion with CARE. The second remained with the project for 13 months. No efforts were made to get the other three volunteers.

Instead of working to iron out its difficulties with these four organizations, CARE decided to acquire its own equipment, and turned to other organizations such as SSID and FEDA for assistance in areas where its own equipment was inadequate.

In health education and sanitation, there was no collaboration with SESPAS at the regional and national levels, although there were some informal contacts with SESPAS promoters in a few communities. But there were limited because of a high turnover of SESPAS health promoters.

Following the change in technology utilization in 1987 CARE started working with CEA in the Batey communities, where the progress made is evidence of a fruitful relationship. CARE's relationship with INAPA has also improved, and INAPA has been involved in site selection and feasibility studies since 1988.

The less than optimal collaboration with other agencies has isolated CARE to some extent. While this may have had no significant effect during the construction phase of the project, it has denied CARE the opportunities to share valuable experiences, to learn from other organizations, and to lay a durable foundation for long-term followup during the operation and maintenance phase of the project.

3.6 Summary of Inputs and Outputs

Table 4 provides a summary of project inputs and outputs from October 1985 to December 1988 by CARE fiscal years. The operational status of the water systems installed has already been discussed in section 3.4.6. Chapter 4 discusses the utilization of project outputs and systems.

Chapter 4

FINDINGS: PROJECT PERFORMANCE

A functioning water system and health education sessions do not of themselves guarantee improved health and living conditions. These benefits will occur only if people use the water from the system as intended. Project planners often assume that water only from the improved system will be drunk, and that more of it will be used for personal and domestic hygiene and sanitation because of its increased quantity and accessibility. This does not always happen. What follows is an assessment of project performance as it relates to the utilization of project outputs and systems.

4.1 Water System Utilization

Handpumps

Forty-nine handpumps have been installed in 28 communities with a total of 23,400 beneficiaries. Only 31 reportedly are working. The evaluation team visited 26 handpumps and found 11 out of operation and 6 that appeared to be underutilized. This means only nine were in full service, providing water to 33 percent of the beneficiaries.

The main reasons for abandonment or underutilization of handpumps were:

- Community preference for the quality of water from the traditional source
- Silting up of the well
- Handpump competing with INAPA's water source
- Frequent breakdowns

No crowding was observed at operational handpumps, except in Arroyo Dulce, which has only one pump for 3,500 people. This suggested that in most communities the number of pumps installed is adequate.

Distribution Systems

Distribution systems are working fine and safe water is provided in adequate quantities. No queues were observed at the standpipes. In many of those with two taps one was plugged, suggesting either that the water system is overdesigned for current use or that the communities want to reduce O&M expenditures. The water committees have closed down some standpipes and showers as punitive measures against certain members of the community. This prevents full utilization and may reduce the spread of project benefits. At the same time it indicates that the committees feel confident to take action when required.

In general, it appears that the consumption of water has increased, although the absence of baseline data precludes accurate measurements. Most people interviewed during the household survey indicated that they are using the water system for different purposes: washing hands, drinking, cooking, bathing, and washing. The evaluation was not able to determine whether people are collecting drinking water from the new system alone, but this is likely because 79 percent of those interviewed indicated that the new system is closer than the traditional source. Proximity probably remains the most significant factor in determining where people collect water.

4.2 Water System Management, Operation & Maintenance

The most important management activities of the water committees to date have been to supervise the operation of the distribution system or handpump by the community and to collect money for the O&M fund. All committees interviewed indicated they had collected money, and most had some sort of a user fee system. They estimated that about 50 to 70 percent of the households contributed regularly. The treasurers' ledgers and field estimates indicated, however, that the income from user fees is much lower: about 10 to 25 percent for handpumps and 25 to 50 percent for distribution systems.

All committees but one (Batey VII) had spent some money for operation and maintenance, most frequently for spare parts, supplies, and transportation. Money is also spent on tools and labor. In general, the quality of the financial records was very poor, except in Las Clavellinas. This indicates a need for improved record-keeping, training, and follow-up. One encouraging sign was that 67 percent of the committees had operational bank accounts, giving assurance that funds are secure.

There were significant differences in maintenance by communities with piped systems and those relying on handpumps. Communities with piped systems require little assistance from CARE, except for disinfection of storage tanks and distribution facilities. By contrast, communities with handpumps rely heavily on CARE for maintenance. Of the nine communities visited, four reported making some repairs such as replacement of leather cups and foot valves. In only one community did the water committee own the maintenance tools. Maintenance is corrective rather than preventive, except for drainage activities in some instances.

This dependence on CARE results from the history of paternalism in the country and a lack of spare parts and tools. For example, leather cups, which are the parts requiring most frequent replacement, had not been available from the manufacturers for the six months preceding the evaluation.

4.3 Current Health Practices and Latrine Utilization

Of the total of 122 respondents, 90 percent indicated that they bathe their children daily, 76 percent that they keep the water containers in their homes covered, and 92 percent reported that they used soap for bathing or washing clothes, dishes, or hands.

Latrines were found in 52 percent of the households surveyed, and the biggest problem cited in latrine maintenance was roaches. In the households without latrines, 73 percent reported lack of funds as the main reason.

Regarding the disposal of garbage, 72 percent said they burn it and 14 percent that they dump it in the countryside. The rest indicated they bury it or leave it wherever they happen to be. The evaluators noticed large piles of garbage strewn about, and saw animals and children defecating around the homes in many communities.

The areas around public standpipes and handpumps generally were clean and free of debris, but the showers were poorly maintained and not enough attention had been given to drainage and the accumulation of surface water. Some design modifications of standpipe drainage would correct these conditions.

For lack of time, it was difficult to find out whether the householders actually practice what they stated. As reported earlier, in most instances water from the standpipes and handpumps is completely safe. But water samples from household storage containers tested for bacteriological contamination revealed that contamination does take place somewhere between collection at the standpipe and consumption from a storage container in the home. More studies will be needed to determine where and how contamination occurs. But it is clear that more attention must be given to teaching better care and to determining if simple messages urging the rinsing and covering of containers are adequate or if periodic disinfection of household storage containers is the answer.

4.4 Recurrent Cost

As explained earlier, most water committees have a user fee collection system, in itself a significant achievement since most communities were unaccustomed to paying for water or other utilities. The functioning of these systems needs to be improved, however, so that they can recover O&M costs. Both CARE and the water committees are aware of this and have assigned this task a high priority.

Handpumps

The annual O&M cost for a handpump on a hand-dug well is about RD$172. For drilled wells it rises to about RD$300 (or RD$1.50 per capita). These estimates are based on breakdowns reported on handpumps currently installed and assume that all maintenance is done in the community, which presently is not the case. If a regional maintenance team is required for below-ground maintenance (when the length of the riser pipe exceeds 40 ft.), these costs will be significantly higher. Also, a rise in costs can be expected as the pumps get older and more parts require replacement.

Handpump maintenance costs vary with the depth and condition of the well and the number of people using it. Experience with the Santo Domingo handpump in the southwest region has indicated that maintenance, and thus recurrent, costs increase significantly if the pump's cylinder is installed at depths greater than 60 ft.

Each handpump on average serves 60 families. If all families pay their monthly user fee, the annual revenues will amount to RD$360, which in theory should cover O&M costs. In instances where a regional maintenance team is required, revenues would at least cover expenses for spare parts and supplies. Since present revenues are much lower than estimated, it is still too early to determine whether the O&M cost recovery mechanisms are adequate.

Water Distribution Systems

For water distribution systems the situation appears to be more promising. Per capita O&M costs are modest for the level of service provided, and fee collection by water committees has been more successful. Annual costs are RD$1.66 per capita for a solar-power system (of which CARE presumes RD$0.59 for the maintenance of the motor/pump set would be absorbed by CEA), and RD$1.05 per capita for a gravity-fed system. The fee collection systems established by the project would recover RD$1.20 per capita per year if 100 percent of the population pays.

In Las Clavellinas, the committee has been able to save money in spite of expenditures for corrective O&M on a number of occasions. An analysis of the Batey VIII books for the first eight months of operation (April - December 1988) showed RD$270 in revenues against RD$210 in expenditures. As explained above and shown in Appendix F, these expenditures are expected to rise as the systems age. Even now it was evident that a certain amount of corrective maintenance was due.

While a promising start has been made, more research on O&M cost recovery for all types of systems is required for expenditures at both the community and regional levels (e.g., CARE, CEA). Further training is essential to establish proper record-keeping systems.

Chapter 5

FINDINGS: PROJECT EFFECTS AND BENEFITS

The following are some impressions of the team regarding benefits and the perceptions of the beneficiaries.

5.1 Role of Women

Survey responses indicated that in 95 percent of the households women had actively participated in the project. Their primary role was carrying water and cooking for the male workers, but many said they had participated in community meetings and all indicated that the water system had improved the quality of their lives. When asked how, most responded that water was cleaner and more accessible, and many said that diarrhea in their children was now less of a problem.

Of the nine water committees surveyed, five have a total of eight women in leadership positions, including one president and three treasurers. One woman treasurer was the only one in the nine committees who had an appropriate record-keeping system.

The two project health educators are women who are excellent role models for the community women, continually encouraging them to speak out at meetings and to take part in committee activities.

5.2 Public Health

The perceptions of community members regarding changes in health were positive. In particular, many householders and committee members indicated they had fewer problems with diarrhea in their children. In addition to convenience and time saved in transporting water, 88 percent of the respondents indicated that their water was now cleaner and safer for drinking. Most householders also recognized that contaminated water is a cause of illness.

5.3 Convenience

Among the benefits of the water system most frequently mentioned was the time saved in transporting water; 79 percent of the householders said they now had to walk shorter distances. Since 86 percent of those who carry water are women, this is clearly a positive change for them.

In many communities the time saved was not considerable since the traditional sources of water (rivers and irrigation canals) were nearby. But it is noteworthy that the project, recognizing that proximity is often the main determination in water collection, has succeeded in most instances in installing distribution outlets closer to people's homes than the traditional sources.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 General Conclusions and Recommendations

Conclusions

Overall, the CARE-Dominicana Water Supply and Sanitation Project has been a worthwhile activity. Much progress has been made towards achieving the project's objectives, and valuable lessons have been learned and applied to improve project implementation. The initial project design had many weaknesses that created problems in implementation, but most of these were ultimately overcome, albeit at times with great difficulty.

The change in project design to allow a diversification of technology has had a positive effect on performance at all levels.

The objective of providing an improved water supply has been met in those communities where piped water distribution systems have been installed. There has been less success with handpumps, primarily because of less interest on the part of the population, unreliable pumps, and a poorly developed operation and maintenance program.

Although the project has promoted latrines, only two have been constructed. It is apparent that promotion alone is inadequate in low-income areas such as the southwest region.

The resources committed for technical assistance and for health education and training are inadequate.

The project health promoters have gained the trust of the communities and have made some progress in health education. This is manifested by evidence that the relationship between water and health is well understood in the project area. There is also evidence that some health practices have improved. However, a health education strategy needs to be developed and much more health education is required in all project communities.

The evaluation team found functioning water committees and water system caretakers who have received some training through the project. Most committees are active in overseeing the operation of the water supply systems and collecting funds for maintenance.

Communities are aware of the role and purpose of the committees and the foundation for community-based maintenance programs has been established. In many instances, however, the communities will not be able to perform all maintenance tasks, and a comprehensive operation and maintenance program should be defined.

Project management generally has been satisfactory. Initially, coordination with other agencies was weak but some progress has been made in improving this. As a result of its own contributions, sound fiscal management, and the proper utilization of outside resources, CARE has achieved considerable results with limited USAID funds. The field staff, after initial difficulties with recruitment and performance, is now one of the project's greatest assets.

Recommendations

The project merits continuation beyond the current project activity completion date. CARE should develop a solid multiyear proposal for the second phase, avoiding some of the pitfalls of the original project design. This second phase, building on the experience gained, should emphasis project areas for which adequate resources were not available during the past three years. In particular, health education and information systems should be given greater attention.

The remainder of the current project should concentrate on strengthening the operation and maintenance program and assisting communities unable to perform handpump maintenance themselves.

Any future projects in the southwest region, whether by CARE or other agencies, should seek a flexible approach to water supply technology.

The following sections offer specific recommendations for areas to be targeted for improvement in the next few years.

6.2 Community Participation

Conclusions

Despite the long tradition of paternalism in the project area, CARE has succeeded in involving beneficiaries in decision making in communities where piped water systems have been constructed and has thus confirmed the validity of the community participation approach. By contrast, communities with handpumps have shown less readiness to assume responsibility for water system management.

Recommendations

CARE should further refine its community selection and preparation strategies by developing a phased approach to community identification, project feasibility, and negotiation. Such an approach will be particularly important if more handpump systems are installed.

The contracts should clearly spell out the responsibilities of CARE and the community not only during construction but also with regard to operation and maintenance and any health education programming. Communities should be free to select their own technology.

6.3 Health Education and Sanitation

Conclusions

Health education has been limited by the absence of clearly established goals and a lack of materials and resources. There has been no assessment of community health education needs.

The members of the health education and community participation team are highly motivated and eager to expand their knowledge and the range of activities in the communities, where they are well known and respected. But they cannot do much move without a comprehensive health education program.

The project has sharpened community awareness of some health and sanitation measures and has laid a foundation for expanded health education activities. Children in the communities are very responsive to the team, but there has been no focus on children as recipients and transmitters of health education messages.

Water quality tests conducted at standpipes and in the homes revealed that significant bacteriological contamination occurs between the time water is collected and the time it is consumed.

The project staff has urged the building of latrines, but only two have been constructed. Householders gave lack of funds as the primary reason for not having more.

Recommendations

The approach to health education should encompass the school, the community, and mass communication and social marketing.

Technical assistance should be provided in:

- Conducting a thorough assessment (knowledge, attitudes, and practices) at the beginning of each project
- Conducting focus group interviews
- Establishing objectives and a direction for expanded health promotion activities
- Developing and implementing a social marketing strategy that includes a school health education program

- Training field staff in the principles and methods of health education

- Designing and field testing material

The community outreach staff should be increased to match the scope of the program defined through the needs assessment, and community members and the WS&S committees should be involved in health education from the start. If necessary, CARE resources in health education should be made available on a regional basis.

CARE should strengthen the latrine promotion program to include adequate training for community members and appropriate subsidies for construction and maintenance.

CARE should allocate 20 percent of present and future project funding to health education.

6.4 Water Systems Development

6.4.1 Technology Selection

Conclusion. The technology in most systems is appropriate. If parts and tools are made available, the communities should be able to carry out most preventive and corrective maintenance on their own.

Recommendations. For handpump systems, the community should acquire tools and materials to last for at least one year from the time of installation.

6.4.2 Design

Conclusions. CARE's design approach meets most of INAPA's design standards and WHO recommendations. However, some changes still need to be made. Drainage systems are inadequate, and stagnant water around the standpipes invites mosquito breeding and the consequent spread of malaria or dengue. Salty water and silting up are features of several wells.

Recommendations. INAPA's design standards and WHO recommendations should be used in the future for the design of water and excreta disposal systems. Moreover, in areas with impermeable soils, drainage systems for waste water should be improved by using mound systems or evapotranspiration beds. Additionally, use of test wills to assist in the design of water wells before drilling should be seriously considered. Finally, a water quality monitoring program for water supply sources as well as for water containers at selected homes should be instituted.

6.4.3 Construction

Conclusion. Water systems are soundly constructed and are expected to last fairly long without major breakdowns. The only deficiency is the use of home-made screens in wells located in sandy soils.

Recommendation. Factory-made screens should be purchased and professional assistance should be sought to determine the best range of slot for the soils found in the project area.

6.4.4 Water Quality

Conclusion. Water supplies generally are safe; only 22 percent of the samples taken contained harmful bacteria and 4 percent did not meet the TDS standard.

Rec mendation. At least one sample per quarter should be taken for bacteriological analysis, and where successive samples are positive, a survey should be conducted to determine the sources of pollution.

6.4.5 Water Quantity

Conclusion. The distribution systems and handpumps provide water in adequate quantities except in Las Clavellinas.

Recommendation. Las Clavellinas should be given technical assistance for the construction of a water storage tank.

6.4.6 Reliability

Conclusion. The distribution systems perform well and occasional breakdowns last only a few hours. Handpumps have a higher rate of breakdown, which can last from a few days to several months.

6.4.7 Accessibility

Conclusion. The distribution systems are easily accessible. Handpump distance though greater are not inconvenient.

6.5 Operation and Maintenance

Conclusions. Caretakers have been trained to carry out most O&M tasks. In distribution systems communities manage without CARE assistance, but in handpump systems CARE is still heavily relied upon. Therefore, CARE has initiated a followup program.

Management training for water committees has been limited. User fees are collected, but at a rate insufficient to cover anticipated recurrent costs.

Nevertheless, it is still too early to determine whether the communities will be able and willing to correct this.

No plans for preventive or other maintenance have been developed for either handpumps or distribution systems. Without such plans it is unlikely that the benefits of the project will endure. Furthermore, no agency other than CARE appears to be equipped and ready to handle major handpump maintenance.

Cost recovery has been acceptable with regard to capital outlays, but no adequate cost recovery plans have been made with regard to recurrent costs. It is fairly certain that communities will be able to contribute little or nothing for system depreciation or replacement costs.

Recommendations

CARE should develop a comprehensive O&M strategy, using WASH Technical Report 35, and should consider the levels of maintenance required and decide which entity should be responsible at each level. An in-depth training needs assessment for water committees and local technicians should follow, and should be used to improve the current training programs for community members.

Community dependence on CARE should be reduced through training and education and by ensuring that tools, materials, and spare parts are available and monthly maintenance plans are in place.

CARE and USAID should determine which agency at the regional level could eventually take over the responsibility for major handpump maintenance, and should prepare a long-term plan for transferring this responsibility. Meanwhile CARE should establish a small unit for maintenance that is beyond the capability of the communities.

CARE should conduct further studies on cost recovery, verifying the data and the assumptions made in the evaluation report. CARE also should strengthen water committee training in financial management, and establish a simple method for monitoring user fee collection and O&M outlays in project communities.

Prior to starting water supply systems in the Bateys at the request of CEA, CARE should develop a tripartite agreement, to be signed by each water committee, CEA, and CARE, that clearly assigns responsibilities for operation and maintenance and defines the fiscal obligations and record-keeping requirements, if any. Considering the number and size of systems to be maintained in the Bateys, CEA should make special budgetary provisions for maintenance as of the current fiscal year.

6.6 Project Management

Conclusions

Project management generally has been satisfactory. The only exception was the poor coordination during the first years of the project between CARE and the governmental and private agencies identified in the project proposal. This appears to have improved during the last 12 months. It was evident that with at least one organization poor coordination and collaboration resulted from a significant difference in expectations stemming from the project identification and design phase.

However, when assistance was not available as planned from one agency, CARE looked elsewhere (e.g. CEA, SSID). As a result of its own contributions, sound fiscal management, and the proper utilization of outside resources, CARE has achieved much with relatively little USAID funding.

Rapid staff turnover in the early phases sometimes affected progress. The project has outgrown these problems, however, and at present its field staff is one of its greatest assets.

The information systems are weak, and although this has not affected the rate of progress in a significant way, it means that there are no data to evaluate project performance.

Recommendations

CARE should improve coordination with other organizations, particularly INAPA and SESPAS, at the local and national levels.

During the next phase, CARE should establish a simple but comprehensive information system and should consider the use of short-term technical assistance for this purpose.

CARE should develop its human resource base in Barahona, identifying training opportunities and budgeting for them.

6.7 Project Design

Conclusions

The initial project design proved to be weak in these major respects:

- Poor assessment of the socioeconomic situation, especially with regard to community attitudes and preferences
- Insufficient and inaccurate engineering investigation leading to the selection of unsuitable technologies

- Underestimation of the requirements of the health education component, especially in terms of budgetary and technical assistance

- Lack of institutional analysis to determine the ability of the proposed counterpart agencies to contribute to the project

- Unrealistic expectation that communities would provide the building materials for latrines

- Inadequate drilling budget that did not reflect the complexity of the task and its importance to the project

Recommendations

CARE should ensure that any future project design team should have extensive experience in CARE project planning and implementation, as well as an excellent knowledge of the socioeconomic situation in the country and, if possible, the project area to be served. Any new water and sanitation project design exercises should also involve CARE-Dominica's present project field staff.

Chapter 7

LESSONS LEARNED

Projects often have to be designed in short periods of time. If sufficient time and information are not available when deadlines have to be met, the result can be a less than optimal project design. The reality of development financing, however, often makes it necessary to rapidly design projects. When this occurs, appropriate strategies for project implementation should be developed to cope with the consequences of a less-than-ideal project proposal. If participating parties are willing to recognize the fact that a project design is not optimal and are open to exploring alternative approaches, projects can overcome difficulties brought on by poor design and can still become successful.

Resource and technical assistance requirements for the health education components of water and sanitation projects are often underestimated. Health education is a critical component and should be carefully planned and budgeted in order to ensure lasting effects and sustainability of projects. Simply designating individuals to carry out health education in the communities is not adequate. They must be trained in methods and techniques and they should have resources and materials to support their activities. WASH experience suggests that 20 percent of project resources should be allocated to health education.

Technical assistance in developing and implementing a comprehensive community and school health education approach is necessary. Organizations attempting, for the first time, to integrate a health education component into a WS&S project should plan long-term technical assistance for this purpose.

Staff members who are committed to development work in the areas served are essential to the success of a project. The sense of teamwork and the interdependence of the community health promotion, engineering and support personnel provide a cohesive bond for all project activities and enable the staff to plan and problem-solve with confidence. Management support of the team dynamics and process positively influences the staff's sense of purpose and commitment to the communities served.

The assumption that people will construct latrines on their own if a project promotes them usually is proven wrong in low-income areas. While promotion and education are necessary preconditions to latrine construction, use and maintenance, project planners should also make provisions for training, equipment, and subsidized construction materials in these circumstances. In future projects, financial support (along with the promotion of latrines) is essential.

When community members are involved in decision making regarding the type of water supply system to be constructed and their preferences regarding the level of service are taken into consideration at the time of the feasibility study and design, the chances of sustainability and project success increase considerably. The appropriateness of this principle was proven again during this project following the modification of project strategies regarding technology selection.

The southwest is a difficult area for water development because of the natural resource limitations and lower availability of services. Flexibility and creativity are required because of the relatively low success rates of wells.

Chapter 8

LINKAGES BETWEEN WATER SUPPLY & SANITATION AND CHILD SURVIVAL PROJECTS

8.1 Background

Diarrheal disease is the principal killer of very young Dominican children. Those under the age of four and under the age of one experience an average of 5.2 and 6.7 diarrheal episodes respectively each year. A primary factor in diarrheal disease is the lack of potable water and adequate sanitary and waste disposal facilities. In urban areas only 60 percent of households have running water and 15 percent are reasonably close to public water systems. Only 30 percent of the rural population has access to potable water.

While it has long been recognized that water supply and sanitation projects answer the most basic needs of a community, water system breakdowns and poor maintenance have often led to donor disenchantment and serious doubts about the long-range benefits and cost effectiveness of water and sanitation interventions. Beginning in the early eighties, oral rehydration therapy (ORT) has often been promoted as a more cost-effective alternative to deal with the high incidence of diarrhea. But ORT is an effective treatment for the consequence of diarrhea (dehydration), not a means of preventing future episodes.

ORT and other child survival activities, such as growth monitoring, breast feeding, and immunizations, are not substitutes for improved water supply and sanitation programs. Rather they are supplementary. As full water supply and sanitation coverage still seems a distant objective for many developing countries, ORT is a useful stopgap measure until adequate primary health care systems are available. It is a remedial rather than a developmental intervention that alone can do little to improve the health of those infants and children who stay alive.

Briscoe (PAHO,1987) states that the current strategy for the child survival revolution gives low priority to improvements in water supply and sanitation because it has been concluded that these interventions are not cost effective. He argues that this conclusion is incorrect for the following reasons:

- Water and sanitation projects have multiple impacts, and the application of conventional cost-effective measures may not be appropriate.

- Adequate water supply and sanitation facilities are necessary but not sufficient by themselves to make measurable improvements in health. They are essential for reducing fecal-oral pathogens and the morbidity from diarrheal diseases.

> The long-run effect of improved water supply and sanitation on child survival is probably much greater than would be expected from an assessment of its immediate effects on diarrheal disease.

Briscoe concludes that there are serious flaws in current analytical methods to determine priorities for child survival activities, and that water supply and sanitation improvement does have a major role to play. It is imperative to make donors, host country governments, and implementing agencies more aware of this. Water and sanitation and child survival must be seen as completely <u>interdependent</u> if any long-range impact on health at the community level is envisioned.

8.2 Potential Strategies

There are two strategies to effect a linkage between water supply and sanitation projects and child survival activities:

1. <u>Building child survival activities on the achievements of WS&S projects</u>

   The advantage of this approach is that child survival activities can augment an established success, giving the community a twofold benefit. The water and sanitation project provides the foundation for primary health care activities including child survival. A community that has gained organization and management experience through its water and sanitation committee has the confidence to embark on health promotion. The water committee, which assumed a decision-making role in the operation and maintenance of the community water system, takes on the responsibility not only for health promotion and education activities related to water and sanitation but also for the basics related to child survival, particularly ORT and the promotion of breast feeding.

   The duration of water project activities in a community is relatively brief, leaving little time for educational activities to have much impact on people's behavior. Child survival interventions are spread over a longer period and provide a greater opportunity to extend the influence of hygiene education.

2. <u>Integrating WS&S activities with a community-based child survival project</u>

   If a needs assessment by a village health committee reveals that water supply and sanitation is a priority, there is an immediate inducement for community participation. The advantage of this approach is that child survival and water and sanitation will be viewed as interdependent. If this strategy is chosen for integrating the two, site selection criteria for child survival activities should include the feasibility of a water supply and sanitation intervention as well.

The project should have the organizational, financial, and technical capacity to assist the community with both. Convincing the community of the direct relationship between child survival and water and sanitation is a challenge. But the potential benefits for health improvement are substantial.

APPENDIX A

SCOPE OF WORK/TIME FRAME

SCOPE OF WORK

DOMINICAN REPUBLIC FINAL EVALUATION OF THE CARE RURAL WATER PROJECT (517-0232)

I. BACKGROUND

In August of 1985, A.I.D authorized a three-year Operational Program Grant (OPG) to CARE in the amount of $430,000. The purpose of the grant was to provide administrative and operational funds to increase the quality and quantity of water supplies and sanitation facilities and to teach communities through health education to use their new resources properly. The target population was located in 50-70 communities located in four southwestern provinces of the Dominican Republic. The expected number of project beneficiaries was estimated between 33-41,000 persons.

By January 31, 1988, water systems had been initiated in 48 communities. However, since wells in 13 of these communities were non-functional (because of high saline levels or lack of water) the actual number of communities provided with water was 35, covering some 23,429 beneficiaries. CARE is now installing water systems in 7 more communities, containing some 13,626 inhabitants. As of the end of November 1988, $32,000 remains in the project budget.

II. PURPOSE OF THE EVALUATION

The purpose of the evaluation is to review the implementation status of all project elements. It will assess the status of project inputs, and results obtained since the project start-up. It will also identify any existing problems in the planning and management of project activities, and propose potential solutions. The evaluation will examine project sustainability and list lessons learned.

III. QUESTIONS FOR THE EVALUATION

1. Adequacy of project design to achieve project purpose.

2. Adequacy of the implementation plan and work plans in meeting targets.

3. Adequacy of the monitoring and data collection systems for project implementation, analyses, and decision making.

4. Extent to which impediments impact implementation progress.

5. Extent to which inputs are producing desired outputs.

6. Extent to which progress has been made towards project outputs.

7. Extent to which each party (CARE, USAID, and SESPAS (other) is meeting its responsibilities.

8. Adequacy of management and coordination at all levels.

9. Technological appropriateness of equipment, materials, and methodologies.

10. Adequacy of financial management control system, e.g., monitoring of local costs.

11. Adequacy of training objectives and plan.

IV. SPECIFIC TASKS (as requested by A.I.D.)

1. Determine if project objectives were met.

2. Analyze the technology chosen for each community in relation to appropriateness[1], operations, maintenance and sustainability.

3. Assess water quality and quantity.

4. Evaluate the economic, public health, convenience[2], and service level benefits to communities.

5. Determine the capital and recurrent costs per capita for each type of system installed.

6. Evaluate if communities have been prepared to maintain their system.[3]

---

1) Handpumps, gravity flow systems, photovoltaic systems, etc.

2) Include distance required to haul water, time spent queueing and filling containers, ease of drawing water, and reliability of water source.

3) Training, materials (tools and spare parts), funding, and assignment of responsibilities.

7. Assess degree of community participation in project planning, implementation, evaluation, and maintenance.

8. Analyze the health education component of the project and its impact on the knowledge, attitude, and practices of project beneficiaries.

9. Determine the role of women in the project.

10. Determine the potential linkages for water supply with child survival activities given that WS&S provides the opportunity for community entry, community participation, and sustainability.

11. Review levels of collaboration between CARE, the host government, and A.I.D.

12. Examine prospects for project sustainability and lessons learned.

13. Make recommendations for a possible program extention.

V. METHODOLOGY

1. Review project documents.

2. Analyze project objectives and outputs.

3. Interview project staff, ministry and A.I.D. officials, project beneficiaries, and other appropriate individuals.

4. Survey a representative sample of varied technologies, communities, and beneficiaries served by the project.

5. Assess administrative and financial capabilities.

6. Collaborate throughout the evaluation process with A.I.D., CARE and country personnel responsible for project implementation.

VI. EVALUATION TEAM COMPOSITION

The evaluation team for the Dominican Republic Rural Water/Sanitation Project will consist of two Rural Water Supply and Sanitation Specialists, with skills in finance, and a primary health care, child survival Education/Community Development Specialist.

1. Rural Water Supply and Sanitation Specialist

   Qualifications:

   (a) Degree in sanitation engineering, water resources engineering, or related field required.

(b) Seven to ten years professional experience, at least five of which was project design, implementation, management and evaluation and/or institutional development in developing countries, preferably in Latin America.

(c) Experience in planning, implementing, and evaluating rural water supply projects.

(d) Knowledge of construction and hydrology practices and technologies in both developed and developing countries.

(e) Excellent writing and organizational skills.

(f) Speaking and reading ability in the Spanish language at the FS-3 level or above.

2. <u>Health Education/Community Development Specialist</u>

Qualifications

(a) Graduate degree in public health or equivalent required, with emphasis on third-world rural primary health care and education preferred.

(b) Minimum of seven years professional experience, at least five years of which was field experience in preventive health programs, preferably related to water supply/sanitation in developing countries. Latin American experience required.

(c) Experience in planning, implementing, and evaluating the health education and community participation aspects of rural WS&S project preferred.

(d) Ability to collect, absorb, analyze, and relate large quantities of information to project goals.

(e) Excellent writing and organizational skills.

(f) Speaking and reading ability in the Spanish language at the FS-3 level or above.

VII. PROPOSED EVALUATION SCHEDULE OF ACTIVITIES

To be developed in team planning meeting 26-27 January.

VIII. REPORTING REQUIREMENTS

1. The evaluation team will prepare a written report containing the following information:

   (a) Executive Summary. No more than three pages, single space.

   (b) Table of Contents.

   (c) Body of the Report. The report should include a description of the country context in which the project was developed and carried out, and provide the findings and analysis on which the conclusions and recommendations are based. The general length of the body of the report should not exceed 40 pages. Details are to be included in Appendices or Annexes.

   (d) Conclusions. These should be short and succinct, with the topic identified by a short subheading. Conclusions should be related to findings.

   (e) Recommendations. These should correspond to the conclusions; wherever possible, the recommendations should specify who, or what agency take the recommended actions.

   (f) Appendices. These are to include at a minimum the following:

      (1) The Scope of Work, etc.

      (2) Tools, or questionnaire used in the evaluation.

      (3) List of persons consulted.

      (4) A bibliography of documents consulted.

      (5) Other appendices may include more details on special topics, etc.

SCOPE OF WORK

DOMINICAN REPUBLIC REVIEW OF THE SAVE THE CHILDREN

CHILD SURVIVAL DATA BASE

I. BACKGROUND

The Child Survival Data Base will monitor the major causes of childhood mortality including dehydration due to diarrhea in three geographical locations over a four-year period. The project computer arrived in the Dominican Republic in December of 1988. Variables for monitoring are now being identified.

II. PURPOSE OF THE PROJECT REVIEW

The purpose is to review the variables identified for monitoring in the data base and to develop inputs in water and sanitation related to child survival.

III. SPECIFIC TASKS ARE:

1. Formulate a broad-based CS project to include water and sanitation.

2. Recognize WS&S as a key stimulus and basis for initial community entry, community participation, and sustainability.

3. Identify variables related to water quality/quantity and essential behaviors related to the proper use of WS&S systems.

4. Identify issues related to operations, maintenance, and sustainability.

5. Identify essential messages in WS&S as part of a child survival health education program.

TIME FRAME

Santo Domingo

DATE	ACTIVITY
30/01	Entry meeting with USAID and CARE to discuss background, scope of work, priorities, issues, work plan, resources and logistics
31/01-01/02	Develop evaluation methodology, protocols, instruments, data collection and analysis procedures
	Meeting with SESPAS and Peace Corps
	Arrange computer services
	Reach consensus with CARE
02/02-10/02	Meeting with Mr. Lee, R. Hougen and Tim Truitt, USAID representatives, to reach consensus.
	Travel to project area
	Visit project office
	Interview project staff
	KAP survey, preparation, identify surveyors, train surveyors, test instruments, select communities, implement survey, analyze data
	Prepare water committees survey
	Engineering survey: review designs, plans, assess water quality, quantity, and pressures.
	Assess community participation, sanitation, latrines, project management, sustainability, health education activities
	Preliminary data analysis
	Discuss major findings with clients
	Return to Santo Domingo
11/0-15/02	Data analysis and report writing and submittal
16/02-17/02	Meet with clients to discuss report
	Finalize report

APPENDIX B

LIST OF PERSONS CONTACTED

Appendix B

LISTS OF PERSONS CONTACTED

NAME	ORGANIZATION	POSITION
Arroyo Dulce	Community	Water Committee
Baez, Francisco	CARE	Community Organizer
Batey 5	Community	Water Committee
Batey 7	Community	Water Committee
Batey 8	Community	Water Committee
Boulos, Sami	CARE	Manager
Cabral-Herrera, Jose	SESPAS	Coordinator WSP
Cespedes, Ana Maria	CEA	Social Worker
Clavellinas	Community	Water Committee
Coello, Minerva	CARE	Administrator Assistant
El Guaba	Community	Water Committee
Estevez, Antonio	CEA	Administrator, Barahona
Feliz, Claritza	CARE	Health Educator
Feliz, Miguel	CARE	Engineer, WSP
Garcia, Danila	SESPAS	Epidemiologist, Region 4
Guzman, Carlos	CARE	Coordinator, WSP
Holzman Lawrence	CARE	Director
Hougen, Lee R.	USAID	Chief,HPD
Jimenez, Francisco	CARE	Health Educator
Leon, Miguel	Peace Corps	Associate Director for Health
Los Robles	Community	Water Committee
Marte Lorenzo	CARE	Field Technician
Mendez, Bolivar	CARE	Community Organizer
Montes-Oca, Milsiades	CEA	Director, Social Promotion
Paniagua, Domingo	SESPAS	Engineer, WSP
Pena, Sandra	CARE	Logisitic Manager
Rivas, Favio	FUNDASUR	President
Sanchez Elpidio	CARE	Technician,WSP
Truitt, Tim	USAID	Project Manager HPD
Uvillita	Community	Water Committee
Vuelta Grande	Community	Water Committee
Wellhous, Henry	USAID	Program Officer
Williams, Julio	INAPA	Executive Director Assistant

APPENDIX C

WATER COMMITTEE SURVEY

CARE DOMINICA WATER SUPPLY & SANITATION PROJECT

QUESTIONNAIRE FOR WATER COMMITTEES
(Perceptions of Water Committee Members)

Name of Community: ______________________ CARE # ________

District/Province: ______________________ Date ________

Activities Initiated: ______________; Completed ______________

Committee Members:

Name:	Function	Present(Y/N)

1. Type of System:
   a)____Hand pump on shallow well
   b)____Hand pump on deep well
   c)____Gravity-fed with distribution system
   d)____Solar pump with distribution system
   e)____Other (specify)______________

2. Is the System Functioning? YES/NO

3. If NO, since when is system out of order?______________

4. Did they have a water system before? YES / NO

5. If yes, what happened to it? ______________

____

5. When was the committee established?______________

(a- < 1 year ago)(b- > 1 but < 2 years ago)(c- > 2 years ago)

7. By whom?
   a)____CARE
   b)____CEA
   c)____Government of D.R.
   d)____Community

8. What is the purpose of the committee?

a)____To organize the community members

b)____To construct/install the water system/handpump

c)____To maintain the water system/handpump

d)____To help CARE

e)____To improve the health of people in the community

f)____To provide health education

g)____To develop the community

h)____Other (specify)________________________________

9. What are the responsibilities of the committee members?

____

____

____

____

____

____

10. Did They receive any kind of training?

a) YES / NO

b) From whom?________________________________

11. What did they learn during their training?

a)____Leadership skills/ Community Organization

b)____Bookkeeping (for Treasurors)

c)____How to keep minutes of meetings and record activities

d)____What is an improved water supply system

e)____Hygiene education

f)____Water system operations & maintenance procedures

g)____Other (specify)________________________________

12. Who is responsible for maintaining the system and covering recurrent costs? (and for what aspect of O&M/RC)

a)____CARE ____________________

b)____Government of D.R. ____________________

c)____Community ____________________

d)____Other (specify) ____________________

13. Do the local plumbers/technicians have adequate a)-knowledge (YES/NO), and b)_tools (YES/NO) to maintain the system?

14. How do they collect revenues for system maintenance?

a)____From public user fees

b)____Other (specify) ____________________

15. How much is the fee they collect from households?

Peso ______ per week/month/quarter/year

16. What proportion of households pay regularly?

________per______; or ______ %

17. What kind of expenditures do they incur?

a)____wages of plumber/mechanic

b)____outside skilled labor

c)____parts & supplies

d)____transportation

e)____other (specify) ____________________

18. Where and how do they obtain spare parts & supplies?

a)____from CARE, where? ____________________

how? ____________________

b)____buy at hardware stores in Barahona or the region

c)____other (specify) ____________________

19. Where do they store spare parts, supplies & tools

____

20. Do they think that the revenues collected will be sufficient to cover Operations & Maintenance costs?

a) YES / NO

b) If NO, what will they do to address this issue?

____

21. Since the completion of their water system, how many times has it broken down?

____

22. How long was it out of service?

____

23. Who repaired it?

____

24. What would they do if their system broke down and they couldn't afford to repair it themselves?

____

25. To whom are they responsible? To whom do they report?

a) ____CARE ______________________

b) ____Government of D.R. ______________________

c) ____Community (incl. committee) ______________________

d) ____Other (specify) ______________________

26. What do they find the most satisfying part of being a committee member?

____

____

27. What do thery find the most difficult and frustating part of being a committee member?

____

____

28. Could we see the Secretary's notebook? (see attached sheet)

29. Could we see the Treasuror's ledger? (see attached sheet)

30. Could we see the spare parts/supplies depot?

28. NOTES REGARDING SECRETARY'S NOTEBOOK

29. NOTES REGARDING TREASURER'S LEDGER

30. NOTES REGARDING DEPOT, TOOLS AND PARTS

31. OTHER OBSERVATIONS

APPENDIX D

HOUSEHOLD SURVEY

INSTRUCCIONES

BUSCA A LA MADRE DE FAMILIA U OTRO RESPONSABLE

ENCUESTA

FECHA ______________________ PAIS ______________________

1. DATOS GENERALES

COMUNIDAD: ______________________

SECTOR ______________________

NOMBRE DEL ENTREVISTADO ______________________

2. DATOS DE CONTROL

ENCUESTADOR/CODIFICADOR: ______________________

DIGITADOR/ANALISTA CRITICO: ______________________

OBSERVACIONES: ______________________

____

____

3. INSTRUCCIONES PARA EL ENCUESTADOR

INTRODUCCION: Somos del Programa de CARE/USAID: Queremos conversar con la madre de familia o algún adulto de esta casa.

INFORMACION GENERAL

1. La persona que responde al cuestionario es:
La madre /0/ el padre /1/ el abuelo (a) /2/ Otro adulto /3/ /_/

2. ¿Cuántos niños menores de cinco años hay en esta casa? /_/

3. ¿Cuántos niños mayores de cinco años (hasta 12 años) hay en esta casa? /_/

4. ¿Cuántos van a la escuela? /_/

5. ¿Cuántas personas saben leer y escribir en esta casa? /_/

6. ¿Tienen radio en esta casa?
Sí /0/ No /1/ /_/

7. ¿Tienen televisor en la casa?
Sí /0/ No /1/ /_/

AGUA Y SALUD

8. ¿Cómo se almacena el agua en la casa?
Destapada /0/ Tapada/cerrada /1/ /_/

9. ¿Con qué frecuencia baña a sus niños?
Diariamente /0/ cada 2 días /1/ cada 5 días /2/
semanalmente /3/ cada diez días /4/
Una vez por mes /5/ Otro /6/ ____________________ /_/

10. ¿Cuál es la diferencia entre el agua de la llave y el agua del río y/o canales?
Ninguna /0/ El río y/o canal es sucio /1/
El agua de la llave es limpia /2/ Otra /3/ ____________________ /_/

11. ¿Cuáles son los beneficios de tener agua buena cerca de la casa?

1. ____________________ 2. ____________________

3. ____________________ /_/

12. ¿Cuáles son las enfermedades más comunes entre los niños menores de 5 años en esta comunidad?

1. ____________________ 2. ____________________

3. ____________________ /_/

13. ¿De dónde cree usted que vienen estas enfermedades?

1. ____________________ 2. ____________________

3. ____________________ /_/

27. ¿Qué personas en la comunidad les han dado información sobre la salud, agua potable y/o el uso de letrinas?

Profesor de escuela primaria	/0/	/_/
Enfermera	/1/	
Médico	/2/	
Promotor	/3/	
Comadrona	/4/	
La iglesia	/5/	
Otro ______________________	/6/	

28. ¿Qué han aprendido de estas personas?

Higiene	/0/	/_/
Limpieza de casa	/1/	
Transporte de agua a la casa	/2/	
Cuidado y mantenimiento de fuentes	/3/	
Saneamiento del área	/4/	
Recogida y quema de basura	/5/	
Los problemas que nos traen aguas negras	/6/	
Lavarse las manos con jabón (antes/desp. de hacer sus necesidades)	/7/	
Otro ______________________	/8/	

29. ¿Le gustaría que le hablen de algunos de estos temas de salud?

Sistemas de agua	/0/	/_/
Higiene personal	/1/	
Control de diarrea	/2/	
Vacunación	/3/	
Lactancia Materna	/4/	
Nutrición de niños	/5/	
Planificación familiar	/6/	
Otro ______________________	/7/	

ORGANIZACION COMUNITARIA

30. ¿A quién pertenece el sistema de agua o bomba manual?

CARE	/0/	/_/
Gobierno	/1/	
A la comunidad	/2/	
Al Comité	/3/	
A otros (especifique)______________	/4/	

40. ¿Por qué fueron elegidos? /_/

Porque son los que tienen mayores conocimientos/educativos /0/
Porque son los líderes naturales /1/
Porque tienen influencia /2/
Por responsabilidad y/o respeto /3/
No sé /4/
Otros (especifique)________________________ /5/

41. ¿Participó usted en la construcción o instalación del sistema de agua? Sí /0/ No /1/ /_/

42. En caso afirmativo, ¿Cómo? /_/
Dando dinero /0/
Dando materiales /1/
Excavando zanjas /2/
Instalando tuberías/construyendo fuentes /3/
Cocinó para los trabajadores /4/
Otros (especifique)________________ /5/

43. Si usted no participó en los trabajos del sistema, ¿Por qué no lo hizo? /_/
Porque no me importa el sistema de agua /0/
Porque no me lo pidieron /1/
Porque no me iban a pagar /2/
Otras razones (especifique)____________/3/

44. Participó usted en reuniones para hablar del Proyecto de Agua? Sí /1/ No /1/ /_/

45. En caso afirmativo, ¿En cuántas reuniones? ____________ /_/

46. De que se habló en esas reuniones? /_/
De la construcción /0/
Participación /1/
De higiene /2/
De letrinas /3/
Cómo usar la bomba/llave /4/
Cómo mantener la plataforma/fuente limpia /5/

47. ¿Quién decidió dónde se colocarían las bombas/fuentes en su comunidad? /_/
CARE /0/ Gobierno /1/ CEA /2/ la comunidad /3/
El comité /4/ Otros (especifique)______________/5/

48. ¿Quién debe mantenerlas limpias? /_/
CARE /0/ Gobierno /1/ CEA /2/ La comunidad /3/
El Comité /4/ Otros (especifique)____________/5/

49. ¿Participaron las mujeres en este proyecto de Agua Potable Sí /0/ No /1/ /_/

50. ¿En qué actividades participaron las mujeres?

1.____________________ 2.____________________

3.____________________

APPENDIX E

HEALTH EDUCATION MATERIAL

Su vasija o lata de cargar agua debe siempre estar limpia.


La organización de la Comunidad, ayuda a resolver los problemas de la Comunidad.
CONSTRUCCION DE ACUEDUCTOS
CARE
Educando para una mejor organización comunitaria.

La participación de la Comunidad es la Clave para el desarrollo Comunitario.

CARE: Educando para la organi-zación.

Limpie con frecuencia su tinaja o recipiente donde guarda el agua de tomar.

Educando para la salud

CARE

El agua debe llegar limpia a la casa.

CARE

Educando para la salud.

APPENDIX F

FINANCIAL ANALYSIS

APPENDIX F

FINANCIAL ANALYSIS

F.1 CAPITAL COSTS

In determining the capital costs of project activities and outputs, the following types of costs can be distinguished and calculated:

1- Materials & Equipment installed in the water systems and financed by CARE, USAID or CEA. This also includes any contract labor paid for under the project. These costs were determined by reviewing materials used and labor contracted for a "typical" system, i.e., hand-dug wells and drilled wells of average depth, the only gravity-fed water system constructed and a representative solar pump-assisted system.

2- Other Direct Site Costs related to water system design and construction, community organization, and health education activities. These costs include expenditures for field staff salaries and per diem, and transportation costs (fuel, maintenance, amortization of vehicles).

3- Other Project Costs not allocable to any particular site. This includes costs incurred for project management, administration, office rent, etc. and CARE/NY indirect costs. Without these general services, the project could not be implemented.

4- Community Contributions, which are mostly materials and services provided in-kind by the population. These costs were not managed by CARE.

The "other direct site costs" and "other project costs" were assessed for two distinct periods in the project, from January 1986 to June 1987, and from July 1987 to December 1988. During the first period, the main focus was on well construction. Hence 85 percent of the direct site and other project costs was allocated to the wells constructed during this period, while the remaining 15 percent was allocated to the gravity-fed systems. During the second period, the main focus of the project was on constructing solar pump-assisted distribution systems. Therefore, 80 percent of the direct site and other project costs was allocated to these systems. Currency exchange fluctuations were taken into account to the extent that information was available. The devaluation of the RD$ appears to have benefited the project, as, in US$ terms, prices and salary costs lagged following the devaluation.

The cost assessments provided in this annex are approximations only. It is recommended to study this matter more in-depth when preparing a financial plan for future projects. The per capita costs are provided in Table 2.

F.1.1 Hand-dug wells, equipped with handpumps

A. Materials & Equipment
(1986-87 prices and exchange rate)

Concrete/Masonry work (RD$)	255.00	
Casing, PVC 4"x30' (RD$)	675.00	
Handpump w/ riser pipe (RD$)	1,200.00	
Total	2,130.00	$ 710
B. Other Direct Site Costs		$ 1,677
Subtotal		$ 2,387
C. Other Project Costs		$ 3,946
Subtotal		$ 6,333
D. Community Contributions		$ 310
GRAND TOTAL		$6,643

F.1.2 Borehole wells equipped with handpumps

A. Materials & Equipment for an average depth well (55')
(1988 prices & exchange rates)

Drilling 55' (RD$)	6,600	
Casing (RD$)	8,250	
Pump, platform, riser pipe(RD$)	2,390	
Subtotal	17,240	$ 2,745
B. Other Direct Site Costs		$ 1,677
Subtotal		$ 4,422
C. Other Project Costs		$ 3,946
Subtotal		$ 8,368
D. Community Contributions		$ 150
GRAND TOTAL		$ 8,518

F.1.3 Gravity-Fed Water System

Las Clavellinas data (from H. Silva report, 1987) were used as it is the only gravity-fed system constructed thus far.

A.	Materials & Equipment Installed	$ 13,794
	Contract labor (est. 10 percent)	$ 1,379
	Subtotal	$15,173
B.	Other Direct Site Costs	$ 12,131
Subtotal		$ 27,304
C.	Other Project Costs	$ 28,547
Subtotal		$ 55,851
D.	Community Contributions	$ 6,879
GRAND TOTAL		$ 62,730

F.1.4 Solar Power-Assisted Distribution System

It was determined that Batey VIII was the most representative system of this type in terms of population served, level of service, and capital costs

A.	Materials & Equipment (CARE/USAID)	$ 15,689
	Materials & Equipment (CEA)	$ 8,738
	Subtotal	$ 24,427
B.	Other Direct Site Costs	$ 18,361
Subtotal		$ 42,788
C.	Other Project Costs	$ 25,216
Subtotal		$ 68,004
D.	Community Contributions	$ 4,704
GRAND TOTAL		$ 72,708

F.2 RECURRENT COST

F.2.1 Handpumps

Handpump breakdown and maintenance data were collected and analyzed for 29 handpumps which had been installed for at least 18 months. Excluded from the sample were handpumps of which the cylinder was installed more than 60' deep. An analysis of the performance of the Santo Domingo pump prepared in July 1987 had shown the extremely high breakdown rate of pumps in these conditions and subsequently most of these pumps had been removed.

The data for the 29 pumps are presented in Table F.2.1. It is apparent that the breakdown rate of the 11 pumps installed on (shallow) hand-dug wells is significantly lower than that of pumps installed on (deep) borehole wells. Therefore, separate calculations have been prepared for estimating annual O&M costs.

Currently, most communities do not have a set of maintenance tools. The evaluation team recommends that in the future the procurement of a tool set by the community be a prerequisite to pump installation. Meanwhile, in the current project many committees have been able to save most of the O&M funds collected thus far as CARE has paid almost all O&M costs. They should therefore be able to purchase the tools with their accrued balance.

It should be noted here that a complete tool set does not have to be bought for each pump. Often there are two to four pumps installed in one community or in a group of small nearby communities. Therefore, the O&M cost estimates presented in this annex assume that the communities have one complete set of tools at their disposal for every three pumps. The annual O&M cost estimates assume that on average, tools will be replaced once every five years.

Normally, pump replacement and/or amortization costs should also be considered an integral part of recurrent costs. It is felt, however, that given the low socioeconomic status of the project communities, replacement and amortization costs are presently not within their financial capacity (neither for the well nor the handpump). Therefore, these costs have not been considered in this analysis.

Finally, this analysis also assumes that the costs of a regional maintenance team, needed for below ground maintenance on pumps of which the cylinders are installed at depths greater than 40', will not be covered by the communities.

TABLE F.2.1 : ANALYSIS OF HAND PUMP BREAKDOWNS

No.	Name of Community	Type of well	Well no.	Population Served	Date Pump Installed	Nos. of Operational	Cup Leather	Check Valve	Drop Pipe	Chain Nut	Plunger Rod
1	La Costa	hand dug	1	100	4/85	33	2	2	1		
2	El Centro	hand dug	1	100	3/86	34	3	2			
3	El Cruce	hand dug	1	125	7/86	30	3	1	1		
4	La Curva	hand dug	1	150	7/86	30	1	1			1
5	Mesa Abajo	hand dug	1	325	6/87	31					
6	Mesa Abajo	Drilled	2	325	10/87	27	4	2			
7	Arroyo Dulce	Drilled	1	1750	3/87	22	7	5	4	1	
8	Arroyo Dulce	Drilled	4	1750	3/87	22	3	2	2		1
9	Vuelta Grande	hand dug	1	250	10/86	27	2				
10	Vuelta Grande	hand dug	2	250	10/86	27	1	1		2	
11	Vuelta Grande	Drilled	3	250	10/86	27	1	1			
12	El Granado	hand dug	1	367	9/86	28	3	4		2	
13	El Granado	Drilled	3	366	12/86	25	2	2	1	2	
14	El Granado	Drilled	4	366	12/86	25	3			2	
15	Barranca	Drilled	1	350	11/86	26	2				
16	Barranca	Drilled	2	350	11/86	26					
17	Guanarate	Drilled	1	470	12/86	25	1	1			
18	Los Robles	Drilled	1	275	1/87	24	3	1	1		
19	Los Robles	Drilled	2	275	1/87	13	5	2	1	1	
20	Uvillita	Drilled	1	130	2/87	23	1				
21	Uvillita	Drilled	2	130	2/87	23	5	1			1
22	El Guaba	hand dug	2	500	7/87	9	2				
23	El Guaba	hand dug	3	500	7/87	9	2	1			
24	Selva Muerta	Drilled	1	414	3/87	22	7	1	6		
25	Batey 1	hand dug	4	1800	3/87	22				3	
26	Bateicito	Drilled	1	540	5/87	20	2			1	
27	Bateicito	Drilled	4	540	5/87	20		1		1	
28	[illegible]aoyo School	Drilled	1	260	4/87	21	5	2	1		
29	Mencia	Drilled	1	280	4/87	21	7	2	3		2
	Total Hand dug					280	19	12	2	7	1
	Total Drilled					412	58	23	19	8	4
	Grand total					692	77	35	21	15	5
	Life span of parts, for hand dug well (months)						15	23	140	40	280
	Life span of parts, for drilled well (months)						7	18	22	52	103
	Life span of parts, for all well (months)						9	20	33	46	138

Handpumps on Shallow Wells

Following is a cost estimate for the annual planned maintenance costs (in RD$) for one handpump installed on a shallow well (cylinder at less than 40' depth). The replacement frequency was adapted from Table F.2.1.

Description	Replacement Frequency	Unit Cost (RD$)	Annual Cost (RD$)
Cup Leather	12 months	10.50	10.50
Check Valve	24 months	90.00	45.00
Miscellaneous Supplies (grease, packings, nuts)			30.00
Wages			36.00
Transport			12.50
Tools replacement			38.00
TOTAL			172.00

This estimate does not include savings for major breakdowns (e.g., riser pipes or plunger rods) as these have been infrequent in pumps installed on shallow wells. It is recommended that a certain amount of money (RD$50 to RD$100) be saved each year for this purpose.

Handpumps on Deep Wells

Following is a cost estimate for the annual planned maintenance costs (in RD$) for one handpump installed on a deep well (cylinder at more than 40' depth). The replacement frequency was adapted from Table F.2.1.

Description	Replacement Frequency	Unit Cost (RD$)	Annual Cost (RD$)
Cup Leather	6 months	10.50	21.00
Check Valve	18 months	90.00	60.00
Chain nut	24 months	10.00	5.00
Riser pipe, 10', 260PSI	24 months	150.00	75.00
Miscellaneous Supplies (grease, packings, nuts)			40.00
Wages			36.00
Transport			25.00
Tools replacement			38.00
TOTAL			300.00

This estimate does not include savings for major breakdowns other than riser pipes. It is nevertheless recommended that a certain amount of money (RD$50 to RD$100) be saved each year for this purpose.

F.2.2 Piped Distribution Systems

Given the short period during which these types of systems constructed under the project have been in operation, insufficient data are available to date to make a good estimate of recurrent system costs. Therefore, the following is a tentative O&M cost estimate only for such systems in the Southwest region of the Dominican Republic. Project staff should establish a proper data collection system to allow better O&M cost assessments in the future.

The basis for the estimates are two distribution systems which were observed by the evaluation team and which are considered to be representative: Las Clavellinas (gravity-fed) and Batey VIII (solar pump-assisted). As stated above, these estimates are illustrative for an average year, without any major system breakdowns. It is recommended, therefore, that revenues be collected as planned and saved to cover unforeseen expenditures.

GRAVITY-FED SYSTEM

Description	Quantity (annual)	Unit Cost (RD$)	Annual Cost (RD$)
Pipe, PVC 3"x20'	1/2	300.00	150.00
Pipe, PVC 2"x20'	1/2	150.00	75.00
Coupling, PVC, 3"	4	22.00	88.00
Coupling, PVC, 2"	4	12.00	48.00
Adaptor, PVC, 3"	1	30.00	30.00
Adaptor, PVC, 1/2"	2	5.00	10.00
GI nipple 1/2"x3'	2	12.00	24.00
GI coupling, 1/2"	2	2.00	4.00
GI union, 1/2"	2	8.60	17.20
GI pipe, 3"x20'	1	654.00	654.00
GI coupling, 3"	2	20.80	51.00
GI union, 3"	2	8.10	16.20
Brass taps, 1/2"	12	48.00	576.00
Gate valves, 1/2"	6	66.00	396.00
PVC solvent cement (Qt)	1	92.00	92.00
Teflon tape, roll	1	2.50	2.50
Padlock	2	25.00	50.00
Lubricant, (Pt)	1	6.00	6.00
Red Oxide paint (Qt)	1	24.00	24.00
HTH or bleach			12.00
SUBTOTAL PARTS & SUPPLIES			2,326.50
Remuneration skilled labor			360.00
Transportation			60.00
Other Costs (incl. tools replacement)			300.00
TOTAL ANNUAL O&M COSTS			3,046.50
Per Capita costs (2900)			RD$1.05

SOLAR PUMP-ASSISTED SYSTEM

Description	Quantity	Unit Cost (annual) (RD$)	Annual Cost (RD$)
Pipe, PVC 4"x20'	1/2	450.00	225.00
Pipe, PVC 2"x20'	1/2	150.00	75.00
Coupling, PVC, 4"	4	32.00	128.00
Coupling, PVC, 2"	4	12.00	48.00
Adaptor, PVC, 4"	1	45.00	45.00
Adaptor, PVC, 1/2"	2	5.00	10.00
GI nipple 1/2"x3'	2	12.00	24.00
GI coupling, 1/2"	2	2.00	4.00
GI union, 1/2"	2	8.10	17.20
Brass taps, 1/2"	12	48.00	576.00
Gate valves, 1/2"	6	66.00	396.00
PVC solvent cement (Qt)	1	92.00	92.00
Teflon tape, roll	1	2.50	2.50
Padlock	2	25.00	50.00
Lubricant, (Pt)	1	6.00	6.00
Red Oxide paint (Qt)	1	24.00	24.00
HTH or bleach			12.00
Aluminum paint (gallon)	3	60.00	180.00
Subtotal for storage/distribution system:			1,914.70
Remuneration skilled labor			480.00
Transportation			60.00
Other Costs (incl. tools replacement)			300.00
Annual O&M costs for water system			2,754.70
Per Capita costs (2580)			RD$1.07
For solar pump/motor set (by CEA)			
Carbon brushes	2	125.00	250.00
Brush spring holder	1/2	30.00	15.00
Pump Replacement (5 yr)	1/5	4,800.00	960.00
Labor			300.00
Subtotal for solar pump/motor set:			1,525.00
TOTAL ANNUAL O&M COSTS			4,279.70
Per Capita costs (2580)			RD$1.66

APPENDIX G

COURSE CONTENT FOR CARETAKERS

CARE-BARAHONA

TALLER ENTRENAMIENTO BOMBAS MANUALES SANTO DOMINGO

A G E N D A

1º DE SEPTIEMBRE DE 1987

8:00 - 8:30 A. M.	Desayuno
8:30 - 8:45 A. M.	Bienvenida y Presentación Lic. Carlos Guzmán
8:45 - 8:55 A. M.	Metas y Objetivos del Taller Francisco Báez
8:55 - 9:15 A. M.	Agua Subterránea y Ciclo Hidrológico Selección de Sitios Potenciales para hacer los Pozos Francisco Báez
9:35 - 9:50 A. M.	Componentes de las Bombas Santo Domingo Elpidio Sánchez
9:50 - 10:10 A. M.	Preguntas y Respuestas sobre los Componentes Elpidio Sánchez - Lorenzo Marte Hdez.
10:10 - 10:15 A. M.	Café
10:15 - 10:45 A. M.	Discusión sobre Medición de un Pozo (Profundidad y Flujo de Agua). Elpidio Sánchez Preguntas y Respuestas sobre Medidas y Clorificación Lorenzo Marte Hernández
10:45 - 11:00 A. M.	Presentación de los Problemas y Soluciones de las Bombas de Santo Domingo Lic. Carlos Guzmán

11:00 - 12:30 P. M.	Discusión y Demostración de Reparación a las Bombas Santo Domingo - Cambio de cheque y zapatilla de goma - Cambio de pistón y zapatilla de suela - Cambio de caja de bola - Reparación de la cadena - Pegamento tubo PVC con cemento PVC - Demostración y práctica de cómo hacer rosca a la varilla de la bomba Elpidio Sánchez - Lorenzo Marte Hdez.
12:30 - 2:00 P. M.	Almuerzo
2:00 - 3:00 P. M.	Discusión y Demostración de Mantenimiento de la Bomba Santo Domingo - Limpieza de la zapatilla del pistón - Poner grasa a la cadena - Cambio de la empaquetadura - Cepillar rosca de hierro y poner cinta de teflón - Poner grasa a la rosca de varilla y apretar bien el acoplamiento y contratuercas - Mantener la bomba y plataforma limpias Elpidio Sánchez - Lorenzo Marte Hdez.
3:00 - 4:00 P. M.	Instalación de la Bomba Santo Domingo con los Instructores de CARE Elpidio Sánchez - Lorenzo Marte Hdez.
4:00 - 4:10 P. M.	Café
4:10 - 5:30 P. M.	Evaluación y Clausura Cristina Veloz - Lic. Carlos Guzmán

APPENDIX H

DOCUMENTS REVIEWED

1. Briscoe, Water Supply, Sanitation, and Child Survival, PAHO Bulletin 21 (2), 1987.
2. Esrey, S.A., Feachem R.G., and Hughes J.M., "Interventions for the control of diarrhoeal diseases among young children: improving water supplies and excreta disposal facilities. Bulletin of WHO, 63(4) 757 - 772 (1985).
3. Isely, Raymond B. and Warner, Dennis B."Evaluation Methodologies for Managers of Water Supply and Sanitation Programs." Annual Conference of the National Council For International Health, June 11-13 1986.
4. Silva, Homero "Assessment of CARE Rural Water Supply Project in the Dominican Republic and Project Proposal Ammendment", Sto. Domingo, Dominican Republic, July 1987.
5. WASH Technical Report No. 11. The Role of Women as Participants and Beneficiaries in Water Supply and Sanitation Programs. Arlington, VA. WASH Project, 1981.
6. WASH Technical Report No. 40. Framework and Guidelines for CARE Water Supply and Sanitation Projects. Arlington, VA. WASH Project, June,1986.
7. WASH Technical Report No. 57. New Participating Frameworks for the Design and Management of Sustainable Water Supply and Sanitation Projects. Arlington, VA. WASH Project.
8. WASH Field Report No. 186. Malawi Self Help Rural Water Supply Program: Final Evaluation. Arlington, VA. WASH Project, 1986.
9. WASH Field Report No. 201. Final Evaluation of USAID/Catholic Relief Services Water and Sanitation Program in Ecuador, Peru, Guatemala, Honduras and Dominican Republic. Arlington, VA. WASH Project, Jan 1988.
10. WASH Field Report No. 218. Guidelines for Designing a Hygiene Education Program in Water Supply and Sanitation for Regional District Level Personnel. Arlington, VA. WASH Project, Sep 1987.
11. WHO "Minimum Evaluation Procedure for Water Supply and Sanitation Projects", Februray 1983, Geneva Switzerland.

APPENDIX I

TOOLS REQUIRED FOR SYSTEM MAINTENANCE

APPENDIX I

TOOLS REQUIRED FOR SYSTEM MAINTENANCE

1. Tools recommended for Handpump Maintenance

For above ground maintenance the following tools are required:

Description	Qty.	Unit Cost	Total Cost
Wrench 3/4" x 11/16"	2	16.00	32.00
Allen Wrench, 5/16"	1	5.75	5.75
Steel Brush	1	10.25	10.25
SUBTOTAL (above ground O&M)			RD$48.00

For below-ground maintenance the following additional tools are recommended:

Description	Qty.	Unit Cost	Total Cost
Pipe wrench 24"	2	81.00	162.00
Pipe wrench 14"	1	55.00	55.00
Measuring tape	1	30.00	30.00
Gloves, 1 pair	1	19.75	19.75
Screwdriver	1	6.00	6.00
Carpenter's hammer	1	29.00	29.00
Hacksaw frame	1	73.00	73.00
File	1	18.50	18.50
Pipe clamps, set	1	60.00	60.00
Vise grips	1	35.00	38.00
Adjustable wrench	1	30.00	30.00
SUBTOTAL (below-ground O&M)			RD$521.25

GRAND TOTAL			RD$569.25
		or,	US$ 90.64

2. <u>Tools Recommended for Piped Water Distribution System Maintenance (for systems constructed under CARE-DR project)</u>

Pipe wrench 36"	2	150.00	300.00
Pipe wrench 14"	1	55.00	55.00
Measuring tape	1	30.00	30.00
Gloves, 1 pair	1	19.75	19.75
Screwdriver	1	6.00	6.00
Hacksaw frame	1	73.00	73.00
File	1	18.50	18.50
Vise grips	1	35.00	38.00
Adjustable wrench	1	30.00	30.00
Shovel	2	30.00	60.00
Pick	2	35.00	70.00
Chisel	1	15.00	15.00
Sledge hammer (4lbs)	1	45.00	45.00
Trowel	1	18.00	18.00
Bucket	1	30.00	30.00
TOTAL			RD$808.25
		or,	US$128.70

It should be noted that some of the tools listed above do not necessarily have to be owned by the Water Committee, as contractors performing maintenance may own some. On the other hand, if the Water Committee intends to install house connections in the system, it would probably be cost-effective to purchase a small pipe threading set (1/2") at a cost of RD$700. With the current amount of (re)threading required, it is probably cheaper to buy or to have manufactured nipples of the required dimension.