XD-AAU-926A

DRAFT

WASH FIELD REPORT No.

PRELIMINARY DESING FOR HAND PUMP INSTALLATION PROJECT IN EL SALVADOR

Prepared for the USAID Mission to El Salvador

under ACT-227

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Feb. 1986

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ACKNOWLEDGEMENT

WASH would like to thank to Mr. Charles Brady and Mr. Leopoldo Reyes from USAID Mission in El Salvador for their guidance and suppor during this - consultant's work.

PLANSABAR and ANDA are engaged in the development of water supply to rural and fringe areas of the country. Mr. Roberto Arturo Arguello from PLANSABAR was particularly helpfull to the team work.

In addition, WASH is grateful for the assistance given by some representatives of the private civil engineering sector in San Salvador, particularly to Mr. Orlando Flores, General Manager of Pozos y Riego S.A. de C.V.

EXECUTIVE SUMMARY

USAID/El Salvador is assisting ANDA and PLANSABAR in developing water supply projects for fringe sectors of some urban areas and for small communities in the rural area. USAID is now focusing on the development of groundwater supplies using hand pumps. In December 1985 USAID Mission in El Salvador requested WASH assistance to develop a rural water supply program. S & T/H and WASH proposed a technical assistance through a three-person team for two weeks. Finally a two-person team for two weeks was assigned under ACT-227. Upon arrival to San Salvador the team discussed the scope of work with USAID and modified it to incorporate a second component requested by the Mission to identify technical assistance required by ANDA and PLANSABAR in order to expedite the preparation of projects for implementation with USAID assistance.

Following the program for contacts suggested and arranged by USAID/Mission, the team had working sessions with several national institutions, private consulting engineering firms, construction and wall drilling companies and PVO. During those sessions data was gathered related to the scope of work. The team also revised several documents provided by national agencies and some references to the subject.

Finally a draft report was produced; discussed with the Mission and typed.

Based on the analysis of the existing situation at ANDA, PLANSABAR and other national institutions and private sector, WASH evaluated the capacity of each one to carry on a new national wide program for hand pump installation using the existing installed capacity at private drilling companies.

On the other hand and in order to comply with Mission request, WASH's evaluated the existing workload and instituional capacity of PLANSABAR and ANDA to speed up the preparation of projects for implementation using USAID assistance.

ANDA is responsable for urban areas. Due to its constraings and insuficient installed capacity, ANDA created a special unit or project UDI to develop projects in a short time, managed by a local consultant. This arrangements is working smoothly but still have some delays in fund disbursements.

PLANSABAR is responsable for rural areas of the country. A great deal of their activities are devoted to attend requirements for the implementation of IDB loans. By now they are completing the second phase and preparing for the third one which covers 100 news projects to be implemented in 4 year at a cost of USD 2 1 million.

PLANSABAR installed capacity and physical installation are, withoutany doubt, overtaxed with no single way to get out form such situation in order to attend any other kind of projects, old or new, with existing institutional resources.

Local consultants, constructors, drillers and managerial experience and capacity is remarkable in El Salvador and it could be strengthen if sufficient market is open.

Based on evaluation results WASH team present a twofold program to comply with Mission expectation:

First project proposes the installation of 1250 handpumps in selected rural and periurban areas over a program schedule of three years. The total fixed cost for 1250 wellsof medium deph finished with handpump is estimated in US 7.075.500. An allocation of US 590.000 is also suggested to import five drilling equipment to strengthen the drilling capacity of local contractors and to develop local manfucturing of 500 handpumps needed for the last year of the project. A third subcomponent of this project is the training for 1250 community handpump caretakers, 15 regional trainers and the implementation of 15 regional maintenance workshops equiped with vehicles, tools, spare parts, heath education material and facilities to collect water fees if the community is to be changed for services. Total cost of the project is estimated in USD 9.804.600 which include 20% for contingencies.

The second project proposes an inmidiate technical assistance for 1) USD 10.000 to complete 9 or 10 ongoing desings; 2) 4 weeks of a sanitary engineer to assist PLANSABAR in identifying and prioritizing sets of communities for design and implementation through private contractors; 3) USD 240.000 as technical assistance per year to assist PLANSABAR to have designed some 80 projects using local - private consultants. This activity might need 2-3 years of - effort; 4) -

Construction supervisory services could also be performed through private consultants. The cost of this item is uncertain yet; 5) A six weeks evaluation consultanship at middle term is suggested at an estimated cost of USD 12.000;

The overall cost for technical assistance, for the known items of this component would thenbe US 510.000 over two years of implementation.

Chapter 1
BACKGROUND

In December 1985, the USAID Mission in San Salvador requested WASH assistance to develop a rural water supply program for El Salvador. Because of the scarcity of surface water supplies and USAID's concern about constructing regional supply and distribution facilities that might be subject to sabotage, AID is focusing on the development of groundwater supplies using handpumps.

AID will consider other local types of water supply technologies (i.e., groundwater pumping or rainwater catchment) subject to an analysis of ease of implementation of these types of systems. S&T/H and WASH proposed to the mission that technical assistance be provided through a three-person team for a period of two weeks.

1.1 Scope of Work and Work Plan

The scope of work and work plan for the WASH consultants was as follows:

1. Assist mission in determining feasibility and scope of a water supply program for rural and some urban areas of El Salvador.
2. Provide criteria and program goals for source development (drilling shallow and medium depth wells) and source improvement (enhancing and disinfecting existing wells).
3. Assess alternative water supply technologies including handpumps, well pumping and rainwater catchment.
4. Determine community and institutional capabilities to accept, implement, and maintain water supply facilities.
5. Develop a preliminary project design that incorporates the following items:
   - o institutional arrangements
   - o provides O&M management, community participation and health education components in the plan

- o provides water quality testing of new sources and ongoing monitoring of quality for completed systems.
- o provides training (based on assessment of community and institutional capabilities) to include, but not limited to, pump installations, desinfection practices, O&M, and water testing.

6. Assist mission in determining need for and type of drilling equipment required to support project implementation.

7. Assist mission in identifying consultants and private voluntary organizations that can assist in the implementation and management of the project.

8. Prepare a draft report in English to be left with the mission before leaving El Salvador. Mission wishes to place maximum emphasis on needs assessments and developing project plan. Report should be written to provide basic support for conclusions and recommendations.

1.2 Team Planning Sessions

In February 6 and 7 a team consisting of two persons only (the third member could not be assigned) participated in team planning sessions in order to:

- o Discuss the scope of work
- o Discuss team members working habits
- o Prepare a preliminary table of contents for the report to be left with the AID mission in El Salvador
- o Prepare a preliminary work plan for the team
- o Provide the team with background information

Modified Scope of Work

:bruary 10 the team met with Mr. Charles Brady, General Development
:er, US AID, in El Salvador to discuss the scope of work and the preliminary
: of contents of the report and the team time table - In this meeting it -
'stablished that the scope of work had to be expanded to encompass an asses-
by the team of the needs in technical assistance of El Salvador water -
y systems excecuting agencies in order to speed up the formulation and
ıtion of a backlog of projects to be financed by AID.

Chapter 2

EXISTING CONDITIONS

2.1 Project area and population

El Salvador is one of the five Central American countries. To the north and east, El Salvador has limits with Honduras; to the east and south-east with the Golfo de Fonseca; to the south with the Pacific Ocean; and to the west with Guatemala. The country has some 21,041 Km^2 with an average population density of 235 people per Km^2 (1983). There are three well defined geographical areas which are the coastal area along the Pacific Ocean; the central plateau and the mountaneous region with elevation up to 2,700 m. above sea level.

One chain of mountains runs from rio Lempa valley to the north along the Honduras border; a second chain of mountains goes from Guatemala border to the Gulf of Fonseca between the rio Lempa valley and the low lands or coastal area on the Pacific shore. The coastal plateau comprises the low lands along 321 Km of sea shores and has an average width of 20 Km.

Dry season in the country normally occurs from middle November to middle April with one month of transition to the rainy season which begins about May 21 and ends on October 16. The average yearly precipitation value is reported to be 1,182 mm. having a 90% concentration during the rainy season.

The country is divided into 14 "Departamentos", 261 "municipios", 2,061 "cantones", 7.754 "caseríos" and 29 "distritos". Urban population is considered to be that which lives in the municipal capital cities while rural lives outside those limits and in the "cantones", "caseríos" and disperse population.

Population estimates and distribution by "departamentos" are shown in Tables 1 and 2 below. Such information

is taken, with permission, from a paper delivered by Mr. Walter Pedrosa de Amorín, PAHO/WHO engineer to the First Seminar Workshop on Water and Sanitation for Fringe Areas, December 16-20, 1985

Table 1

URBAN AND RURAL - 1950 a 200

YEAR	TOTAL	URBAN	%	RURAL	%	TOTAL
1950	1.930.641	700.618	36.3	1.230.023	63.7	
1960	2.542.148	984.236	38.7	1.557.912	61.3	2.79%
1970	3.397.642	1.384.732	40.8	2.012.910	59.2	2.94%
1980	4.539.515	1.902.507	41.9	2.637.008	58.1	2.94%
1984	5.090.954	2.142.704	42.1	2.946.250	57.9	2.89%
1985	5.235.673	2.204.868	42.1	3.030.805	57.9	2.76%
1990	5.997.034	2.524.100	42.1	3.472.934	57.9	2.66%
2000	7.730.402	3.213.819	41.6	4.516.583	58.4	2.66%

PLAN de la DIAAPS

Table 2

DEPARTMENT	TOTAL	%	URBAN	%	RURAL	%
El Salvador	4.539.515	100.0	1.902.507	41.9	2.637.008	58.1
Ahuachapán	224.937	5.0	45.686	20.3	179.251	79.7
Santa Ana	405.063	8.9	189.356	46.7	215.707	53.3
Sonsonate	305.218	6.7	109.925	36.0	195.293	64.0
Chalatenango	204.513	4.5	61.134	29.9	143.379	70.1
La Libertad	371.389	8.2	131.848	35.5	239.541	64.5
San Salvador	1.050.256	23.1	830.907	79.1	219.349	20.9
Cuscatlán	182.322	4.0	50.308	27.6	132.014	72.4
La Paz	227.533	5.0	60.646	26.7	166.887	73.3
Cabañas	154.314	3.4	29.056	18.8	125.258	81.2
San Vicente	186.008	4.1	52.786	28.4	133.222	71.6
Usulután	358.548	7.9	92.989	25.9	265.559	74.1
San Miguel	406.697	9.0	146.653	36.1	260.044	63.9
Morazán	181.627	4.0	37.246	20.5	144.381	79.5
La Unión	281.090	6.0	63.967	22.8	217.123	77.2

PLAN de la DIAAPS

Available information on percentages of rural and fringe area population that have easy access to any kind of drinking water facilities show the following variations:

Area	Type of Service	Year 1980	1981	1982	1983
Urban	Easy Access	5.8	5.5	5.4	5.2
Rural	Easy Access	32.8	33.9	33.3	16.9
Toral rural population	House conexion and E. Access	39.7	41.5	41.2	43.1

Source: Plan DIAPS

On the other hand, the total equivalent for rural population with water services of any kind is estimated on 1,253,422 (1983) being 15.6% scattered population. The team feels that the baseline for coverage estimations is 1983 because data beyond that point is not well known.

Nevertheless, there is still a large number of rural population without water facilities of any kind that need to be attended in order to increment the coverage or at least to match with rural population growth, as well as to provide easy access drinking water to the population living in fringe areas of the principal cities and for the displaced persons in camps and cooperatives.

Recent studies and data analysis made by the Project HOPE demonstrate that access to water in appropriate quantities and quality have deteriorated in the camps where by 1985 a single tap is serving up to 2,870 inhabitants

Furthermore, studies made by different institutions document the fact that population migration pressure over San Salvador

and other cities has increased during the last years, is estimated that some 500,000 persons live in fringe areas of San Salvador, that is to say, nearly 50% of the total population of the Metropolitan area of the capital city. Some 40% of such population lives in "colonias ilegales" and other sectors around San Salvador without ANDA distribution system. That population is getting water from vendors, public standposts or ANDA trucks.

2.2 Institutions

Several institutions participate in the water and sanitation sector in El Salvador; some of them were contacted in order to "determine community and institutional capabilities to accept, implement and maintain water supply facilities", to learn about their capacity to "provide water quality testing of new sources and ongoing monitoring of quality for completed systems" and to "identify consultants and private voluntary organizations that can assist in the implementation and management of the (hand pump) project". The persons interviewed are listed in Annex "A", and the meetings for their interviewing were arranged by AID Mission, through Mr. Leopoldo Reyes.

The institutions visited were the following:

- Administración Nacional de Acueductos y Alcantarillados, "ANDA".
- Plan Nacional de Saneamiento Básico Rural "PLANSABAR".
- Dirección de Desarrollo Comunitario "DIDECO".
- Organización Panamericana Sanitaria "OPS".
- Banco Interamericano de Desarrollo "BID".
- The People-toPeople Health Foundation, Inc. (PROJECT HOPE).
- Consulting Engineers and Well Drilling Contractors.
- Instituto Ricaldone.

In the next paragraphs a short description of the institution and the WASH team appreciations derived from opinions given by the interviewed persons and some reference material (Annex B) that was provided are given:

2.2.1 ANDA

Is the institution responsible for the planification, financing, execution, maintenance and administration of the water and sewer works needed to provide water and sewerage services to the urban centers in the country. ANDA was created in October 17, 1961. An important reason for its creation was the

need to make the urban water and sewer systems self sufficient from a financial viewpoint. The municipal systems have been overtaken by ANDA according to its capacity, and up to 1983 managed 125 of the 261 municipal systems in the country.

ANDA is using funds provided by AID through ORE to expand its water distribution networks and its sanitary sewers in some cities in order to provide services to the periurban population (colonias informales). It also provides services to people that has been resettled or displaced by the prevailing internal conflict (reubicados y desplazados) when they happen to be in a city managed by ANDA. In order to develop the project in a short time, ANDA created a special project unit, named UDI, managed by a local consultant that has been charged with the responsibility of coordinating the whole effort, preparing contracting documents for consulting and construction contracting, and supervising the work done by these contractors. This approach is felt to be effective, even though the administrative and financial management are retained by ORE. The eligible neighborhoods are those that own the land and are willing to repay the investment. ANDA has installed hand pumps in some cases, and feels that its use could be appropiate for "colonias informales", but, due to a large deficit that it is facing, is not interested in giving support to an activity that would be not self financing. Besides, ANDA's capacity for Ø & M in the system that manages is overtaxed. ANDA has one central Laboratory for water analysis only. There is not an effective control of the water quality that is supplied, due to a lack of the chemicals needed for water analysis.

In the near past ANDA has been doing the design and construction by force account, recently, for the seventh phase of ORE, design work will be done partially by local consultants, and about half the construction will be done by local contractors. The procurement of pipes and equipment is done by ANDA and supplied to the contractors.

2.2.2 PLANSABAR

This institution is part of the Ministry of Public Health and Social Welfare, which is responsible for "introduction of potable water and execution of basic sanitation works in the rural communities, as part of an integrated medical concept". PLANSABAR was constituted as the Executing Unit for the National Plan for Basic Rural Sanitation in October 1980, by Ministerial Resolution N° 322, reporting to the upper levels in the Ministry. PLANSABAR's main objective is "give support to the economic and social development process in the rural area, by means of the improvement of the sanitary conditions through basic sanitation and community education actions". PLANSABAR has executed two rural water system programs financed by BID and is about to start a third program, that will build 100 water systems to supply about 230,000 people, and will install 75,000 latrines for 450,000 people with a cost of US$ 21 millions, and an execution period of four years. The community size for this program is between 300 and 2,000 people. It is expected that 60% to 70% of the systems will require pumping.

In this program all the design work and construction has to be done by force account. This requirement forces PLANSABAR to use all its installed capacity in this project.

As part of the program there is a Technical Assistance that will provide short term consultants in financial information and in operation and maintenance. Also visits to other countries will be financed. PLANSABAR is building water systems using AID funds from ORE. Its execution is being delayed by the lack of personnel to do the design work, by insufficient gasoline for field work (even though there are enough surveying crews) and by strikes.

In order to speed up the design work ORE has contracted local consultants that are designing water systems which studies

were done by PLANSABAR. PLANSABAR is supervising the consultants and the afterward construction. ORE is buying the materials and paying for the construction labor. PLANSABAR has asked for ORE to pay for the construction supervision (because now the same personnel has to supervise BID, ORE and other projects), but to no avail.

The procurement aspect is a restriction in the construction of the systems whether PLANSABAR or ORE are responsible. In order to begin the construction of 9 water systems to be financed by ORE, PLANSABAR has requested that at least 50% of the materials be delivered at the work site before commencing construction.

The administration, operation and maintenance of the water systems built by PLANSABAR is turned over to Local Administrative Boards (Juntas), which receive supervision and support from Plansabar Regional offices. The Juntas bill and collect the water rates, and deposit the collection in a revolving fund. As there is a lack of payment PLANSABAR is facing a deficit condition. The deficit is produced, in part, for the O & M costs of the pumped systems; PLANSABAR is currently negotiating with the Juntas for them to pay the salaries of the pump operators.

Even though some of the systems have hypochlorination facilities none of them provides disinfection, due to the lack of funds to buy chemicals. There are no laboratories for water analysis in San Salvador or in the Regional offices of PLANSABAR, so there is no water quality control. A project funded by PNUD, that began in January 1986 will provide for the laboratory equipment supply for the Ministry of Public Health and ANDA regional laboratories. PNUD is also funding a Technical Assistance for hydrogeological studies. With the ongoing projects PLANSABAR is overtaxed in its project implementation capacity, and doesn't seem interested in managing another project.

The PLANSABAR engineers feel that the hand pumps could be used in areas with ample ground water resources, high water table, and small population in the rural areas. They don't feel PLANSABAR can give support in the maintenance of the hand pumps under the present conditions.

It is interesting to note that the two main programs undertaken by PLANSABAR (the BID and ORE Programs) conflict in two basic issues:

a) ORE pays the people to build the waterworks. BID requires that the unskilled labor and local materials be provided free of charge by the community.

b) BID financed water systems Juntas charge a connection fee to the new users that didn't contribute to construction. As ORE's systems don't require the community's collaboration, there is no basis for this type of charge.

It is convenient that some criteria be developed to resolve these discrepancies, otherwise communities will be reluctant to collaborate without payment in the construction of BID systems if they can be paid for the same work in the ORE systems.

2.2.3 DIDECO

DIDECO participates in some water system projects because it has been designed as the channel to distribute the food in a PMA food for work program that provides the goods to several governmental agencies.

It is also responsible for the communities' development, and participates in their organization. As part of its work it has had some limited experience in water works construction.

As part of their campaings they recommend the boiling of water for human consumption.

It doesn't seem that DIDECO can play any significant role in the hand pump project execution, but can be of importance in the selection of communities to be attended.

2.2.4 OPS/OMS

OPS is providing technical assistance to ANDA and PLANSABAR, especially to the latter, and is managing the PNUD project for laboratory equipment acquisition and hydrogeological studies. On the other hand, it maintains a long term advisor for sanitation and is currently assigning short term consultants in water quality control and operation and maintenance.

At the meeting with WASH Team, the OPS personnel showed a mild enthusiasm for the hand pump project, and provided some background information. It was remarked that:

- The sector is facing difficulties in obtaining spare parts.
- OPS efforts to improve operation and maintenance in PLANSABAR have been totally ineffective.
- There have been experiences with previous hand pump programs, for instance in some country in Africa, that failed.

2.2.5 BID

BID has been financing projects both to ANDA and PLANSABAR. For ANDA the last project was "Proyecto Zona Norte", a water supply improvement for San Salvador. The project, originally estimated at a cost of US$50 million was finished with a total cost of US$82.0 million. The construction time exceeded the original estimate.

There exists the possibility that some new improvements for San Salvador water and sewer works be financed by BID. There

also exists the idea to rehabilitate some urban water systems.

For PLANSABAR, BID has financed two Rural Water Programs, and is beginning the third one. In the execution of the second one the execution time, originally established in four years was extended to 6 1/2 years. The sectorial specialist feels that:

. The procurement in PLANSABAR is too slow.
. Some changes in PLANSABAR's organization will be needed.
. The design capacity of PLANSABAR is below the required to comply with the time frame (70 projects in two years).

2.2.6 PROJECT HOPE

Project Hope, managed by "The People-toPeople Health Foundation, Inc.", a non-profit organization, is providing primary health services to the displaced persons camps and certain agricultural cooperatives. The project is funded through an AID grant by means of a cooperative agreement.

HOPE employes 160 Salvadoreans. Only the Director and Subdirector are expatriates.

HOPE coordinates its efforts with the Government of El Salvador in accordance with an agreement between the Ministries of Public Health, Agriculture, and Interior and HOPE, the main counterpart being the Ministry of Public Health. The Government provides office space, public services and guidance.

Presently HOPE provides primary health care to 1500 people monthly. In order to do so, HOPE has built 30 health posts (dispensaries) and provides the required logistic support through two main offices, one in San Salvador and another in San Miguel. HOPE also is providing health education epidemiological monitoring, and vector control.

HOPE effects monitoring of the water quality in the settlements where it is working using a Millipore portable incubator and compares the results with the tolerable limits established by "Agua del Pueblo" project in Guatemala because they feel the OMS standards are too stringent. Based on "Agua del Pueblo" standards the water quality in most of the places is acceptable and doesn't show colliform presence. A sanitary inspector is researching the feasibility of home water filtration using sand and carbon. According to HOPE, the main water problem is not water quality but not enough quantity and the lack of hygienic habits.

In the original project scope, presented to AID in 1984, HOPE proposed "an integrated program including epidemiological studies, provision of primary health care and improvements in environmental sanitation. Due to budgetary constraints USAID was unable to fund the portions of the Project HOPE's proposals dealing with environmental sanitation."

In September-October 1985 HOPE hired a consultant to prepare a paper describing an environmental sanitation program for the displaced persons camps and certain cooperatives showing an increased need of water and sanitation in these human settlements presumably to be presented to AID for additional funding because "Recent data analysis and field studies document the fact that while certain conditions have improved in the campus (specifically, an increased number of latrines,

drainage improvements, and access to primary health care), the problem of acces to water in appropiate quantities and quality has grown".

According to HOPE the displaced population is around 500,000 people. The settlements increase or decrease in size, and those that develop close to existing towns are overtaxing the capacity of existing water systems creating problems to the regular customers. It has been a policy of the Government of El Salvador and donor agencies that the provision of adequate water supply would make the camps permanent and discourage the inhabitants from returning to their original lands. This previous concept points to the convenience of using hand pumps as an interim solution for the camps.

2.2.7 Consulting Engineers

Two meetings were held with two consulting engineers, Mr. Guillermo Imery and Mr. Carlos Montenegro. From these meetings it appears that:

- There are five to ten consulting engineering firms with experience in sanitary engineering design. CRE and FOSEP (Fondo Salvadoreño para Estudios de Preinversión) keep updated lists of prequalified consultants.
- PLANSABAR has experience in contracting consultants for rural water systems design work. Most of the systems are supplied by ground water (wells or springs). It takes between two and three months to process a contract. The usual form of payment is lump sum with a 10% to 15% initial payment.
- The normal design contract is between ₡4,000 and ₡15,000 per project (usually a project is designed to supply several communities). The previous figure doesn't include topographic survey which cost is between ₡1,000 to ₡1,500 per kilometer. Usually it takes two to three months to prepare

the design work. The unit cost and time per project could be reduced if with each consulting firm were contracted 5 to 10 projects in one area (the time for completion would be from 6 to 8 months).

- The supervision of construction could be handled by local consultants, the approximate cost would be ₡10,000 per month per system.
- Individual expert services can be contracted with professional engineers at a salary cost of ₡8,000 per month.
- The preparation of the Terms of Reference for the consulting contracts should be prepared by experienced engineers in order to avoid vagueness, loopholes, and clauses that can interfere with the contract execution.
- The type of Construction Management Contract that ANDA, through UDI, is using is seen as an effective way of developing a project.

2.2.8 Well Drilling Contractors

Two meetings were held with Mr. Orlando Flores. The following information was obtained.

- There are about five large well drilling contractors who own large and medium size rigs. It is felt that for small diameter wells (4" casing) in rural areas with poor roads small and easy to transport well drilling rigs are required; these small rigs cost about US$45,000.
- There is experience with different kind of wells: hand dug wells, jetted well points, and deep wells drilled by cable tool and rotary rigs. The technology varies according to the geographical zone. There is a preference to use imported well screens, even though there is experience in using sloted PVC pipe. PVC pipe has been successfully used as well casing in medium depth wells (300 feet).
- For shallow to medium depth wells the well contractors could drill 50 wells per year.

The principal problems the well drilling contractors are facing are the scarcity of ofreing currency to buy spares, equipment and materials; the lack of financing to buy new rigs and drilling tools, and the slowness of purchasing using letter of credit procedures, that is being used, due to a lack of commercial credit in the U.S.A, where they buy most of their supplies.

2.2.9 Instituto Ricaldone

Instituto Ricaldone is a high school that gives technical training in mechanical, electrical and electronic areas to its students. It was visited because the Assistant Dean, Padre Giuseppe Coro knows, andmaintains working relations, with several industries in El Salvador that could be able and interested in locally manufacturing the hand pumps. According to Padre Coro there are about ten industries that could do the job, as there is local fabrication of light agricultural machinery. Padre Coro feels that the local industry is loosing highly trained personnel due to the internal conflict and that its capability has been diminished in the last few years.

The WASH Team feels that it is doubtful that a high quality hand pump can be immediately manufactured locally.

2.3 Water resources

Water resources in El Salvador are abundant both surface and underground. Country water authority, with the purpose of undergrcund water development have established five hydrogeological characteristics, as follows:

I. Soil formations with good porosity and permeability characteristics with high values of transmisability and storage. Water table is found between 2 to 20 m. depending upon the topography of the ground. Sediments; coarse and fine sand are common in this type of soil. Yield is reported to range from 500 to 1000 GPM. Jetted well being the most appropriate technology for water withdrawal.

II. Volcanic rocks and formations likewise with secondary permeability values belongs to this classification. Yield ranges from 200 to 400 GPM and the water table is between 30 and 100 m.

III. It's characteristics are volcanic sediments, ashes and similar sediments with medium permeability and good porosity values. Water level is located at 60-100 m and yield could be 100 to 300 GPM.

IV. Rock conglomerates and lava deposits are common characteristics of this area. Sometimes hydrological conditions are such that groundwater is seeping through small fractures. Yield could be between 15 and 100 GPM and water table be from 80 to 100 m.

V. Hard rock formations with confirmed aquifers. It's possible to obtain yields of 20 to 200 GPM.

There is no doubt that in the country there is abundant rainfall and some of the rain percolates into the ground to re-

charge the aquifers. The yearly distribution of rain in El Salvador is shown below :

	Duration		Average Rainfall	
	Days		mm	
Dry season	157	43.0%	77	3.8%
Dry to rainy season	31	8.5%	119	6.0%
Rainy season	149	40.8%	1.627	81.3%
Rainy to dry season	28	7.7%	177	8.9%

3.1 Project Concept and Strategy - Objectives and Goals

3.1.1 Project Concept and Strategy

As can be seen from the previous discussion in chapter 2, there exists the need to provide with a water supply to ample groups of population in El Salvador, especially in the small rural communities (less than 300 people); in the displaced persons camps; in the agricultural cooperatives and in the periurban areas where informal settlements develop.

In order to cope with this need AID, through ORE, has been financing water distribution expansion of existing systems, which in some cases are not developed in conjunction with source of supply expansion (creating water shortage for the present consumers), and in the construction of rural water systems. A BID funded project is directed to tural communities that are willing to participate with a community contribution of about 20% of the water system cost; and are able to pay water rates that can raise enough funds to pay for the operation and maintenance of the systems.

The conventional approaches that are being followed suffer from two clear disadvantages if it is required to rapidly supply with potable water the large numbers of population that require the service:

a) The beaurocratic procedures require long time for project execution through the governmental agencies responsible for the water supply sector (ANDA and PLANSABAR); and
b) The water supply systems goe against the policy of non-permanence of the displaced persons camps adopted by the Government.

The use of wells equiped with hand pumps is a viable technological alternative because:

(.) It is an interim source of supply that can be used until a permanent system is implemented.
(.) It uses untapped hydraulic resources instead of creating conflicts with the present users of water systems.
(.) It provides, if the wells are properly protected, safe water for human consumption.

The sector project implementing organizations, AND and PLANSABAR have all their resources committed to the ongoing projects, and have started using private consultants and contractors to help the the projects' execution. The lack of funds to pay for the projects management efforts and for the private consultants' services still impede the projects' timely execution. On the other hand, HOPE, a Private Voluntary Organization is successfully implementing a primary health services program for displaced persons camps, and has expressed its willingness to incorporate water and sanitation components as part of their project. The use of a PVO, like HOPE, for the Hand Pump project management can be very effective because:

(.) It works in areas where the proposed technology is suitable.
(.) It has experience in dealing with communities in the rual areas.
(.) It feels the need to complement its ongoing efforts.
(.) It has experience in dealing with AID, as it is currently developing an AID funded project.
(.) It has shown disposition to work with local personnel, taking advantage of their knowledge of local conditions.

There exists in the country technical capability to develop the limited engineering and hydrogeological requirements for the hand pump project. On the other hand, there exists the

well drilling contractors to drill the wells and install the pumps. Both should be used in the project execution.

With reference to Operation and Maintenance, PLANSABAR and ANDA are facing large financial deficits, a situation that impedes the proper execution of O & M. The financing institutions devote all their resources to the construction of new water systems and limit their participation in O & M to the provision of technical assitance through short term consultants, which is clearly ineffective. In order for the hand pump opeation and maintenance to be successfull it has to be involved as a project component; without resorting to the existing institutions for support.

In summary the project concept and strategy is the implementation of a water supply project for the small rural communities, displaced persons camps, agricultural cooperatives and informal periurban developments using as a source of supply shallow and medium depth wells equiped with hand pumps. The project management will be the responsibility of a non-profit organization, this organization will also be responsible for monitoring and supporting the operation and maintenance to be done by the communities during the project lifetime, including the quality control of the water supplied. The project execution will be directed by a Steering Committee formed by selected Governmental Organizations, AID and the PVO and will use local consultants and well drilling contractors.

As a separate effort, to facilitate the execution of projects financed throug ORE, Technical Assistance funds will be provided to pay consultants services to do water systmes design work for PLANSABAR, using a scheme similar to ANDA's VDI.

3.1.2 Project Objectives and Goals

3.1.2.1 Hand Pump Project

a) To provide safe water by means of wells equiped with hand pumps to 225,000 persons by means of 1250 wells in the rural and periurban areas in a three year period.

b) To increase the local well drillers installed capacity from an estimated capacity of 250 to 500 wells per year by financing the acquisition of drilling rigs to be used by the well drillers in rural areas within the first year of the project.

c) To create the local capacity to fabricate an estimated 500 per year good quality hand pumps by the end of the second year of the program.

d) To provide the physical means and develop the administrative and technical capabilities at local and regional level to effectively operate and maintain the following quantities of hand pumps:

- During the first year - 250
- During the second year - 750
- During the third year - 1250

e) To enhance community participation in construction and operation and maintenance of the wells and hand pump, and to provide health education to all the hand pump users during the lifetime of the project.

3.1.2.2 Technical Assistance Project

a) To prepare by contract with private consultants the final designs for ten rural water systems that PLANSABAR will build with ORE assigned funds, during the first semester of 1986.

3.2 Alternatives for source development and technology

From data analysis and information gathered through team interviews with local professionals and technicians it appears that El Salvador is a rich country in underground water resources, specially at the coastal area and central plateau. There is also a good experience in withdrawal of underground water by means of drilled and hand dug wells for multiple purposes like human consumption and irrigation. Private contractors advised the team that productive water table at coastal area is found at about 16 m depth varying up to 60 m at the central plateau. Due to the rock formations encountered along the mountain ranges, the probabilities of finding water at a reasonable depth is uncertain. This fact provides a basis for the development of appropriate low cost technology to supply drinking water, of acceptable quantities and quality, for rural communities and fringe areas by means of shallow and medium depth wells operated by hand pump, as described below :

3.2.1 Driven wells

The soil formation that prevails at the coastal region is suitable for driven or dug wells. Driven wells are made by driving a pointed screen known as "well point" into the water bearing formation. To prevent damage, the point at the lower end is made of hard material like hard steel. It is important to design driven wells properly to ensure a year round supply of water; this involves selection of well point; chosing a method of driving; and determining the required personnel, tools and equipment.

There are two categories of well points: the screen type that consists of an open or perforated frame covered with one or more screens. This type is relatively less expensive but less resistant to damage during driving or over pumping; the slot-

ted type of well point is more expensive but less likely to become plugged during over-pumping.

Driven wells are not suitable for hard rock or heavy beds of clay or coarse gravel; their practical depth is limited to about 8 m. Most well points have a diamter in the 30-50 mm. range. The yield from a driven well is generally small, somewhere between 0.1-1 l/s which would be sufficient to supply domestic water for a small community.

3.2.2 Jetted wells

Do not differ much from driven wells and is much faster. Mechanical force is not needed so that plastic instead of steel can be used for casing and strainer. Unconsolidated formations and sandy aquifers are best suitable for this method. Jetted wells can be carried to depths of about 60 m. increasing the chances of reaching a good yield. Constructing these wells requires a water pump, hoses and other materials which raises the cost. El Salvador has a good experience in the public and private sectors on this method.

3.2.3 Dug wells

Are made by digging a hole in the ground. They can be satisfactory if the conditions are right and generally no special equipment or skills are needed for the construction. Usually the diameter of the well should be at least 1.2 m if two men are to work together. Further increasing the size of the well is seldom usefull since the additional yield is likely to be very small. Dug wells provide both groundwater withdrawal and storage due to their large diameter. They can be constructed in almost any type of soil except hard rock; its practical depth is about 10 m but depending upon the type of ground and fluctuations of the water table, well for communal use are frequently between 20-30 m. Most dug wells need an inner lining made of brick, masonry, stone, concrete cast in

site or precast concrete rings. The lining also provides a seal against polluted water seeping from the surface into the well; for this the well has to be covered.

3.2.4 Cable tool wells

Require special drill equipment and skills to operate it but they are very fast in comparison with other methods. These wells can be sunk in nearly every type of soil and reach depths of 75 m or more increasing the changes of finding reliable groundwater sources. To select the most suitable equipment to be used in El Salvador would require the participation of an expert in geology and drilling equipment.

3.2.5 Alternative technology

Where it is not possible to obtain surface or groundwater for household use at a reasonable cost, the rainwater harvesting offers a simple and low cost solution for supplying drinking water for small rural communities in El Salvador. Rainwater can be collected from houseroofs that are made of tiles; galvanized, aluminum or plastic corrugated sheeting. Rainwater needs to be collected through roof catchments and stored in appropriate containers or household cisterns. With sufficient storage, the roof-catchment could provide water over the rainy season and some 40 l/day which is the basic drinking and domestic water requirements of a family of 6 persons, during 2 to 3 months of the dry season.

3.2.6 Hand pumps

Different types of hand pumps have been used in El Salvador. From data analyzed by the team it appears that out of some 368 systems administered by the MSPAYAS, 58 are shallow and medium depth wells using a hand pump. PLANSABAR has standarized the type of pump and is using the cast iron Red Jacket type with fair results. Most of the problems encountered

are apparently due to a lack of proper maintenance procedures and shortage of spare parts. For the conditions prevailing in El Salvador, the USAID pump is suitable. Is a single action, reciprocating, positive displacement pump designed by Battelle-Columbus Laboratories for USAID. It's specifications are for long life under severe operating conditions, easy maintenance using single tools and unskilled labor and suitable to be operated by women and children. The shallow well versions have the piston and cylinder assembly incorporated into the above-ground pump stand and are suitable for wells of less than 8 m deep. For the - deep-well version, the piston and cylinder are below the water level as deep as 30 m or more.

3.2.7 Windmills

In some areas of El Salvador where hand pumps are likely to be installed, the water table could probably be too deep to raise water by means of human effort and no other source development may be available. In such a case, the team feels that a windmill of proper size and design could provide an adequate and acceptable solution.

3.3 Project Elements

3.3.1 Feasibility

The total number and distribution of small rural communities that could be supplied through a shallow or medium deph well and handpump is not well known, but based on data analysis and interviews with local authorities and international institutions working at water sector, the team found that USAID can implement a program for instalation of handpumps in some areas of the country, both rural an fringe urban areas. Some basic criteria are provided for the project design and implementation:

3.3.1.1 Beneficiaries

One handpump can serve up to 30 families of six persons each depending upon the distribution of the population. These represents a design populations of:

$$30 \times 6 = 180 \text{ persons/pump}$$

3.3.1.2 Water Consumtion

Considering the basic drinking and domestic water requirements of a family on rural areas of the country, a consumption of 20 liters/persons/day is considered appropiate.

This means that for a family of 6, the water need would be:

$$180 \times 20 = 3600 \text{ liters/day}$$

or

$$\frac{3600}{(24)\ (60)} = 2.5 \text{ liters/minute}$$

3.3.1.3 Distribution

Whenever posible, the walking distance should be kept about 200 m one way depending upon the topography of the terrain. El Salvador is a rather hilly country where rural population lives mostly on top of the hills with a typical linear distribution along roads. Children and women use to carry the water to the house in plastic containers, "cantaros" of some 10 - 12 liters capacity People in one community visited by the team reported that as an average one of these "cantaros" provides the water required for one person per day. If that is so, the proposed 20-l/p/day would definitly represent an upgrading step in water availability for personal hygiene.

3.3.2 Operation and Maintenance.

The success of a hand pump water program depends primarily on the operation and maintenance of the pumps. According to a World Bank document * "the record of hand pump water supply programs is quite bad; failure rates of 30%-70% have been reported within two years after pump installation. Each time a system or hand pump breaks down, the villagers will seek water elsewhere, often from unsafe and polluted sources."

The governmental institution responsible for the rural water systems in El Salvador is PLANSABAR. It has been stated previously that PLANSABAR can't provide effective supervision and support to the water systems that are actually in opeation. Some of the more obvious problems are:

(.) Lack of vehicles.
(.) Lack of repair materials (PVC pipe, solvent, fittings, etc.)
(.) Lack of chemicals for disinfection.

The O& M practice is that once the system is built it is turned over to an Administrative Board of local villagers (Junta), that is responsible for billing and collection, and for O & M. PLANSABAR gives support with plumbers and electricians regionally based. PLANSABAR operations are basically financed by funds provided by the government, and these funds are not sufficient. The other source of funds are the water rates that usually are enough for gravity flow systems, but not enough for systems that need pumping and the use of electric power and have high maintenance costs. In order to reduce its operating costs PLANSABAR has adopted the following measures:

(*) World Bank Technical Paper Number 12
Watter Supply and Sanitation Project Preparation Handbook

(.) Only systems whose water source doesn't need treatment are built.

(.) For systems that require pumping, only those large enough to pay for the operating costs are built.

(.) Presently, the payment of the pump operator, (that is paid by PLANSABAR) is being transferred to the "Junta".

From the previous comments there are two basic conclusions:

(a) The community participation in O & M is a usual practice in El Salvador.

(b) PLANSABAR is in a difficult position to give adequate support to the rural systems that have been built up to now.

Based on these two conclusions, the O & M scheme proposed will rely on the community for local activities and on the P.V.O. for regional support, adopting a three tiers system.

At village level the villagers will be responsible for administration and maintenance through a local Junta similar to the adopted by PLANSABAR. A caretaker will be selected and trained to operate and maintain the hand pump. The caretaker training wil encompass how the pump is built and how it operates, trouble shooting check list and the simplest rules for coping with drainage problems. As part of his training the caretaker will learn about the waterborne diseases, the need for drainage and the need for hygenic habits. The caretakes will be provided with tools and a kit of spare parts.

At regional level there will be a regional support office with a spare parts warehouse, and technicians to make repairs with which the village cannot cope. The regional office technicians will also visit the installations periodically to check on routine maintenance and operation and see whether the installation is in good repair. Also at the regional level should be established an organization that will be formed by representatives from the local Juntas to

work as a means of feedback for the PVO, and to serve as a nucleus for regional O & M cooperatives that could take charge of the O & M when the project is finished, with a minimum suport from PLANSABAR.

At the third level, the PVO central office will be responsible for establishing policies and supervising and implementing the overall program, budgeting, bulk purchase and supply of materials and training of second level personnel.

In order to develop the outlined scheme an agency with experience in this field should be contracted. Among its duties there will be the development of a Management Information System, O & M procedures and manuals, development of training material and the training of trainers for O & M.

3.4 Project Preliminary Design

3.4.1 Wells

Local public institutions and private companies have a great experience in drill medium depth wells using the jetted systems. The capacity of public institutions to assume additional responsabilities for drilling small wells is almost nil. The team suggests that the project would be implemented through private contractors.

These are five private companies with an actual capacity for drill and finish some 24 medium depth wells with the equipment they have now in operation, mostly for 150 mm in diameters wells. The team feels that such output could be increased on a project basis and reach an end product of some 50 finished wells per year per each of the five private companies using the existing capacity:

(50 wells) (5 companies) = 250 wells/year

to increase even more the capacity for drilled well development, it could be necessary to include in the project ffunds for the adquisition of one extra drilling equipment for each company for the second year of the project. With this criteria, the total capacity could be increased as follows:

First year	Second year	Third year
5 existing rigs End product: 250 wells	5 existing rigs 5 new rigs End product: 500 wells.	10 rigs End product: 500 wells
Comulative end product: 250 wells	750 wells	1250 wells

Based on local experience, the average estimated cost for a well runs between 3.000 and 6.000 dollars wich include cassing and well point.

Which includes a PVC cassing of 100 mm and well point of 50 mm. For budget estimations the team assume a general cost of 5,000 dollars for construction of one well. So, this item would represent a total cost of US 6,250.000 dollars.

The amount needed to purchase five now drill rigs, mounted on small truck could be estimated in 40,000 dollar each, which gives a total capital investment of US 200,000 dollars.

3.4.2 Hand Pumps.

As stated previously, the team recommend the use of the USAID hand pump both for, shallow and medium depth wells. Is has a variety of advantages among which is the possibility of local production of some pumps needed for the third - year of the project.

The estimated cost for such pump is 1,100 dollars which gives a total of US 1.375,000 dollars for the three years project. It would be necessary to import some 750 pumps to cover the needs for the first and second year of the project while trying to develop a local capacity for incountry manufacture of the other 500.

Detailed especifications would be writing for well constructions, capping and protection against contamination. All wells need to be sanitary sealed water tight and hamp pump mounted on a protrude above ground level with gentle slope from the pump to de drainage spill water sookaway.

3.4.3 New Wells Desinfection

All new wells after field testing and before be operative should be disinfected with a hypochorite solution. The most easily obtainable and safest desinfectants are chlorine compounds. Calcium hypochlorite, 70% strengh is recommended for a solution of 0.2 % chlorine in 25 liters of water using 7 ml of HTH; put the mixture down the well, then operate the pump until the water smells of chlorine; wait one hour before pumping again; repeat the procedure and wait 12 hours and then pump water until it does not smell chlorine.

The amount of HTH needed for inicial desinfection of 1250 wells could be estimated in 32 kg. with a cost of US 500.

3.4.4 Water Quality

The most important parameter of drinking water quality is the bacteriological quality. Water samples are examined for a especif type of bacteria that originates from human and animal excreta whose presence is indicative of faecal contaminations. Faecal bacteria are members of the wide spread coliform group. Suitable indicator are those known as Escherichia-coli (E.coli) and faecal streptococci. In almost all small community drinking water sources faecal bacteria are likely to be found being pointless to conden all supplies because that. Water should be examined for faecal pollution using appropiate guidelines to assess the suitability of water source. Project Agua del Pueblo has proposed a maximum permissible level of 6 coliform/100/for rural water supply in Guatemala which could also be applied in El Salvador. Project HOPE in El Salvador is reporting their results using this criteria. Testing for faecal contamination could be carried out twice a year.

As for the chemical and phisical characteristics a yearly sampling could be conducted looking for the principal parameters suggested by the latest would Health Organization Criteria.

3.5 Community Participation, Health Education and Training

Community participation in a project of handpumps installations is considered to be escential. Analysis of aboundant existing data shows that the participation in the early design stages greatly contributes to the general success of the project. If the installations are not accepted and supported by the community they are likely to be misused. Community people can be motivated to help in the planning; construction and the operation and maintenance of the pumps. The most important community participation for the proposed project would be on the performance of operation and maintenance responsabilities delegated to them. Primary responsability for the continuous operation of a hand pump lies with community, at local level, backed by regional and national levels. At - least one caretaker (operadores) should be trained not only to better care and up keep of the pump, but also may help stimulate activities like health education personal hygiene and adequate water use. For the whole project 1250 caretakers will need to be trained at the following schedule.

o First year	250
o Second year	500
o Third year	500

This task will require a carefull planning and, probably, the training of - trainers and allocation of funds for support activities.

At this stage, the team estimates that some US 300,000 will be needed for those workshops to 1250 pump operator and about 15 regional supervisors.

The team recommens that a training specialist assists the design of the courses, contents, materials needed and so on.

The knowledge of the equipment installed is a garantee for a good O and M routine, the people selected as caretakers of the pumps must participate at least in the final stages of construction to become familiar with the system. Also is important

to prepare an inventory of the components of the equipment installed; this can be achived by using a card for recording details of the shallow or medium deph and its subsequent history of maintenance. An example of such card is given in the next page.

Health education may be an important part of the community motivation. A - user's education programme can be started as early as possible during the construction, on personal, household and public hygiene and other selected health aspects.

At community level its necessary to have tools and a stock of spare parts for maintenance, like leather pistons, washers and other parts suggested by the - manufacturer.

At regional level will also be necessary to have sprare parts, tools, adecuate movil equipment like a pick-up all terrain and a equiped workshop.

The cost of this item could run about US 15.000 each, that is an estimation of US 225.000 for 15 regional units.

SAMPLE EQUIPMENT HISTORY CARD FOR A SHALLOW WELL

FRONT OF CARD

District: Name of Village:

Date of Installation: Location of Well:

Well Identification No.: Number of Users:

Water Quality Laboratory Reference Number and Date of Sample:

Location of Hand Pump Spare Parts List:

Technical Data:

A. Well

1. Hand Dug/Mechanically Dug
2. Inner Well Diameter: m
3. Depth of Well: m
4. verage Wet Season Depth of Water: m
5. Average Dry Season Depth of Water: m

B. Hand Pump

1. Name:
2. Type:
3. Serial No.:
4. Cylinder Diameter: mm.
5. Depth of Cylinder: m.

REVERSE OF CARD

Date	Work carried out	Record of Maintenance/Repair		Cost	Signature
		Materials, Spares, etc., used	Time taken for work		

3.6 Cost Summary

The following table contains a summary of installation of hand pumps component; it cost and the phases for implementation.

On the cost effectiveness analysis it could be considere that:

a) Population be served

(30 families) (6 per/fam) = 180 persons/pump

(180) (1250) = 225.000 inhabitants

b) Unite Cost

$$\frac{9.804.600}{225.000} = 43.58 \text{ USD}$$

COST PROJECT IMPLEMENTATION

1986 (February 19)

COMPONENT	1st. Year		2d. year		3d. year		TOTAL	
	Quantity	USD	Quantity	USD	Quantity	USD	Quantity	USD
. Well construction	250	1.250.000	500	2.500.000	500	2.500.000	1250	6.250.0
. Purchase Drill Rigs	5	40.000					5	40.0
. USAID Hand Pumps Importation	250	275.000	500	550.000			750	8. .0
. USAID Hand Pumps Local Manufact.					500	550.000	500	550.0
. New Well Desinfection, HTH, Kg.	6	100	13	200	13	200	32	5
. Training Pump Operators	250	50.000	500	100.000	500	100.000	1250	250.0
. Training of trainers	15	30.000					15	30.0
. Regional O & M Warehouses	5	75.000	5	75.000	5	75.000	15.	225.0
UB-TOTALS		1.720.100		3.225.200		3.225.200		8.170.5
. 20% contingencies		344.020		645.040		645.040		1.634.1
OTAL ESTIMATED COST		2.064.120		3.870.240		3.870.240		9.804.6

Population Served - 225.000

unit Cost = $\frac{9.804.600}{225.000}$ = 43.58 USD

Chapter 4

PROJECT IMPLEMENTATION

As was stated previously there are two sub-projects to be implemented: hand pump sub-project and technical assistance sub-project, that can be implemented separately. The first one aims at the adoption of a technological option to supply water to the very small communities in the rural area that cant' be economically supplied by a water system, or that have a low priority and could not be incorporated in the ongoing projects in the immediate future, and the periurban settlements in cities where it is no feasible to extend the distribution network to incorporate these urban poor customers. The second sub-project is directed to the institutions (ANDA and PLANSABAR) responsible for the development of water supply and sanitary sewer projects in the urban area (system improvements to incorporate periurban settlements) and rural water systems and delineates some measures to speed up the design and construction work. In the following sections the two sub-projects are discussed separately.

4.1 Hand Pump Subproject Implementation

This subproject is divided into two phases: the first one, to be implemented in the short term, will use the existing installed capacity for well drilling in areas with well known groundwater resources and where the need for water supply can't be answered by other means. This first phase will involve the special studies to asses the applicability of hand pumps in areas where there is little information about groundwater occurrence; will recommend the need to expand the well drilling capacity of local contractors by means of the financing of the purchase of small well drilling rigs; will asses the feasibility of manufacturing locally the hand pumps; and will asses the adequacy or the procedures

used to promote and organize the community and to operate and maintain the wells and the pumps. The second phase, to be designed based on the results of the first one will comrpise the expansion of the sub-project to other areas and whatever is required to increase the capability to drill or excavate the wells and to produce the hand pumps.

4.1.1 Hand pumps sub-project breakdown structure

In order to develop the hand pump sub-project the activities necessary to do the work have been grouped as follows:

A. Project Unit Establishment
   - A-1. Project Agreement with PVO
   - A-2. Funds Allocation to PVO
   - A-3. Interinstitutional Agreement
   - A-4. Project Unit Staffing

B. Community Participation
   - B-1. Selection of area and eligible communities
   - B-2. Communities promotion and organization (1st phase)
   - B-3. Communities O & M training and health education (1st phase)

C. Engineering and Special Studies
   - C-1. Field studies of the selected area (hydrogeology)
   - C-2. Design and specifications of wells and pumps
   - C-3. Design of community participation campaign
   - C-4. Training material for Operation and Maintenance
   - C-5. Bidding documents for well drilling contracting and materials purchasing
   - C-6. First phase evaluation and second phase design
   - C-7. Evaluation of local hand pump fabrication capacity
   - C-8. Operation and Maintenance organization design
   - C-9. Purchasing Operation and Maintenance equipment and materials
   - C-10. Operation and Maintenance unit staffing

D. Physical Execution (First Phase)
   D-1. Well drilling contracting
   D-2. Construction materials purchasing (screens, casing, hp)
   D-3. Well drilling and hand pump installation (FP)
   D-4. Hand pump operation and maintenance commissioning

E. Second Phase Community Participation
   E-1. Selection of areas and eligible communities
   E-2. Communities promotion and organization
   E-3. Communities O & M Training and Health Education

F. Second Phase Physical Execution
   F-1. Well drilling rigs purchasing
   F-2. Local fabrication of hand pumps and well screens
   F-3. Second phase well drilling and hand pump installation
   F-4. Hand pump operation and maintenance commissioning

4.1.2 Project Unit Organization

Figure 4-1 shows an organization chart for the proposed Project Unit. At the first level are the PVO and AID; the former is responsible for project implementation, and has among its duties the administrative and financial functions to support the project manager's efforts, functions that are shared with other PVO projects and are not specifically dedicated to the hand pump sub-project. In this same level is shown AID, that will provide the funding for the sub-project and will give overall direction and follow-up of sub-project implementation by the PVO. In the next level are shown the Project Manager who is responsible for directing, organizing, planning and controlling the project execution, and

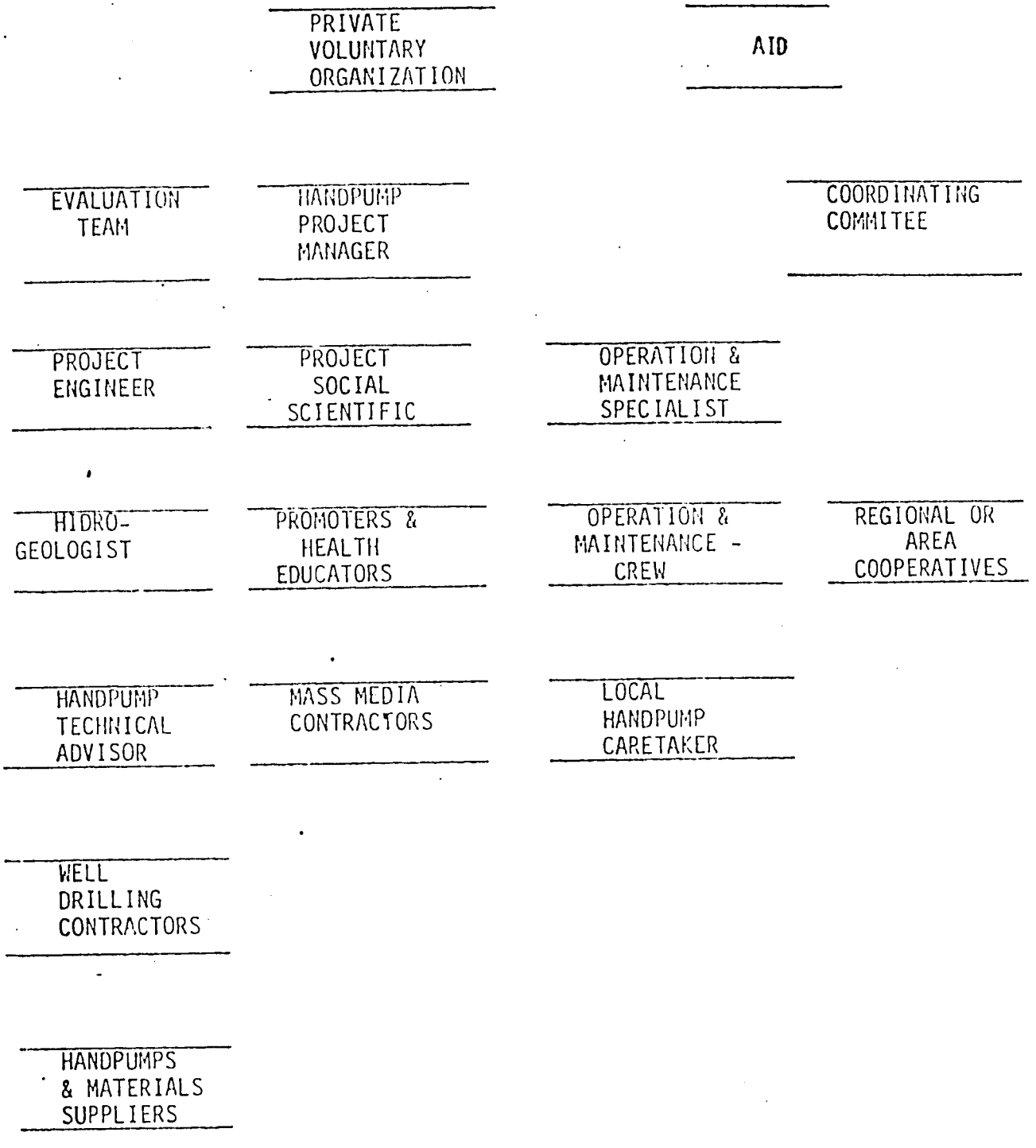

FIGURE 1

ORGANIZATION CHART FOR
PROJECT EXECUTING UNIT

The Coordinating Committee. In this committee will be represented both ANDA and PLANSABAR, DIDECO, AID, and the PVO. Its function is to give guidance to the Project Manager to avoid conflicts with ongoing projects in the sub-project area, to provide standards for the sub-project execution, and to be informed of the sub-project development. This last aspect is of utmost importance, since at the completion of the project the O & M of the installed hand pumps will be turned over to ANDA and PLANSABAR.

Bellow the Project Manager are three functional department heads, for Engineering, Community Participation and Operation and Maintenance; the particular role of each of this functional subdivision is discussed in the following paragraphs.

Engineering. A sanitary engineer will be in charge of this function, with the collaboration of ahydrogeologist. This function will be responsible for:

- Developing technical criteria for community selection.
- Field studies to select communities and to select well location.
- Formulation of design of wells, and specifications for drilling or excavation.
- Bidding document preparation for purchasing of construction materials (screens, casing, hand pumps) and well drilling.
- Supervision of well drilling and hand pump installation
- Liaison between the hand pump technical advisor and the PVO.

The hand pump technical adviser should be some institution, like the Georgia Institute of Technology, with ample experience in this field, to help in the selection of the hand pump, participate in the preparation of O & M manuals and

in the training of the personnel at regional and community levels, and advise in the operation and maintenance system organization and implementation. Also will be responsible for the evaluation of local capabilities for hand pump manufacturing.

The hydrogeologist should be a local professional with good knowledge of the geology in the project area, and could be contracted on a consulting or retainer basis.

All the well drilling should be done by local contractors. The construction materials acquisition should be done by international purchasing by the PVO.

Community Participation

The head of this function will be a social sciences professional, supported by the field promoters and health educators. It's responsbilitieis will be:

- Developing socio-economic criteria for community selection.
- Developing training material, and doing in-service training for the field promoters.
- Field studies to select communities from a socio-economic viewpoint.
- Project promotion with the selected communities.
- Communities' organization for participation during construction and for operation and maintenance.
- Health education campaign design for the project area.
- Supervision of the health education and community participation campaign developed by mass media contractors.
- Field studies to evaluate project impact, baseline study and annual evaluations.

The community participation and health education campaign will be developed by the promoters and health educators at the local level, supported by messages through mass media contractors working in the project area.

Operation and Maintenance

This function will be headed by a specialist in the O & M of rural water systems, who will be the supervisor of the O & M Maintenance crews that will work at a regional level, giving supervision and support to the local operators. Its main responsibilities will be:

- Formulation of O & M training material.
- Developing training sessions for the personnel at regional and local levels.
- Bidding document preparation for purchasing of vehicles, equipment, tools and spare parts for hand pump maintenance.
- Operation and Maintenance organizational design.
- Planning ans scheduling preventive maintenance activities.
- Supervision of preventive maintenance done by local operators and execution of corrective maintenance that can't be done at the local level.
- Hand pump operation and maintenance commissioning to the local institution at the end of the h.p. sub-project.

First Phase Project Evaluation and Second Phase Project Design

Before the end of the first phase, a team from an outside organization like WASH, will be charged with the task of evaluating the project first phase, and with designing the second one, so both will overlpa.

During the second phase planning several decisions will be made concerning:

. Expansion of the project to new areas.
. Local fabrication of well screens and hand pumps.
. Need to increase the well drilling contractors by means of the acquisition of new well drilling rigs of a small size that can be easily transported through narrow dirt roads.

Based on the previous decisions the second phase of the project will be launched. For this report preparation it was assumed that the project will continue, that the well driller contractors will need extra equipment, of a lighter weight to move easily in the rural roads, and that the hand pumps will be locally manufactures, so the second phase was scheduled and costed with these basic assumptions.

4.1.3 Institutional Arrangements

As can be seen from the previous discussions, there exists the need to agree and institute the following aspects.

PVO Selection and Contracting

Even though a PVO that could manage the project was identified (HOPE PROJECT), there exists the possibility that another more suitable one exists, some time should be allocated to make a final decision and some time is required to negotiate, approve and sign the cooperative agreement between the PVO and AID.

Coordinating Committee Creation Agreement

In order to make sure that the project will not conflict with ongoing efforts, that the communities selection will be in the most needed areas, that the standards used are applicable, and that the eventual difficulties encountered in the project execution are readily solved, it is proposed

that a Coordinating or Steering Committee be created, with representation of the relevant national and international agencies. The Coordinating Committee will meet at least semi-annually to formulate policies, review progress and serve as the official spokesman of the project. The Committee will initially include representatives of the following institutions:

- ANDA
- PLANSABAR
- Pan American Health Organization
- Community Development Division of the Ministry of the Interior
- U.S. AID
- National Committe of the Displaced Persons (CONADES)

Technical Assistance in hand pump technology

As the use of hand pumps in a widspread fashion has not been practiced in El Salvador, it seems that an institution with ample experience in this field, like the Georgia Institute of Technology should be contracted to assist in the project execution.

4.1.4 Project Scheduling

Table 4-1 delineates the timing of the activities listed in Section 4.1.1 divided into three main time slices. The first one is a six month period to start the project; the second one is a twelve month period, in this period the first phase of the project will be developed using existing capabilities and importing the required goods. The third one is a two-year period; during this period the hand pump fabrication will be started (providing half of the required pumps) and 80% of the hand pumps will be installed.

TABLE 4-1

IMPLEMENTATION SCHEDULE

PROJECT START-UP March-August 1986	PROJECT FIRST PHASE September 1986 to August 1987	PROJECT SECOND PHASE September 1987 to August 1989
.1 - Project Agreement with PVO	B.2 - Communities promotion and organization	E.2 - Communities promotion and organization
.2 - Funds Allocation to PVO	B.3 - Communities O & M training and health education	E.3 - Communities O & M training and health education
.. - Interinstitutional Agreement	C.6 - First phase evaluation and second phase design	F.3 - Well drilling and hand pump installation
.1 - Selection of Area andeligible communities (ph 1)	C.7 - Evaluation of local hand pump fabrication capacity	F.4 - Hand pump O & M commissioning
.1 - Field studies of the selected areas	D.3 - Well drilling and hand pump installation	F.5 - Local fabrication of hand pumps
.2 - Design and specification of wells and pumps	D.4 - Hand pump O & M commissioning	
.3 - Design of community participation campaign	E.1 - Selection of Areas and eligible Communities (ph 2)	
.4 - Training material for O & M	F.1 - Well drilling rigs purchasing	
.5 - Bidding Documents for well drilling contracting and materials purchasing	F.2 - Local fabrication of hand pumps	
.6 - O & M organization design		
.9 - O & M materials purchasing		
.10- O & M unit staffing		
.1 - Well drilling contrcting		
.2 - Construction materials purchasing		

4.2 Technical Assitance Subproject Implementation

As was stated earlier AID has funded, through ORE, the construction of water distribution network extensions in several urban areas in order to provide service to periurban settlements. The managing of this effort is being done by a private consulting firm, acting as a coordinating unit, and the design and construction of the works is being done by private local consultants and contractors.

ORE is also financing the construction of rural water systems to be designed and supervised during construction by PLANSABAR. The design and construction supervision is being done by PLANSABAR regular staff, as this staff is also responsible for the design and construction of systems financed by BID and by the Government regular programs there is a conflict in priority assignment and the design work has been delayed. The delays become larger because PLANSABAR faces gasoline shortage and workers strikes that slows down the design production.

In order to speed up the design work ORE has contracted with local consultants the design of some systems that PLANSABAR has not been able to finish (the field work was finished but not the design work and drawings).

According to PLANSABAR, all the ORE funds would be committed with ten more water systems.

The Technical Assistance subproject consists in financing, through ORE, the design of ten rural water system with an estimated cost of ₡100,000, a work that should be done in a six months period.

According with data provided by PLANSABAR, they have at present 10 uncompleted designs on the ORE/USAID line that could require an additional funding estimated in US 20.000 to get them completed in a six months period..

Due to the shortage of time the team was not able to revise all the unfinish and waiting list design projects. On the other hand, the team was not provided with a record of existing small communities, by department, and their water - supply situation.

Nevertheless, the team feels that PLANSABAR could prepare sets of eight projects each and contract the designs with qualified private consultant firms. Ten of these packages could be released per year at an average cost of 24.000 dollars each. The total technical assistance for this item would be US 240.000 per year. To achieve better results the team suggest the USAID provide four weeks technical assistance of one sanitary engineer to help PLANSABAR to identify and prioritize communities which do not have water systems or they need to be improved. This T.A. could provide PLANSABAR with the opportunity to match USAID desire to speed it up the preparation of projects to be implemented.

Furthermore, the team suggest that the construction supervision works be contracted with private consultant firms. At this stage the team do not have basis to estimate cost of that part of the component. As a result of the analysis, the technical assistance to PLANSABAR component could be sumarized as follow:

o Technical assistance to complete design of 10 systems March-July 1986	USD	10.000
o Four-weeks of sanitary engineer to help identifying and prioritising rural projects		8.000
o Design of 80 new projects through private consultants July 1986-June 1987		240.000
o Design of 80 projects through private consultants. July 1987-1988		240.000

- Six weeks of sanitary engineer to evaluate progress and design strategies for implementation and supervision activities 1987 — 12.000

REFERENCES

1. Solicitud de Préstamo al Banco Interamericano de Desarrollo (BID) para el financiamiento del Programa de Agua Potable Rural, Tercera Etapa. Volúmenes I and II, prepared by PLANSABAR.

2. "Situación y Proyecciones del Abastecimiento de Agua Potable y Disposición de Excretas en Areas Periurbanas y Rurales de El Salvador". Ing. Valter Pedrosa de Amarin: Asesor de Saneamiento de la OPS/OMS.

3. "Memoria de Labores 1984". Administración Nacional de Acueductos y Alcantarillados.

4. Environmental Sanitation Program for the Displaced Persons Camps and Cooperatives, El Salvador". Clemens Associates for Project Hope. Sept. Oct 1985

5. Primer Seminario Taller Abastecimiento de Agua Potable y Saneamiento en Areas Urbanas Marginales Conclusiones, Recomendaciones, Memoria Patrocinado por ANDA y OPS/OMS. Coniapos 16-20 Diciembre 1985.

6. Village Technology Handbook
Department of State- Agency for International Development Communication Resources Division. Washington D.C. 20523.

7. Implementacion al Proyecto Santa Elena
MFM- Ecuador- WASH Informe de Campo No. 59
Diciembre 1982.

8. Diagnóstico y Plan de Trabajo para la Construcción de Pozos e instalación de Bombas Manuales para Agua en Honduras. WASH. Informe de Campo No. 81. Junio 1983.

9. Appropiate Technology for Rural Water Supply and Sanitation in El Salvador. A brief review and Bibliography. WASH Field report No. 26. Sept. 1981.

10. Feasibility of Rural Ground Water Development in Honduras. WASH Field Report No. 65. December 1982.

11. Training of Trainers Workshop for Handpump Installation and Maintenance in Sri Lanka.
February 12-26, 1984. WASH Fiel Report No. 122.
April 1984

12. Philippine Hand Pump Program (Barangay Water Program) WASH Fiel Report No. 54. August 1982.

13. Operation and Maintenance of Small Water Supply Systems. Per Engebak. a Unicef Presentation at American Water Works Association (AWWA) Annual Conference in Washington. D.C. June 1985

14. Guidelines for Planning Community Participation in Water Supply and Sanitation Projects.
Dr. Anne Whyte. Institute for Environmental Studies University of Toronto.

15. Water Supply and Sanitation Project Preparation Handbook. Volume 1. Guidelines. Brian Grover. The World Bank. Washington D.C. USA.

16. Small Water Supplies. Sandy Cairncross, Richard Feachem. The Ross - Institute Information and Advisory Service. January 1978.

17. India Mark II Deepwell Hand Pump Installation and Maintenance Manual Richard Sun & Cruddas. (1972) LTD. 23, Rajajú Salai, Madras. 600-001

18. Almanaque Salvadoreño 84. Centro de Desarrollo de los Recursos Naturales. División de Meteorología e Hidrología. Servicio Meteorológico-Ministerio de Agricultura y Ganadería. República de El Salvador. C.A.

19. Preventive Maintenance of Rural Water Supplies WHO/CWS/ETS/84.11 - World Health Organization.

20. Visita de Planificación para un Taller de Captación de Lluvia, Informe Interino WASH No. 178-1. Septiembre 1985.

21. Bombas de Mano. F. Eugene McJunkin. Documento Técnico No. 10. Julio 1977. Centro Internacional de Referencia para Abastecimiento Público de Agua. P.O. Box, 140,2260 Ac. Leidschendan, Paises Bajos.

22. Small Community Water Supplies
Technology for Small Water Supply Systems in Developing Countries.
Edited by E.H. Huflees
International Reference Centre for Community Water Supply and Sanitation and John Wiky & Sons.

23. International Workshop on hand pumps for water supply. A report on the International Workshop held in Voorburg, The Netherlands, 12-16 July - 1976. WHO International Reference Centre for Community Water Supply - N.W. Havenstroat 6, Voorburg (The Hagve) The Netherlands.

24. Operation and Maintenance of Rural Drinking Water and Latrine Programs in Honduras. WASH Field Report No. 129. September 1984.

25. Technical Notes "Water for the World" The Development Information Centre.
Agency for International Development
Washington D.C. 20523 USA.

ANNEX "A"

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ANEXO B

ANNEX "B"

ACRONYMS

ANDA	Administración Nacional de Acueductos y Alcantarillados.
PLANSABAR	Plan Nacional de Saneamiento Básico Rural
MSPYAS	Ministerio de Salud Pública y Asistencia Social
BID	Banco Interamericano de Desarrollo
OPS/OMS	Organización Panamericana de la Salud/ Organización Mundial de la Salud
DIDECO	Dirección de Desarrollo Comunal Ministerio del Interior
ORE	Oficina de Recursos Especiales
UDI	Unidad de Desarrollo de la Infraestructura
P.V.O	Private Vluntary Organization
DIAAPS	Decenio Internacional de Abastecimiento de Agua y Saneamiento.
WASH	Water and Sanitation for Health Project
PNUD	Programa de las Naciones Unidas para el Desarrollo
PMA	Programa Mundial de Alimentos