WATER AND SANITATION
FOR HEALTH PROJECT

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EVALUATION OF THE TECHNICAL AND COMMUNITY PARTICIPATION APPROACH OF CARE ASSISTED RURAL WATER SUPPLY PROJECTS IN INDONESIA

WASH FIELD REPORT NO. 107

FEBRUARY 1984

Prepared for:
USAID Mission to the Republic of Indonesia
Order of Technical Direction No. 155

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EXECUTIVE SUMMARY

USAID has assisted CARE in implementing rural water projects in Java, Bali, and Nasa Tanggara Barat (NTB) in Indonesia for over three years. The projects include gravity water systems and handpump programs. A request was made to the Water and Sanitation for Health (WASH) Project in early 1982 to assist CARE in developing a technical evaluation form and community acceptance evaluation methodology for these projects. An initial visit by a WASH consultant resulted in the development of evaluation tools and a schedule of evaluation activities. CARE implemented the technical evaluation and produced a document for use by the evaluation team.

The evaluation team composed of a sanitary engineer, a social anthropologist from Indonesia, a representative from the Ministry of Health, and regional planning agency representatives visited projects in each of the provinces where USAID assisted CARE in rural water supply projects. Three to four days were spent reviewing these projects and interviewing users, CARE field officers, and provincial government officials.

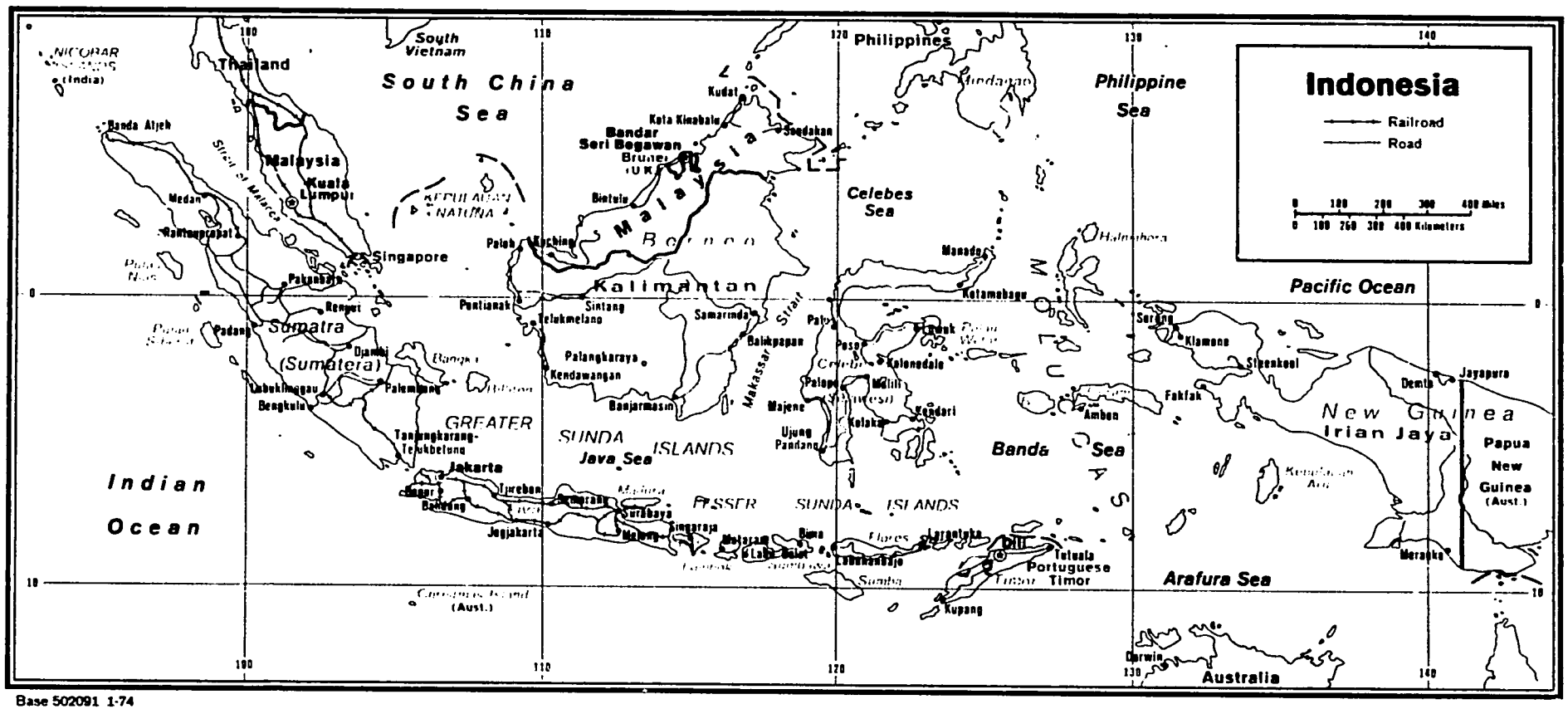
The technical quality of USAID/CARE assisted projects was found to be high. The ability of these projects to deliver adequate safe drinking water to rural communities was viewed as exemplary. The planning, designing, construction, and operation of these systems were integrated into community functions and activities through the effort of the CARE field officers. The technical, sociological and organizational skills of the field officers were judged to be high and accounted for the success of these projects. Handpump programs were equally successful with most of the 1,000 pumps still functioning. The handpump repair program implemented by CARE appears to be a significant factor in the ongoing use of these pumps. The total per capita cost of eight gravity systems in NTB ranged from $18 to $32. These per capita costs represent an excellent investment considering the longevity of these systems.

The role of the CARE field officers in the implementation of these projects was found to be critical to the success of the project. Essentially all of the CARE field officers were actively involved in the implementation of the projects. There appeared to be a strong bond between the CARE field officers and the community members. There was no question as to the ownership of the water projects; it was a community water supply, not a CARE project or a USAID project.

CARE should continue to receive USAID assistance in implementing rural water supply projects. CARE should transfer their techniques and methodologies to other PVO and Government of Indonesia agencies involved in water supply. It is recommended that this transfer of information take the form of media preparation (workbooks and manuals), workshops, and site visits for PVO and GOI development professionals. CARE can play an important role in the water decade in Indonesia by transferring their experiences and approaches to other organizations.

This report contains recommendations regarding the uses of data from this evaluation; the development, packaging, and dissemination of information on techniques for community water supply projects and community participation in their development, operation, and maintenance; curriculum development and

training in water supply for sanitarians and other relevant community workers; standardized procedures and designs for gravity fed and handpump systems; social and hydroclimatological studies; future evaluations; coordination of efforts among the many entities working in community water supply in Indonesia; pump development; and the use of the CARE project as a teaching model and as a model for replication throughout Indonesia.



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Chapter 1

INTRODUCTION

1.1 CARE Indonesia

CARE has completed its 16th year in Indonesia. During the first ten years its programs dealt principally with food assistance in West Java, Central Java, and Jakarta, Medico programs in Central Java and Jakarta, and School Construction in West Java. In 1977 CARE began programs in disaster relief and rehabilitation in Bali and Nasa Tanggara Barat (NTB) and in 1978 introduced a community development program in four provinces of Sulawesi. With the Bali office programmed to close this year and with the addition of East Java, the total provincial involvement will number seven.

Beginning in 1978 CARE entered into a six year agreement with the Ministry of Home Affairs which focused CARE activities on rural development and area development. These programs were designed to provide assistance at the village level for those considered "most needy". At the present time the emphasis of CARE's programming is on the provision of rural drinking water supply through the construction and/or installation of piped water systems, shallow and deep well handpumps, bathhouses and drainage, rain water catchment tanks, filtered surface water systems, hydraulic rams, and public toilets and latrines. Other programming on a smaller scale includes school construction, small rural feeder roads, agricultural activities (lamtoro), animal husbandry, and health and nutrition assistance.

To insure the success of its projects, CARE relies heavily on community participation and local government involvement in its programs and projects. This community involvement can be found in all phases of a project-- planning, implementation, maintenance, and management. CARE has successfully demonstrated user acceptance and management of its systems by involving the community in all phases of a project.

1.2 GOI Water Supply Program: National Level

Indonesia has many direct-financed, co-financed and non-governmental (NGO) water supply projects in the country. Water supply activities of one type or another can be found in almost all of the ministries of the government. Poorly defined areas of responsibility in the urban, rural, and suburban areas coupled with multi-faceted donor and government programs result in considerable overlap and inefficiency. The sphere of influence for the planning and implementation of water supplies is divided between the Ministry of Public Works (Cipta Karya), urban areas, and the Ministry of Health for rural areas. These areas are not easily defined, especially around the fringes of highly developed urban areas. The national government implements its policies and programs in water supply both directly and indirectly through these various governmental and political units. Indonesia is divided into regional areas called provinces and each province is further divided into intermediate units of municipalities (Kotas) which are usually large regional

cities of marketing and mercantile importance. The districts (Kabupatens) are further divided into sub-districts (Ketjamatens). Villages found in the district and sub-districts are called Desa which can be made up of several units of population referred to as Dukuhane or hamlets. These small jurisdictional units vary in population from a thousand to five thousand.

Provincial governments maintain a degree of independent control and self-government in areas of health, agriculture, fisheries, labor, welfare and employment, and veterinary services. The sub-district (Ketjamaten) is the lowest level in which central government officials function.

Municipal water supplies are planned and implemented by Public Works representatives. The ministry, Cipta Karyu, and its representatives are found at the Kota level. Most of the large cities in Indonesia are at present upgrading and rehabilitating existing water systems as Cipta Karya projects. Many urban fringe communities also fall into the present sphere of influence. Quite often these fringe communities are small in size and have the social, cultural, and economic characteristics of rural communities. These projects are planned and implemented by KKD projects.

The Ministry of Health has prime responsibility for rural water supply and sanitation. A special priority project decreed by the President is coordinated through the Sanitation and Water Supply Section of the Ministry of Health. This project, referred to as INPRES, is directed specifically at the Desa level and lower. Bi-lateral and multi-lateral funds are also used in the implementation of these projects. Gravity systems, filtered surface water, rain-catchment, and handpump projects are INPRES type projects.

Most water supply projects are coordinated directly through the national and regional planning agencies, BAPPENAS and BAPPEDA. CARE has worked through these agencies the last seven years as they have moved into the water supply sector of rural development. These planning agencies have several types of rural water supply development activities of which the CARE assisted program is one. CARE initiates these activities at the provincial level based upon direction from BAPPEDA and requests from villages in the province.

Chapter 2

EVALUATION OF CARE/USAID ASSISTED WATER SUPPLY PROJECTS

2.1 CARE Activity

CARE/Indonesia has been actively involved in its water project evaluation for over one year. Initial discussions within CARE and with USAID suggested that a comprehensive technical evaluation could be useful in future CARE program activities and could be utilized by NGO's and organizations operating in the rural water supply sector in Indonesia. In the summer of 1982 considerable discussion was directed toward the measurement of socio-economic and health impacts of the rural water projects. These discussions continued for over six months as various interested parties attempted to develop an approach to measuring these factors. Since initial baseline data were not gathered in the project areas such as health status, income, time use, socio-culture status, etc., it was decided to minimize the evaluation of the social, cultural and economic impacts of those projects. Even though all parties felt that impact determination was of great value it was recognized that a reliable analysis would be almost impossible.

At the same time as discussions were being held with USAID, considerable effort was being made by field representatives, program officers, and field officers to develop questionnaires to be used in the technical evaluation of the rural water supply projects. Scott Faiia, Field Representative in NTB, coordinated and reviewed the development of these questionnaires (see Figure 1).

Figure 1. List of Questionnaires Developed By CARE/Indonesia for the Technical Inspection and Evaluation of Rural Water Supply Systems

1.	Piped Water Systems	8 pp	Form E-1
2.	Water Distribution Checklist	2 pp	Form E-2
3.	Rain Water Catchment	2 pp	Form E-4
4.	Pipeline Inspection Checklist	2 pp	Form E-5
5.	Checklist for Spring Protection	2 pp	Form E-6
6.	Reservoir Inspection Checklist		Form E-7
7.	Water Use Data		Form E-3

Other information used in the technical evaluation was collected directly from project completion reports, personal communication with individual staff members, and with specially designed data forms (operational status of pumps, water quality data, a generalized impact analysis).

2.2 Scope of Work of WASH Consultant

In late February and early March of 1983, a WASH consultant worked with CARE Indonesia to develop a scope of work which would meet both CARE's and USAID objectives. A draft scope of work was developed which separated the technical evaluaton of the elements of a rural water supply project from the project's evaluation relative to CARE's processes and its interaction within the Indonesian rural water supply framework. The technical evaluation was to be completed first by CARE staff prior to the institutional/community involvement evaluation. A scope of work for this evaluation was prepared by USAID/Indonesia and by USAID/WASH in coordination with CARE/Jakarta. The final phase of the evaluation was to be carried out by a team composed of in-country experts, CARE staff, and USAID personnel following the completion of CARE's technical evaluation. The following objectives were established for this final phase of the evaluation:

1. An assessment of the Government of Indonesia's perception of involvement and degree of familiarity with CARE water projects.

2. An assessment of the possibility of wide-scale replication and adoption of CARE's methods by GOI agencies and other NGO's.

3. Recommendations to CARE and, if appropriate, to the GOI concerning planning and future implementation of projects in the water sector.

2.3 Evaluation Team Activity

A team of evaluators composed of a USAID/WASH consultant, a rural sociologist/anthropologist, a representative of the Ministry of Health, various CARE staff members, and provincial GOI agencies visited CARE projects in three provinces. The specific site selection in each province was determined by type of water system, environmental setting, and accessability. The sites had not been specially prepared for nor had the community members been alerted to the visits. The sites were observed under more or less normal social and technical conditions. This unbiased observation was necessary in order to obtain a maximum of information from a technical and user standpoint.

Three and a half days were spent in West Java interviewing CARE staff and government officials and in the inspection of five gravity water systems and two pump projects. Mr. Wahyu from KESRA accompanied the team on the first day, and his representative accompanied the team for the remaining two days in West Java. Two village leaders were interviewed and approximately ten villagers from each project site were asked to respond to the questionnaire. Two village leaders were interviewed and approximately ten villagers from each project site were asked to respond to the questionnaire. Two students from Padjadjaran University in Bundung assisted in acquiring socio-economic information.

Approximately four days were spent in Bali, inspecting seven gravity water systems and a surface water filtration system. Three members of the provincial government, representing the regional planning agency and the rural development project, accompanied the team for three days.

An exit interview was held with the Director of Planning with all members of the evaluation team present. This meeting covered the team's preliminary findings as well as the future direction of CARE programs.

Five gravity systems, one hydraulic ram, and two pump systems (one shallow well and one deep well) were inspected in NTB-Lombok. A briefing conference was held with the chairman of the Provincial Planning Agency and members of his staff. One of the staff members accompanied the team to all sites during the visit. An exit interview was held with the head of the socio/culture section of the Provincial Planning Agency and a staff member who accompanied the team to the field.

In summary, the evaluation team felt that the government of Indonesia fully supported the evaluation efforts by allowing access to national and provincial level officials working in rural water supply development. The government also demonstrated an interest and commitment by allowing field staff members to accompany the team as they inspected CARE projects.

2.4 Development of Questionnaires for CARE Field Officers and Project Beneficiaries

For the purpose of USAID evaluation of CARE's water projects in Indonesia, two kinds of questionnaires were developed. The first set of questionnaires was directed at the activities of the CARE's field officers and the second set was directed at the community members of selected CARE water supply projects. The information requested from CARE's field officers is summarized in Figure 2.

Figure 2. Questionnaire for CARE Field Officers

I. Respondent's identification - information about CARE's field officer's background, education, ethnicity and current job activity.

II. Respondent's job description - including job activities, on the job training, and current job activity.

III. Respondent's project involvement and particular approach to community participation during and after CARE's project implementation.

A questionnaire directed to the beneficiaries of the project was developed to obtain user information and attitudes they have about water supply and sanitation (see Figure 3 below).

Figure 3. Questionnaire for Beneficiaries of Projects

I. Respondent's identity - giving information about respondent's background, education, and family size.

II. Respondent's socio-economic condition - information on concerning occupation, income, expenses, and ownership of land, house and household appliances.

III. Health and sanitation - the objective of this section was to get information concerning bathing habits, the physical condition of bathhouses and latrines, water sources for drinking and washing, and the incidence of any treatment methods and techniques.

IV. Community's responses - to learn respondent's perception of CARE's water project from the planning phase through the implementation phase. It is anticipated that these questions will reveal the community's level of participation in and acceptance of CARE water projects.

V. Water use, motivation initiative - information concerning water use, community organization, and monetary resources associated with the maintenance of CARE's water project.

2.5 Administering the Questionnaire

There are a total of ten CARE Field Officers in West Java and NTB, with no field officers at present assigned to Bali. Because there were only ten field officers, it was possible to interview all of them. In each village a sample of approximately ten heads of families was asked to participate in the socio/cultural interviews. The total number of users of CARE's water projects in Indonesia and all of the provinces visited is approximately 45,442 people. There are approximately seven people in an average Indonesian family. Thus, it can be said that the number of families benefitting from CARE projects is around 6,500. Due to limited time and resources, only about 2.5 percent of the population or about 170 heads of families were interviewed. The respondents were selected for interviews based upon the proximity of their house to the source of water (public tap, handpump, etc.)

The questionnaire in West Java was administered by the sociologist/anthropologist with the help of three CARE field officers. In Bali, the interview was conducted by two students from the Department of Anthropology, Udayana University, Bali. In NTB, the interview was conducted by four students majoring in the social sciences from Mataram University, Lombok. In Bali and Lombok, for every site visited, the evaluator conducted interviews with community leaders and other members of the community. All CARE Field Officers and students who assisted the evaluators, in field interviews were trained in how to implement the questionnaire as well as in interviewing techniques.

Chapter 3

FINDINGS: TECHNICAL ASPECTS OF CARE/USAID ASSISTED PROJECTS

3.1 Gravity Water Systems

A total of 73 gravity water systems has been implemented by CARE serving a total population of approximately 110,000 people. These systems have an average length of service of 14 months with a maximum length of service of 43 months. These systems have a total of 868 distribution points with an average use of 127 people per faucet. Fifty percent of the systems were delivering more than 60 liters/day/capita while seven percent delivered flows less than 20 liters/capita/day. On a water system basis, the faucet demand was considerable. Less than 40 percent of the systems have a 50 person/faucet demand while 78 percent of the sytems have less than 100 person/ faucet use. It was found that 34 percent of the systems experienced reduced flow in the dry season with 19 percent of the systems experiencing problems due to reduce flows. Sixty-two percent of the gravity systems were found to be fully functioning.

Twenty-seven percent of the systems were found to be partially functioning and 11 percent were found to be functioning minimally. Lack of water in the dry season and problems usually associated with differences between villages and/ or individuals at the source account for 60 to 64 percent of non-functioning and partially functioning systems.

CARE gravity flow water systems deliver a sufficient quantity of protected water to rural communities. The unit cost of these systems is well below the "standard" used in Indonesia. The community participation element of CARE water projects is a significant factor in the community acceptance and management of the project was well as a factor in the unit cost per capita.

A functioning system was defined by CARE staff to be a system in which more than 90 percent of the distribution points are operable and the total system has not been out of service for over a month altogether in the last year. A partially functioning system is one where less than 90 percent but more than 30 percent of the distribution points are operable and/or where service has been interrupted for more than one month over the preceeding year. A minimally functioning system is one in which less than 30 percent of the distribution points are operable and/or service has been interrupted for more than four months during the preceeding year.

A system's ability to provide water is measured in two ways in a rural setting: the number of persons per faucet and proximity of source to users. In 1983, CARE adopted a guideline of 100 persons/faucet. Only in exceptionally dry areas (Lombok, Timur and North Bali) did the number exceed 100 persons/ faucet. CARE also recently adopted a design guideline stating that a minimum

TABLE 1

SYSTEM CHARACTERISTICS AND TECHNICAL EVALUATION OF THOSE SITES VISITED IN WEST JAVA - BANDUNG

	Tagog Apu	Cikadut	Nagrak	Cibodas	Cinanggela	Cibeet
User Population	3750		2473	2250	2250	1400
Pipeline Length (m)	5760		6810	3950	3950	3250
Storage Volume (provided)	100		72	60	60	12/23
Storage Volume (function)	100		23	56	56	12
Percent	100		32	93	93	106
Distribution Points (provided)	15		18	15	15	29
Distribution Points (function)	15		10	14	14	29
Percent	100		56	93	93	106
Functioning Status	full		partial	partial	partial	full
Design flow (1/s)	3.2		3.0		8.5	2
Actual Flow (1/s)	3.2		2.8		3.9	4.5
Ratio (Design/Actual)	1.0		0.93		1.11	22
Persons per faucets	35		43		38	116
Additional Storage Advised	no		no		no	no
Per capita water availability	(1)		84		100	147
Material Cost	24704		28809		31788	7685
Per Capita Cost	7		12		14	5
Year Completed	6/83		11/80		7/81	3/82

TABLE 2

SYSTEM CHARACTERISTICS AND TECHNICAL EVALUATION
OF THOSE SITES VISITED IN BALI

	Tukad Semoga	Kayu Putih	Tujung	Suweng	Kuwun	Geliang	Karya Sari
User Population	1400	2000	3600	7600	400	1250	1175
Pipeline Length (m)	3760	11160	6330	9930	1770	2390	3720
Storage Volume (provided)	28.8	96.8	76.8	144	9.6	19.2	5.3
Storage Volume (function)	28.8	-	26.8	144	9.6	19.2	5.3
Percent	100	-	100	100	100	100	100
Distribution Points (provided)	13	39	10	22	8	10	8
Distribution Points (function)	13	-	10	22	8	10	8
Percent	100	-	100	100	100	100	100
Functioning Status	partial	partial	partial	full	full	partial	full
Design Flow (l/s)	2.0	2.7	1.8	3.0	0.3	0.5	2.0
Actual Flow (l/s)	1.6	2.8	1.35	3.0	0.25	0.25	1.7
Ratio (Design/Actual)	0.80	1.03	0.75	1.00	0.83	0.50	0.85
Persons per faucets	66	92	128	126	44	208	53
Additional Storage Advised	no	no	no	no	no	no	no
Per capita water availability	99	121	32	39	59	17	124
Material Cost	14973	27564	28660	48703	2175	8658	11318
Per capita cost	11	14	7	6	5	7	10
Year completed	2/82	8/80	8/80	9/82	5/82	8/80	2/82

TABLE 3

SYSTEM CHARACTERISTICS AND TECHNICAL EVALUATION OF THOSE SITES VISITED IN NASA TENGGARA BARAT (NTB) - LOMBOK

	Presak	Selat	Punikan	Tanjung	Klayu	Swela
User Population		2092	1221	1370	1219	11500
Pipeline Length (m)		3000	1750	1500	2000	22000
Storage Volume (provided)		66	84	-	49	354
Storage Volume (function)		66	84	-	49	354
Percent		100	100	-	100	100
Distribution Points (provided)		4	19	16	48	54
Distribution Points (function)		4	19	16	48	59*
Percent		100	100	100	100	100
Functioning Status		full	full	full	full	partial
Design Flow (1/s)		2.6	2.6	1.5	3.0	1.5
Actual Flow (1/s)		2.4	2.8	3.2	2.8	14.75
Ratio (Design/Actual)		0.92	1.08	2.14	0.93	0.98
Persons per faucets		48	20	86	22	32
Additional Storage Advised		no	no	yes	no	no
Per capita water availabiity		99	198	50	198	111
Material Cost		27385	16902	7666	16959	118763
Per capita cost		13	14	6	14	10
Year completed		8/82	3/83	8/81	4/83	12/82

* Villages added additional taps to bring total to 59.

of 80 percent of the targeted users should be within 100 meters of the distribution point. In ten of the systems surveyed, nearly all met the users, proximity to source criteria. This, coupled with field officers' and evaluators' observations, suggests that CARE design guidelines are found in most of the CARE water systems. Non-targeted beneficiaries in many areas travel considerably greater distances, though, to obtain water from a project source, suggesting a much greater need for water in such areas.

Gravity water systems are the principal types of systems utilized by CARE in developing rural water supplies. For planning purposes, a water supply of 60 liters/capita from a spring and within a reasonable distance of the users determines the feasibility of a gravity system.

Initial surveys are made prior to project site selection to determine if adequate flows are available to meet targeted population needs. In some cases, the available flow at these springs requires systems which do not meet the minimum per capita supply. In other cases, system extension occurs at the planning and design stage to mitigate socio/cultural problems or to increase targeted beneficiaries. This, in effect, reduces the per capita water availability when the initial design had only minimum per capita water at the source. There are instances where source supplies have diminished due to seismic activity, drought, etc., reducing per capita water quantity capabilities. In some cases, CARE has had to deal with the provision of a safe and continuous source of water to communities in spite of an inadequate flow because the CARE source is the only one available. This is a reality with gravity water systems and is a constraining factor in their development.

The capturing of springs in CARE water projects is of a high technical quality and collectively represents a high degree of innovation including many site specific design features. Those project sites visited using gravity systems, demonstrated, without exception, capturing structures which were well-protected, quality-constructed, easily-maintainable, and efficient. Each spring source requires a slightly different approach in terms of allowing for minimum disruption of water vein, outlet alignment, sand and sediment trap and clean out location. No two capturing systems looked the same, but all had necessary components adapted to their unique setting.

Much of the success of these capturing devices can be attributed to the field officer's presence at the time of construction. Many critical factors relating to the effectiveness of a capturing device are not evident until the site is drained and an exact spring location is discovered. Adjustments made in terms of elevation of outlets, sand traps, clean outs, etc. can make the difference of a full or partially available spring source. This was observed at one CARE site where last minute alterations prior to sealing the site resulted in a significant increase in available water. In this case a CARE field representative made the necessary observation and directed the Tukan to alter the design.

The only reoccurring problem observed at several of the capturing structures was forced entry to the manhole of the structure. Either the lock was broken, or the pins were removed from the hinges on the rolled steel manhole cover. In all cases this forced entry represented some dissatisfaction with the distribution of water in the system or in the availability of water at the source. This problem was only observed at two out of the 19 gravity systems visited.

In both cases reduced source production of water initiated these actions. Even though manhole structures could be reinforced and perhaps redesigned to be tamper proof, the possibility of doing more severe damage to the structure, pipe, and/or valves is a real possibility. Instead, these actions should be considered as indicators to village leaders and/or committees that attention should be made to equitably distribute and allocate the available water.

3.2 Spread Reservoirs

Storage reservoirs perform for the most part as designed. Leaking reservoirs were a minimal problem and in no case represented a critical factor in the system. The few reservoirs that did leak could be attributed to poor quality sand and to the lack of supervision during construction. Poor quality sand is usually associated with community contributed sand. Therefore special care needs to be taken in requesting sand or in the purchase of sand. Plastic hoses connected to reservoir faucets are a problem in certain communities. This connection affects both storage and the quality of water. The weak link for possible contamination is now found in plastic pipe laid on the ground. The proliferation of individual plastic hose connections to public taps is a major problem. It appears to be more prominent in those communities where strong guidelines have not been developed or enforced. Once these taps have occurred, for whatever reason, they appear to be difficult to control. It appears that though only 62 percent of the systems are fully functioning, 86 percent of the distribution points are functioning.

The unique and innovative aspect of CARE gravity systems is the utilization of spread reservoirs versus the use of a central reservoir for storage and to even out demand versus supply. The concept of a spread reservoir is to locate small 3 to 10 cubic meter reservoirs in a location central to users, thereby putting peak demands on a sub-system rather than on the main line from a central reservoir. This allows the small reservoirs to fill at night and/or at off peak hours which significantly reduces the size necessary for the mainline supply conduit.

A detailed description of this system can be found in the technical design information produced by Scott Faiia, CARE NTB. The spread reservoir concept has several economic and operational advantages over the use of a single central reservoir. Because of the storage at user location for meeting peak demands, the size of the pipe necessary for supplying the reservoir is reduced. Reduced pipe sizes obviously reduce the size of fittings, valves, and other appurtences. This represents an economic savings and a reduction in material transport and handling. A significant economic factor is the reduced size of the storage reservoir. The 3 to 10 cubic meter reservoirs are human scale structures which lend themselves to hand labor, and minimal foundation requirements and eliminates the need for forms and support devices (see Figure 4). These forms and braces are required for larger masonry and rock structures. Larger reservoir construction also requires contractors for construction and also a pool of skilled laborers. Small reservoirs, on the other hand, require only one skilled mason to build and to demonstrate to villagers how to construct stone/cement structures. Villages customarily have "tunkangs" (skilled laborers) who can lay brick, fit foundation stone, work with ferrocement, and finish concrete work.

FIGURE 4

Six and ten cubic meter reservoir showing tap, drainage pad, and user acceptance.

From a user's point of view, several distinct advantages are offered by the spread reservoir system. The siting of the reservoir becomes the first sub-village community activity which will force the users to become involved in the project. Siting of reservoirs within a community usually involves many factors of which the major factors are: hydraulic constraints, space constraints, drainage considerations, and proximity to users. In many cases either village land, private, or industrial land may be used for a reservoir site or a faucet. If an individual's land is used then that individual might obtain certain rights relative to the water such as use of drainage water or his own connection, etc.

The community participation aspect of siting reservoirs requires much more village interaction than the siting of standpipes. The average number of people using each faucet at a storage reservoir for CARE projects varied from a high of 208 to a low of 17. This wide variation is attributed to the available water within a region, the more arid areas obviously having greater demands for lower supplies. Generally, there are four to six faucets per reservoir located approximately 0.5 meters off the floor. Outlets are available for bathing but are at a higher elevation in the storage tank. This difference in outlet elevation allows the lower half of the storage volume to be used for drinking and cooking but not for bathing and washing clothes. Since these functions can not be completely segregated, it appears that this method of separating water for different usage coupled with user guidelines, reserves water for priority use when the supply is low.

The design of small spread reservoirs has been standardized and many of the details of construction and operation have been thoroughly field tested by CARE. Except for minor drainage alterations and foundation requirements, these small reservoirs could be designed to meet very similar needs in other places regardless of the environmental conditions or socio-cultural conditions.

Several physical configurations or storage reservoirs are already standardized in CARE projects, ferrocement cylindrical reservoirs, ferrocement cubic reservoirs, and cubic masonary and rock reservoirs. This standardized approach could easily be transferred to other NGO and government rural water supply projects.

The quality of the materials and workmanship is generally good in all systems visited except for one. In that particular case, leaks have been a persistent problem in the storage reservoir. These problems have been attributed to the poor quality of sand used in construction. Serious construction problems were observed in storage reservoirs built by villagers as expansions of the CARE assisted system. Since these reservoirs were usually added sometime after the initial constructon phase, there was no construction management and inspection by CARE. In the several cases noted, these added reservoirs had no roofs and were not equipped with shut-off valves. It appeared that the walls were not as thick in these reservoirs and that the workmanship was not as good as in the CARE-assisted structures.

The spread reservoir system design requires an accurate profile of the topographic and hydraulic grade line design. Since pipe sizes are smaller than in a central reservoir system, a significant addition to the system such as an extension of another storage reservoir can cause serious disruptions in the flow of the distribution system.

3.3 Shallow Well and Deep Well Handpump Systems

Over 1,000 handpumps have been installed in the province. Two types of shallow well pumps have been used in CARE water projects, the Japanese manufactured Dragon pump of which 150 have been installed and the Bandung pump manufactured in Indonesia of which more than 175 have been installed. CARE has found it necessary to work closely with drilling crews to insure the development of a groundwater source. Sixty-seven percent of the 924 pumps surveyed were found to be functioning. Coverage of users by handpump systems is generally based upon a criteria of 100 users per pump. In many cases as many as 350 people per pump were found in this evaluation in urban fringe areas of Bandung. Dry wells accounted for 109 of the non-functioning wells. Removing these from the total number leaves 76 percent of pumps working as measured by mechanical effectiveness. In comparison, the Bandung pump showed a 92 percent effectiveness rate while the Dragon pumps showed 49 percent. This comparison of data was available only from CARE NTB surveys. Again these studies represent field analysis of a total program's activity, not a comparative study of well chosen pumps. The technical evaluation showed that 74 percent of the pumps in West Java had a CARE trained user to repair the pump. Similarily, approximately 73 percent of the pump sites in West Java had a repair and maintenance tool kit. CARE plays a minor role in the inspection of pumps and in the supplying of parts directly to the users. In West Java, though, all pump tenders know where the CARE office is located and know that parts are available through the office in Bandung. Since the major working components of the Dragon pump and Bandung pump are common, parts are locally available as Dragon pump parts.

CARE has installed over 700 AID-type pumps in West Java (see Figure 5). Since the type pump was introduced in Indonesia to test its efficiency and acceptability, the record to date should be characterized as a large scale field test. Approximately 66 percent of these deep well pumps are still functioning. These pumps have an average installed life of 23 months while averaging 120 persons per pump. Generally, the longer a pump has been installed the greater its probability of not functioning. First year pumps have an 87 percent functioning rate while second year pumps have a 76 percent rate, third year a 60 percent rate, with second, third, and fourth years having a 67 percent, 60 percent, and 88 percent functioning rate.

The locally produced shallow well Bandung pump is an acceptable alternative design to all forms of the Dragon pump (see Figure 6). The AID-type pump is the only locally produced low cost deep well pump available. However, at the present time, the quality of that pump has diminished from the one originally manufactured. As a result, this pump cannot be recommended due to problems associated with material and manufacturing.

3.4 Pipelines

Acceptable standard procedures for the installation of PVC and GI pipe were found at all field offices. PVC pipes are generally used when possible to

FIGURE 5

Hand dug deep well AID-type project in North Lombok. Approximately 100 families and their livestock use these sources.(Bathouses in the background behind cattle; well 30 meters deep with concrete rings)

FIGURE 6

Bandung - shallow well pump.

reduce cost and to ease construction. Precautionary measures were taken to strengthen and protect pipes when crossing streams and when descending or ascending rocky terrain. Canal and river crossing are always galvanized iron (GI) pipe with special reinforcements and footing protections to minimize natural hazards and vandalism. There did not appear to be any major problems with long distribution lines as the pipes were adequately buried.

3.5 Break Pressure Tanks

Break pressure tanks were specified for critical points on the pipe alignment at the distribution system. Exact site locations for these break pressure tanks depend on available land and other site specific conditions. Where break pressure tanks were found in or close to villages, the outlet overflow was usually contained and used for irrigation or for water in fish ponds. Air relief valves of various types were observed and appeared to be working in all cases except for one valve in West Java. In this particular case, water was continually escaping with minor effect on downstream users. Since there is wide variation in types of air relief valves some attempt by CARE should be made to evaluate those locally available compared to the imported variety. Air relief valves are not locally available in rural Indonesia.

3.6 Bathhouses and Latrines

A standard bathhouse design has been produced by CARE and appears to be readily acceptable by users. These bathhouses can be independent of the storage reservoir, can be adjacent (utilizing one common wall), can be associated with capturing structures, or can be adjacent to deep well pump pads (see Figure 7). Bathhouses are common structures in Indonesia and the construction techniques are found within any village. No major problems were found with either bathhouse construction or usage except for some drainage problems. An attempt was made at one site to dispose of the drainage in an under-designed soakaway. In this particular case space was a critical factor as well as the wet season ground water table. It appeared that the best solution for this was to remove the flow by conduit to a central drain or to a more acceptable soakaway location.

3.7 Cost of USAID Assisted CARE Rural Water Projects

An important consideraton in the evaluation of a rural water supply project is the distribution of costs in the following categories: material and equipment, operating and personnel costs, and community-contributed labor and materials. An analysis was performed by CARE of eight gravity systems on Lombok. The results of that analysis are presented in Table 4.

The sizes of the gravity system in terms of target population ranged from those supplying 419 people to those supplying 1,811 people. The total cost of each of these individual projects averaged US$25,436 with a maximum cost of $38,000 and a minimum cost of $10,841. The material and equipment cost averaged 52 percent of the total cost for these eight projects. The personnel

FIGURE 7

CARE Bathouse/deep well pump complex.

TABLE 4

Two Year Analysis of Material and Equipment, Personnel and Operating Cost, and Locally Contributed and Material (Swadaya) for Eight Gravity Water Systems in NTB, Lombok

	Population	Total Cost (US $)	M & E Cost (US $)	%	P&O Cost (US $)	%	Swadaya (US $)	%	Per Capita cost (US $)	FY
Medawa	690	12,516	7,106	57	4,660	37	750	6	18	1983
Punikan	1,221	34,253	16,954	50	11,081	32	6,213	18	28	1983
Klayu	1,219	38,069	16,902	44	15,257	40	5,930	16	31	1983
Tia	1,811	35,102	19,903	57	13,409	38	1,790	5	19	1983
Nunggi	770	14,890	7,853	52	5,200	35	1,968	13	19	1983
Loloan	1,250	22,542	12,830	57	8,312	37	1,400	6	18	1983
Sanco	1,107	35,205	18,445	53	19,532	41	2,178	6	32	1984
Praba	419	10,841	5,003	46	4,284	40	1,554	14	26	1984
Average	1,060	25,426	13,130	52	19,216	37.5	2,722	10.5	24	
Maximum	1,811	38,069	19,903	57	19,532	41	6,213	18	32	
Minimum	640	10,841	5,003	44	4,284	32	750	6	18	

and operating cost averaged 37.5 percent for the projects. The beneficiaries contributed from 6 to 18 percent of the project in US dollars with an average contribution of 10.5 percent.

The unit cost of these projects averaged $24 per capita with a high of $32 and a low of $18 per capita. These per capita costs were determined by including the three components discussed early (material and equipment, personnel and operating costs, and community contribution).

The variation in unit cost for gravity systems is highly dependent on the length of the pipeline from source to village and on the nature of the terrain of the pipeline alignment. The unit cost of reservoirs, in village distribution lines, and plumbing hardware is more or less standard.

The total per capita cost for the CARE assisted rural water supply projects are significantly lower than the published per capita cost by the World Bank and other multinational organizations. Considering the fact that these projects are technically sound and user accepted, the fact they are economically viable from a donor's point of view is an important finding.

A more important consideration, though, in this analysis is the fact that the CARE projects appeared to be constructed and maintained to protect the initial investment. In other words these projects appear to have a low loss of service as the system ages. Future evaluation should focus on monitoring the loss of service as the water system ages and/or the operating and maintenance cost of protecting or enhancing the initial investment. Many of the rural water projects observed in Indonesia were not operational even though they were recently constructed.

Chapter 4

FINDINGS AMONG GOVERNMENT OFFICIALS AND CARE FIELD OFFICERS

4.1 Perception of Government Officials of CARE/USAID Assisted Water Projects

The data regarding the perceptions of GOI officials and the CARE projects were initially tabulated and reduced to show project site characteristics. The next step was to tabulate data according to provinces in order to determine variations from site to site and to observe any general patterns which might exist. Various government officials were also interviewed to determine their perception of the CARE technical and community participation approach in implementing rural water supply projects.

Mr. Wahyu, chief officer of community health division, KESRA Bureau of Community Welfare, is supportive of CARE's water project in West Java. He considers the CARE projects beneficial and appropriate for the people. Based upon his own field observation, CARE's water projects in West Java are well accepted and maintained by the communities.

Mr. Wahyu thought that the communities accepted CARE projects because the villagers needed the water and because the technology CARE introduced is not overly sophisticated. The technology appears to be appropriate for the individual social/cultural settings.

In Bali BANGDES, BANGDA, and BAPPEDA were actively involved in the team's evaluation. Interviews with individuals from these agencies resulted in the following perception of the CARE projects. Trainees from a CARE water supply training course from Gianyar, Tabanan and Klungkung were also present at the exit interview and actively participated in discussions.

CARE assisted water projects in NTB are viewed as important links in the development strategies of the province. Provincial planning officials were highly supportive of the CARE methodologies and techniques in developing rural water supply systems. The methods which CARE used to include community members in the construction and operation of these systems was specifically noted by the Director of the Provincial Planning Agency. Field personnel from the planning agency accompanied the evaluation team to all sites in NTB.

In general, clean water supply on Bali is not as critical as other areas of Indonesia but there are specific areas which have critical problems. Nusa Penida had a very critical water supply problem. There is not sufficient clean water for drinking and cooking. INPRES water projects have constructed 144 rainwater capturing systems on the island. Sraya and Karangasem have the most critical water problem in Bali in terms of availability and demand. This is an extremely isolated area in which of materials and equipment is a constraint.

The most common problem associated with the CARE water project in rural areas is the lack of maintenance and management of the systems. The LKMD (Village Community Endurance Institutions) is a possible mechanism to assist with this problem. A maintenance budget for such systems exists in the "Anggaran Pendapatan dan Pengeluaran Kantor Desa" (APPKD--Village Office Income and Expense Estimation), but for the most, the village government offices have

limited experience in the area of financing and managing community services. Some of the village communities possess extra income sources which can be used for financing village expenses. For most of the villages, though, there are no village level services. In most situations the "Dusuns" or "Kampongs" have more opportunities for extra income sources than the "desa". Usually every "Dusun" in Bali has a market place and "Tanah Bukti" (customary land) as a source of income which is generated through user's fees.

4.2 Profile of CARE's Field Officers

Nine of the CARE's field officers are more than 30 years old. Among them, five field officers (three in CARE West Java and two in CARE NTB) have technological vocational education, three field officers (one in CARE West Java and two in CARE NTB) have middle school education and the other two (each in CARE West Java and NTB) have high school educational background.

Ethnically, all field officers in CARE West Java are Sundanese, while in NTB two among the five field officers are Sasak, two are Sundanese and one is a Javanese.

Two of the ten CARE field officers have been working with CARE for more than five years, including three to four years as field officers. Both of those field officers are now working in NTB. Five field officers in West Java and three in CARE NTB have been working with CARE three to four years. Two of those field officers (one from CARE West Java and one from NTB) have been working one or two years. The remainder have been with CARE three or four years.

It is necessary for the field officers to have some sociological and/or anthropological background since they are working with villagers in the rural areas. An understanding of local customs, traditions, and economic factors becomes essential information when working closely with village committees. One of those ten field officers has had a 36 month sociological/anthropological course presented by YIS (Yayasan Indonesia Sejahtra--a foundation concerned with community development in CARE's on-the-job training.) The other seven field officers have attended a short sociological/anthropological course of two to four weeks presented by YIS. There are only two field officers who have no formal or informal training in this area.

4.3 CARE Field Officers Involvement in Project Planning

CARE's field officers are actively involved in Project Planning, especially in the village government ("desa") level. Only two field officers (West Java and NTB) have not participated actively in project planning to date. Both of these field officers are recent employees and have not gone through a total project cycle. Normally, field officers with one to two years of experience play the major role in project planning. Two field officers (West Java and NTB) have planned projects with municipal government officials and have therefore had more experience and knowledge in project planning.

At the village level, the field officers discussed the planning of a project with the village chief and his staff and other traditional leaders. They also discussed the project plan with other members of the community. Quite often these community discussions are centered around traditional meeting times such as in the mosque before prayer time.

Most of the field officers (nine out of ten) have constructed piped gravity system projects. One of the field officers has recently implemented a handpump project.

4.4 CARE Trainee Comments on Their Projects

In the village of Klungkung the cooperative work with CARE has not been implemented by the village level government. Funds for the project had not been appropriated at the provincial level for implementing the project. In Tabanan the cooperative work with CARE has been well received. There is still difficulty informing and motivating committees to handle the operation and maintenance of the system. This issue will remain unsolved as long as no reimbursement is paid to the village committee members. In Buleleng a pipe system water project has successfully been implemented. The village government has initiated a service charge to those with individual taps (PAM System). There has been limited experience in dealing with combined systems that have individual users and public taps. In one case, users of a public tap paid from Rp.100 to Rp.150 each month for each family. Some portion of these funds is used to reimburse the committee members who have the responsibility of main taining the water projects. A similar situation was found in villages wh n had handpump water projects.

CARE trained some village extension workers in village water supply. Two of these trainees (from Tabanan and Gainyar) attended the meeting with BAPPEDA and CARE officials in Denpasar.

The trainee from Tabanan described a situation where the water for the clean water projects was formerly used for rice field irrigation. These types of sources need special treatment such as sedimentation and filtration before the water can be used for drinking and cooking. There should be an agreement between the community and the "Subak" organization ("Subak" is a traditional organization in Bali and Lombok that deals with the distribution of irrigation water) in the planning phase of the project as to distribution of water for human and irrigation uses. The Subak organization forbids the people to use the water for purposes other than drinking, cooking, bathing and irrigation.

According to BAPPEDA officials, CARE's water projects in Bali were considered effective and acceptable to the community. These officials assured the evaluation team that CARE's water projects are beneficial. They expressed a hope that the cooperation among CARE, PEMDA, and the community could be carried over to other projects. They also stated that CARE's community approach is appropriate in relation to existing customs and traditions (i.e., Gotong Royong Nyarad Banjar.) Thus the cooperative work among CARE, PEMDA, and the community means reinforcement and revitalization of the customary cooperation found in these Balinese villages.

The trainee from Gianyar stated that the theoretical training by CARE, in water supply development was good, there still was a need to have practical experience in the construction of rural water supply systems. The trainees were never involved in any of the government water projects as originally proposed. The contractors who secure the tender for the government water projects have never used the trainees in their implementation process. The trainees also requested special training in the use of hand level instruments.

4.5 Conclusions

It can be concluded that all of CARE's field officers are field oriented and regard community participation as critical to the success of their programs. The field officers appear to have sufficient technical, sociological and anthropological knowledge to operate effectively in the rural water supply development sector. For some of the field officers, specifically in NTB, their own ethnic background initially was an obstacle in their ability to foster community participation. It appears that this has become less of a problem after three or four years of field experience in Lobmok-NTB.

Chapter 5

THE PROJECT PLANNING PROCESS AND THE INVOLVEMENT OF THE COMMUNITY

The selection of the potential project sites is determined principally by the communities and by the various regional government agencies. However, there were some examples (as indicated by CARE's field officers in NTB) where the selection of the water project sites was determined by CARE. In such cases, most of the community leaders agreed with having the water project in their areas. This represents as complete a contribution of community resources as you would expect to find in a development project.

There were examples where community members were hesitant to have a water project in their village. These cases were found, for the most part, in villages in West Java. The traditional religious leaders and landowners raised the greatest objections to the use of their land such projects. Field staff related that the principal objections to projects, as indicated by community members, were usually related to the use of springs in other communities, in other political domains, or those of individual ownership. This was found to be especially true where a water distribution system was planned to extend some distance to other villages. The intensity of these objections was usually stronger when the particular spring water specified in the design was being used for irrigation of rice or used as a water supply for fish ponds (West Java). Disagreements were sometimes voiced when communities were asked to contribute labor or building materials to the project. In most areas, however, community leaders strongly supported the plan for the CARE assisted water projects and because of the lack of clean water, most proposed water projects were enthusiastically supported by the communities and their leaders.

A major consideration in evaluating the success of CARE water projects was the ability of the villagers to secure building materials (stone, sands, bricks) and the fact that the limited alternatives for clean water supply existed. In many cases, anything would have been better than what was currently being used as a water source.

Because of the above listed supportive factors, nearly all of CARE's water project, have been successfully implemented and continue to be managed and supported by community members as envisioned in the original plan.

5.1 Cooperation Between CARE's Field Officers and the Community During Implementation

Eight among ten of CARE's water projects in West Java and NTB were implemented as planned in an orderly and timely manner. One field officer in West Java and two in NTB indicated that they had some difficulties.

According to the field officers, the success of CARE's water project implementation was primarily attributed to strong community support, the availability of building materials, and the supportive attitude of the government officials and informal leaders. These committees were helpful during the construction phase of the CARE assisted water projects. The community contributions most often offered were labor and building materials (stones, sands, bricks).

Some of those projects, usually projects involving more than one community, could only have been implemented successfully with input from CARE and village leaders. An obstacle that appeared to hamper some of them were the differences in opinion between various elements of the community members concerning the socio-economic conditions of the communty. Obtaining permission for pipeline right-of-way and for using the land where a spring is located for public purpose was a frequent obstacle. Sometimes the field officers had difficulties in obtaining voluntary laborers especially when the male villagers were working in the rice fields. The field officers attempted to overcome such social obstacles by convincing the members of the community of the importance of an adequate supply of clean water for the health of the villagers and by requiring the convenience of obtaining the water for domestic uses. There were also some unpredictable, non-social obstacles such as the constuction of new roads, collapse of the inner spring water source, and droughts which reduced spring flows. etc.

The cooperative work between CARE's field officers and the villagers resulted in an exchange of useful information. Six out of the ten CARE field officers obtained useful suggestions from community members relating to project plans and/or implementation. Most suggestions from villagers related to local environmental factors (spring sources, etc.) and some dealt with social relationships and/or building and construction techniques. One of CARE's field officers obtained suggestions relating to religious and cultural beliefs that became a critical factor in the success of a particular project. Others obtained suggestions concerning location of springs, routes for pipelines and location of reservoirs which were more preferable to the community. Suggestions were most frequently offered by village government staff. The next most frequent source of information was through traditional/religious leaders and teachers. According to CARE's field officers, all of those suggestions/ opinions were taken into consideration and resulted in more successful projects.

5.2 Conclusions

Nearly all of CARE's field officers were involved in CARE's water project planning, especially at the village level. Because of their involvement in the total project from planning through construction the field officers feel that their efforts have resulted in positive impacts on the lives of the villagers. Some socio-ecological conditions were skillfully manipulated so that when the project was implemented, there were positive environmental impacts as well.

It appears that a strong cooperative link exists between CARE's field officers and the community members. CARE is recognized and respected among the "Ketua Kampung", the "Ketua Rukun Tetangga," "Klian Banjar" and the "Ketua Kelompok" (neighborhood chiefs). This recognition and acceptance is a major factor in the success of CARE's water projects.

Chapter 6

THE OPERATION AND MAINTENANCE OF CARE ASSISTED WATER SUPPLY PROJECTS

The long term success of any rural water project system is dependent upon the quality and quantity of the maintenance of the system and how these functions are managed during the system operation. CARE's approach to this problem is to transfer these responsibilities to the users by involving community members in the planning, design, and construction of the water supply systems. Some of the communities, have selected the person(s) to maintain their clean water system on their own initiative. In some cases, community members were identified by CARE's field officres to assist in establishing these committees. Based upon information obtained from CARE's field officers, most of the committee members established to maintain CARE's clean water systems were chosen from among the community leaders. In some cases, though, CARE's field officers encouraged volunteers to take the position of committee member dealing with CARE water system maintenance. However, not all committee members received special training in the operation and maintenance of their particular system. Only five of the ten field officers remember projects where the committee was trained in any informal or formal sense.

These training programs for the committee members dealt mainly with pipe fitting, reservoir, and capturing maintenance techniques and health education. Because of the nature of the information and the background of the community members, most of the training methods were on-the-job demonstrations. Discussion methods were used in some cases during the training sessions.

Based upon information obtained in this evaluation, water supply projects can be a focus of community participation in contribution to the rural development of Indonesia. CARE water projects in Indonesia, specifically in West Java, Bali and NTB, were found to be widely accepted by the community members. Based upon information collected in this survey nearly all respondents that live in close proximity to CARE's water projects supported the project. This conclusion was further borne out by information acquired from the field officers.

The acceptance by the rural communities of the CARE projects in West Java, Bali, and NTB continued through the entire implementation process. In NTB and Bali no cases were found where community members objected to contributing services or material to the CARE water project. There were only two respondents in West Java who did not agree to contribute to the ongoing operation of the community water.

The reasons that CARE's water projects were found to be accepted by the rural communities are listed below:

a. In most cases clean water was a scarce commodity and/or located too far from target villages (see Bappeda-Bali information).

b. Most users in Bali and West Java thought that the water projects were planned and implemented cooperatively by CARE, the government, and the community. In NTB, most of the community members thought that the water system was a CARE project.

c. Seniority and paternalism are still strong influences among the rural communities in West Java, Bali, and NTB. This fact seemed to be well recognized and used by CARE's field officers in their community approach.

d. The contributions requested from the community for the purpose of project implementation were in the form of in-kind labor services and of building materials, such as stones, sands, bricks. The building materials were locally available therefore readily obtainable by community members. The majority of the respondents in West Java, Bali and NTB contributed labor and building materials. Less than one fourth of these interviewed in West Java, Bali and NTB contributed money to the development of the community water system. In some cases the villagers contributed money in lieu of labor. In the rural areas, it is not difficult to obtain community labor for activities viewed as beneficial to all villagers. Community cooperative works (gotong, royong, mapalus, nyarad banjar, etc.) is a strong social and cultural institution in these areas.

The need for clean water was very critical in the areas where CARE has implemented its water projects. Community members formerly used rivers, springs, and dug wells as their water sources prior to the implementation of the project. Most of the villagers use water from CARE's water project (gravity pipe system) as their sole source of water. Only a small number of villagers still use the traditional water sources (none in Bali, one tenth of the respondents in NTB, and none in West Java). Most of the communities where CARE's water projects exist use the water primarily for drinking and cooking, secondarily for bathing and thirdly for washing clothes. There were a few cases in Bali where people used the water to irrigate their gardens and small orchards near their houses. In NTB the pattern of CARE's water use is more specific. The community members in NTB give priority to drinking and cooking and then to bathing. They also use project water for gardening, watering cattle, and brick making. For the most part, the water supply is sufficient in quantity and acceptable in quality for fulfilling their primary needs. However, it should be noted that in some areas of NTB (Selat and Selaparang) and Bali (Tukad Semoga and Selat) the water supplies are not sufficient during the dry season. During these periods the water is used only for drinking and cooking and the river and Kali is used for bathing.

There were some cases of skin disease (fourteen in NTB, three in Bali, none in West Java). Respondents related several cases of diarrhea (referred to as "muntaber"), six in NTB, two in Bali, and one in West Java. The data show some interesting information concerning perceptions of health and sanitation. Respondents in NTB, Bali, and West Java said that they had acquired health information from the Department of Health at the municipal and subdistrict level. In NTB the respondents also indicated that they had obtained health information from CARE's field officers. It seems that in some cases the health education programs were effective since respondents had indicated they had gone to the local PUSKESMAS (Community Health Center) for various problems rather than using traditional doctors.

6.1 Community Involvement During Operational Phase

The operation of water supply system and its longevity depend on the commitment of the users to maintain the system. Although most of the respondents in Bali and NTB were aware that they were responsible for the maintenance of the water systems, they preferred to leave it to the committee rather than to attempt to repair it themselves. This same tendency also occurred in West Java but at a lower frequency compared to NTB and Bali. The villagers that lived in close proximity to CARE's water projects also indicated that they were aware of the need for financial support for their operation and maintenance. Nearly all of the respondents had no major objections to contributing money to finance the maintenance of their clean water installation. Moreover, most of the villagers have already contributed between Rp.25.00 to Rp.100 (US$1.00= Rp. 790) per month per each family for the operation and maintenance of the public tap/handpump. According to most of the respondents, those monies are mainly used for maintaining the water installation but not for paying the person(s) elected/ appointed as committee members. Similar information about the use of the money collection was also stated by committee members, i.e, the chiefs of neighborhood (ketunanrukun tetangga, klian banjar) or other persons who were responsible for maintaining the water supply systems.

6.2 Community Interest in Home Connections

Most of the respondents in West Java, NTB and Bali were interested in having water piped directly to the house. Their reasons for wanting water piped to the house was primarily to save time and human energy. Other respondents stated that the maintenance of water installations can be well financed by the money collected from the user of home connections. Only a small number of respondents felt that the project should deliver water to their home without cost. Nevertheless, they were aware that the more water they used, the more they would have to pay should they have home connection. Some respondents in West Java, Bali and NTB had no interest in home connections because of monthly users fees. Other respondents felt that the public taps around them were quite sufficient to supply their needs.

6.3 Inadequacies of CARE's Water System From the Users Perspective

The users of CARE water systems, mostly in NTB and Bali, complain that the flow of water in the CARE assisted systems was frequently disturbed, either by mismanagement or by technical problems. Several complaints were directed at the problem of water scarcity during the dry season. A smaller number of respondents complained about the time spent waiting in line for water especially during periods of water scarcity. The highest frequency of this later complaint occurred in Bali.

Chapter 7

ROLE OF CARE IN WATER SUPPLY SECTOR AND OPPORTUNITIES FOR IMPACT

Several opportunities exist for CARE to directly and indirectly assist the GOI in their rural water supply and sanitation projects. CARE has demonstrated that it can effectively and efficiently implement rural water supply projects which are accepted and maintained by the users. A need exists in Indonesia for the transfer of those successful processes and technologies to other NGOs and to GOI. Aspects of CARE's rural water supply program need to be documented and integrated into a well planned technology transfer project utilizing formal and informal training courses, educational media development, visual aids development, and of case studies.

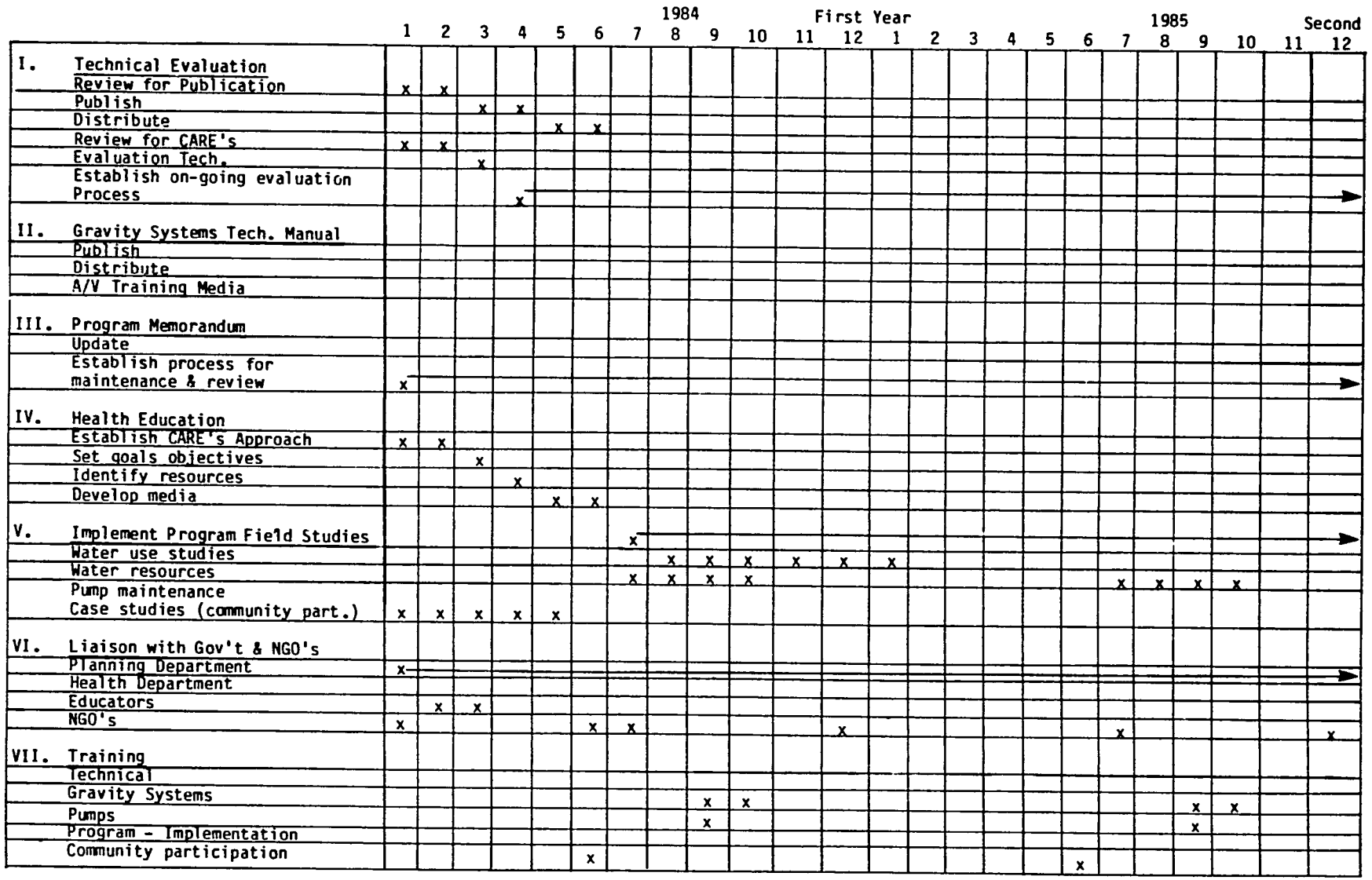
Figure 8 shows a preliminary schedule of some of the training and technology transfer activities which CARE could implement. The first activity could be the final phase of the evaluation process which CARE has just finished. The technical evaluation which CARE prepared should be finalized and published for in-country and international distribution. The CARE technical evaluation represents a comprehensive and objective evaluation of a rural water supply project. The processes and the results from the technical evaluation would be used to establish reasonable expectations for effectiveness of rural water supply systems in terms of community participation and technical approaches.

Since the CARE technical evaluation included all of the systems that CARE developed in the Province of West Java, Bali, and NTB, it represents the first thorough and rigorous assessment of a rural water supply development project in Indonesia. This information could be extremely useful to the in-country NGOs, non-Indonesian NGOs, bi-lateral and multi-lateral donors, and those GOI ministries working in the water supply sector.

CARE should first review and analyze the technical and non-technical findings of the evaluation. This should include a cost analysis of the evaluation in terms of its value for implementing future programs and in terms of its total impact on the rural water supply sector in Indonesia. CARE should establish its on-going evaluation process as soon as possible to minimize any loss of information and to establish an organizational priority. This on-going evaluation should be considered an extension of "progress to date."

The gravity water system design manual and problem set should be published and distributed to all CARE offices and other interested NGOs. This document has educational value as a handbook by an experienced engineer or as a resource document in a formal training program. Since both documents are printed in Bahasa Indonesian, the most immediate use should be with in-country NGOs and by government rural water supply programs. This in fact has occurred in several cases and has proved to be highly successful. Several water supply program officers from other NGOs in Indonesia have been trained by CARE using the approach described in these manuals. As was mentioned in the report, several government officials were also trained and went through the total

FIGURE 8. TWO YEAR PLAN OF ACTION FOR CARE/INDONESIA



design process on actual water projects following the training. They have not been able to carry out the construction phase, though, due to budgetary constraints.

The development of the program memorandum should continue with the objective of eventually developing a field officer handbook. To date, the programs memorandums have been used effectively as a guide for implementing various aspects of the rural water supply projects. This document can be used most effectively in training new field officers and program officers. It represents a compilation of CARE's technical and non-technical experience in Indonesia. Certain aspects of the program memorandum could be useful to other NGOs (such as standard designs, planning factors, etc.). The full development of the program memorandum should be a high priority for CARE. Much of the information obtained on the technical evaluation should be incorporated in this document. The review process for inclusion of material in this document will serve as an excellent means to encourage field officers' involvement in developing organizational goals.

CARE should continue to develop and publish educational pamphlets and visual aids for health education programs in the village. The materials produced in the past have been used effectively both by CARE and other NGOs in Indonesia. CARE should direct its health education activities toward the development of audiovisual materials for community participation programs. Since CARE has demonstrated the ability to mobilize communities to build water supply systems and sanitation structures, they shoud concentrate their activity on those elements they do best. Certain offices such as West Java have shown an interest in the past and are at present interested in including health education media development as components of their program.

The CARE technical evaluation has revealed the need for several field studies which could add significantly to the planning and implementation of rural water supplies in Indonesia. For example, limited information was obtained on the water use pattern at different project sites along with technical information. A well designed experimental study to determine who uses the water sources, hourly demands, and the intended uses of the water could be useful to many professionals in the water supply field.

A field study to develop a map of available water resources within a project area would greatly facilitate project site location and expedite the construction phase of the project. Much of the front-end time of a project is spent searching for an adequate water supply. This would also be useful information for governmental agencies working in this same general location.

An important role for CARE in the water supply sector of Indonesia is to maintain and develop contacts with the GOI, NGOs, bi-lateral and multi-lateral (donors) engineers, and planners. CARE has contributed to the development process in the area of rural water supply. A program should be devised to offer an opportunity to exchange technical and non-technical information in an open and informal setting such as the one which previously existed in Jakarta. A monthly informal lunch meeting was held with all NGO water supply professionals where water supply development issues were discussed. CARE could take the lead and develop a list of possible topics for such a group to consider. Included in this list could be a summary of the findings of the evaluation and a general discussion on evaluation processes in the water supply sector.

Formal seminars and workshops could also be developed jointly with other NGOs. These structured activities could be directed at specific technological approaches and could be designed for hands-on design and construction type activities. These types of activities could best be suited to meet the needs of field personnel on existing or proposed water supply projects.

Professors and teachers in engineering and sanitarian schools should be made aware of CARE's activities in this area. This group of water supply and sanitation professionals can have a significant impact on existing and future government technicians and professionls. At the present time there are 11 schools training sanitarian technologists (SPPH) and three schools training APKs which are distributed throughout the country. A standard curriculum, which is coordintaed through PUSDIKLAT in Jakarta, contains significant emphasis on rural water supply and sanitation. Direct involvement with PUSDIKLAT personnel in Jakarta could open up an opportunity to disseminate CARE's findings and approaches. Much of the development of these schools was supported by a USAID low interest loan. There should, therefore be interest and motivation for considering and possibly incorporating CARE's techniques and methodology into the curriculum.

The possibility of incorporating CARE's approaches in the engineering schools in Indonesia presents a more difficult problem. Sanitary engineering programs exist in the universities in Surbaya and Bandung. These programs are more rigid in design and are more difficult to change. The easiest way to affect these programs is to present convincing information to senior faculty members through guest lectures and by including them on field trips and/or evaluation teams.

7.1 Recommendations for CARE

1. CARE Jakarta should coordinate the development of an informational text which can be used by CARE and other organizations in mobilizing community members in planning, designing, constructing, operating, and managing a rural water supply system. Case studies of several community participation efforts in various socio/economic settings should be produced for this informational text.

2. CARE Jakarta should coordinate the development of standard procedures and design of gravity water systems, deep well pumps, shallow well pumps, and other elements of rural water supply systems demonstrated to be effective in the technical/evaluation.

3. CARE should continue to utilize the spread reservoir for gravity water systems. This has proven to be an innovative and effective means of supplying water to rural communities in Indonesia. The continued implementation and evaluation of these systems will enhance the possibility of the Government of Indonesia utilizing them in their programs. The continued construction of these systems will allow the incorporation of design improvements and operational alternatives developed by CARE staff to-date.

4. CARE should incorporate estimates of water quantities needed for irrigation and for watering animals in the planning phase of their rural water supply projects.

5. CARE should initiate several water use studies at existing project sites with varying climates and socioeconomic conditions. These studies could be done by CARE staff and community members with a standard methodology developed by CARE staff members. The results of these water use studies could be incorporated in the planning and design phase of CARE projects and of the PVO and government projects in Indonesia.

6. The technical evaluation of CARE Indonesia's rural water supply projects should be made available to all interested organizations and agencies in Indonesia. The report should be translated into Bahasa Indonesia and both versions should be published and distributed to in-country and out-of-country development organizations.

7. CARE should continue to encourage and implement on-the-job training of field officers, PVO staff members, and government agency staff members in the design and construction of gravity water systems and deep well pump systems. CARE should identify those staff members to be used in this capacity and should adjust program activity to accommodate this training function.

8. CARE should incorporate the evaluation process into all of their projects. The process and result of the technical evaluation should be used to establish the ongoing project evaluation process. Building standard evaluation and data collection procedures into the implementation of projects will reduce the time required to perform a project evaluation. The findings and recommendations from this evaluation should be used in the development of new projects via CARE's program memorandum document. Results should also be made available to USAID/ Indonesia and other NGOs operating in Indonesia.

9. CARE/West Java should design a bacteriological and chemical water testing program which shows the variation in water quality in deep well and shallow wells on a seasonal and annual basis.

10. CARE should incorporate latrine construction and sanitation elements into their water supply projects. These programs should be introduced only in those communities which have indicated a willingness to actively assist in the promotion of the use, construction, and maintenance of such systems.

11. CARE rural water supply projects should incorporate mixtures of technology, when appropriate, to demonstrate the potential of these systems as well as to disclose problem areas. Water supply systems incorporating combinations of gravity, groundwater, surface water, and rooftop catchment should be designed to supply water for various uses. In some cases, opportunities exist in present CARE projects to augment a reduced supply or over-extension of designed flow.

12. CARE field officers should develop the capability to develop regional water resources data (spring location and flow, surface water flows, and groundwater table) to assist in project site selection.

13. CARE/Jakarta should take the initiative to reinstitute the informal meetings of rural water supply professionals such as representatives from bi-lateral agencies, multi-lateral agencies, non-government officers, and Government of Indonesia officials. Perhaps the first topic covered at one of these meetings could be a review of the CARE evaluation with the technical aspects and the community participation elements.

7.2 Recommendations for USAID/Jakarta

1. USAID should continue the support of CARE rural water supply projects at the existing level or at an expanded level of funding with the addition of program activities in the area of training. The CARE rural water projects represent technically adapted and user accepted projects. The value of the CARE project can be measured in several spheres of influence. To the users these projects are sound, long-lived investments which have had, and will continue to have, a significant impact on the quality of their lives. The CARE projects have direct influence on provincial level government officials in planning, development, and health agencies. This continued influence is critical in terms of insuring a long- term impact on the government of Indonesia's approach to supplying water for rural communities. CARE projects have had and will continue to have a significant effect on other NGO's operating in Indonesia. CARE has developed visibility in Indonesia as the primary source of technical and social information gathered in the field.

2. USAID/Jakarta should support the dissemination and transfer of rural water supply technical and operational information directly funded by USAID. USAID supported projects are making significant contributions in the area of rural waste supply development and the resulting methodologies and techniques can be utilized by other NGOs operating in Indonesia.

3. USAID should coordinate the publishing and dissemination of the rural water supply technical evaluation of CARE water projects to interested government agencies and NGOs involved in rural water supply development.

   Since the technical evaluation will be available in both Bahasa Indonesia and English, the appropriate edition should be forwarded to each designated recipient. USAID/Jakarta should support efforts to have the technical evaluation published by either a private or governmental publishing agent so that the information can be obtained by other developing countries.

4. USAID/Jakarta should assist in the development of the Bandung shallow well pump indirectly through contacts with local technology development groups. At present there is not an acceptable shallow well pump that can be used on a community wide basis. The Dragon pump is minimally acceptable for use by small user groups.

   The single largest impact that can be made on government rural water supply projects is to offer an acceptable substitute for the Dragon pump. At the present time, large numbers of these pumps are being specified and installed. Even though parts are locally available, a large proportion of these pumps remain non-functioning.

7.3 Recommendations for Government of Indonesia

1. The Government of Indonesia should review the CARE evaluation to determine goals and direction for rural water supply projects in Indonesia.

2. The Government of Indonesia through its Water Decade technical committees should exchange technical and operational evaluation of data on rural water supply projects.

3. The engineering schools at Bandung, Surabaya, and Medan at present producing sanitary engineers should be made aware of the CARE rural water supply technical evaluation. Methodologies and technologies proven to be successful should be incorporated into instructional material.

4. The school, training sanitarians and sanitarian technologists should be developing their curriculum in the area of rural water supply by incorporating results of the CARE evaluation of gravity systems, deep well pumps, and shallow well pumps.

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APPENDIX A

Data Collection Form

I. Data Collecting

A. Proposal :
- a. Individual (community) ____
- b. Formal Agency/Government ____
- c. CARE Staff ____

B. Selection:
- a. Government ____
- b. CARE ____

II. Primary Survey :
- a. Interview ____
- b. Baseline data fill up ____
- c. Assumption of height & distance difference ____
- d. Flow measurement ____
- e. Primary documentation (photo) ____
- f. Used current water sources ____
- g. Water quality examination ____
- h. Possibility of piping extension ____
- i. Mapping ____
- j. Decision making ____

III. Community Meeting includes;
- a. Written agreement of the spring owner ____
- b. Requirement being fulfilled by community ____
  Real needs of clean water supply ____
- c. Community contribution ____
- d. Written agreement of the land owner for projects ____
- e. Data of the use of water (fishpond, ricefield etc.) ____

IV. Measurement and selection of physical infrastructures:
- a. Water flow measurement ____
- b. Measurement of distance and height difference ____
- c. Site selection for water distribution ____
- d. Documentation ____

V. Planning:
- a. Internal discussion ____
- b. Decision of distribution system ____
- c. Drafted design ____
- d. Agreement of Central CARE ____
- e. Technical drafted design ____
- f. Budgeting. ____

g. Agreement of the persons in charge of signing the cooperation agreement ____

VI. Community Meeting II:

a. Time schedule of project implementation ____
b. Community fund contribution ____
c. Committee formulation ____

VII. Implementation :

a. Material provision ____
b. Water flow measurement III ____
c. Supporting infrastructures ____
d. Civil building design ____
e. Piping network ____
f. Pipe digging and burrying ____
g. Documentation III ____
h. Filling the PSM I form ____

VIII. Finalization:

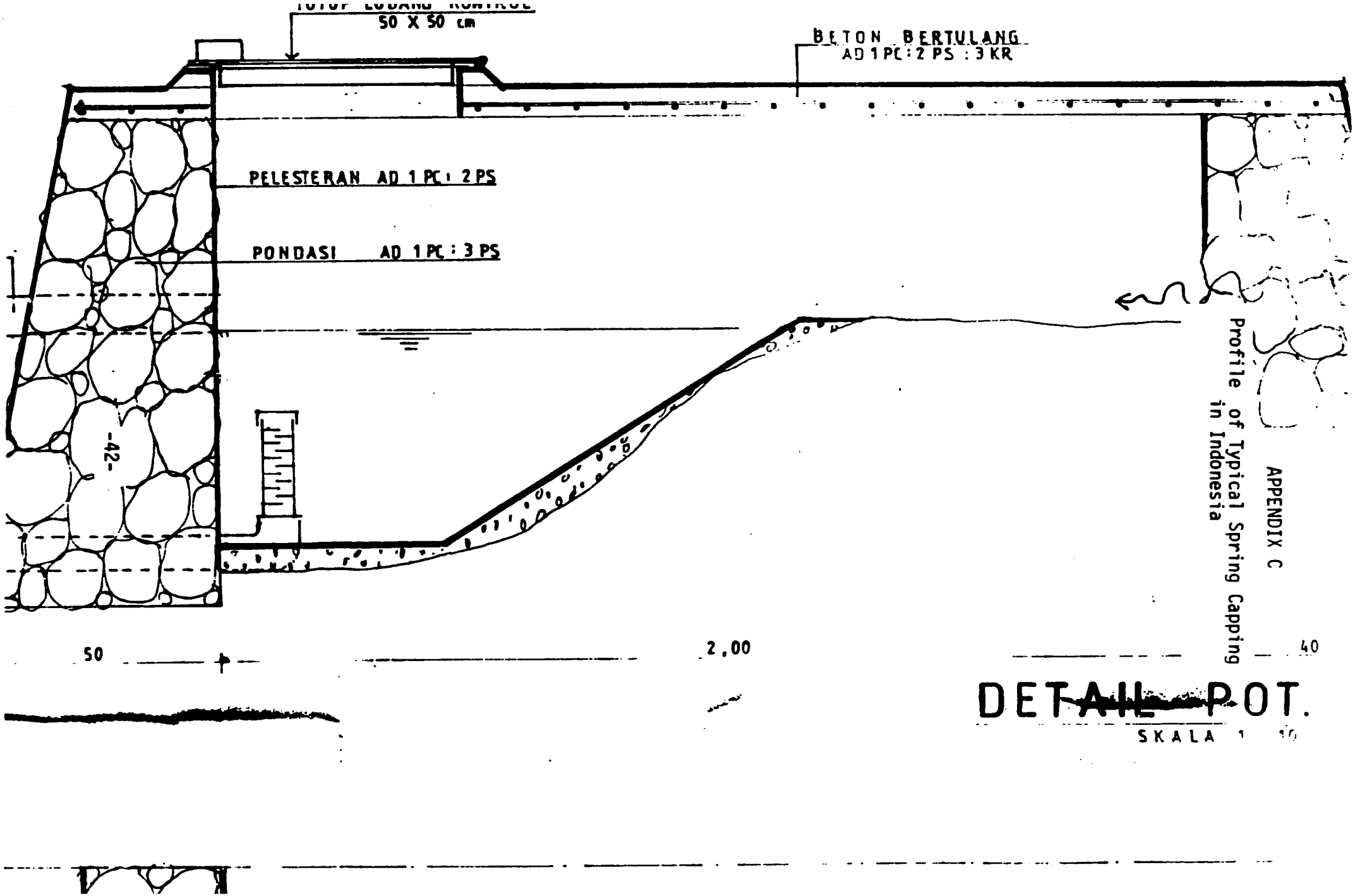
a. Primary evaluation ____
b. SCR (Site completion reports) ____
c. Additional project implementation ____
d. Water flow measurement IV ____
e. Documentation IV ____
f. Tools for repairing work ____
g. Organization formulation ____
h. Cadre training for maintaining and repairing work ____

WK/th
20/9/83

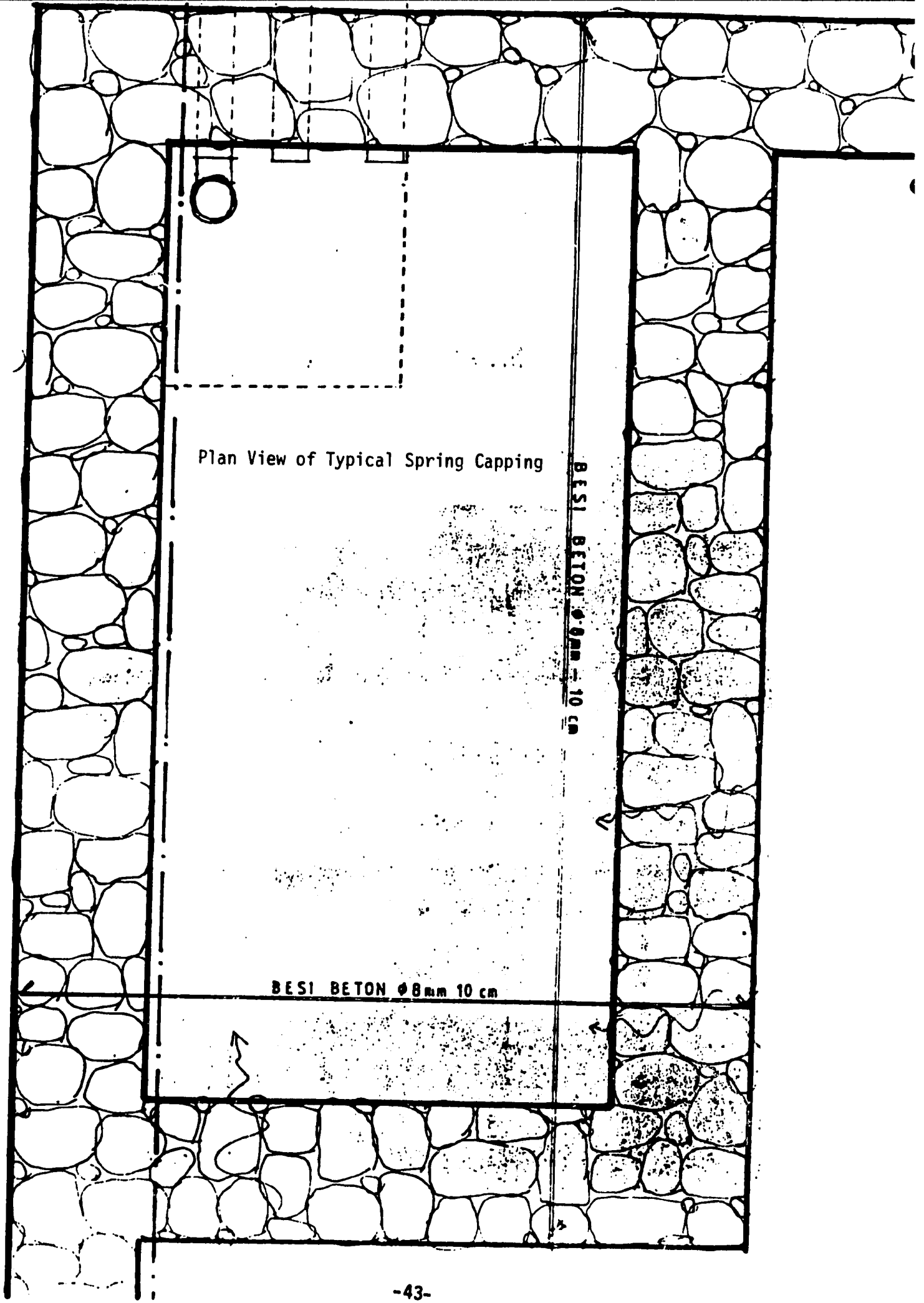
APPENDIX B

List of Topics in Program Memorandum Which is Distributed to all Care Field Officers

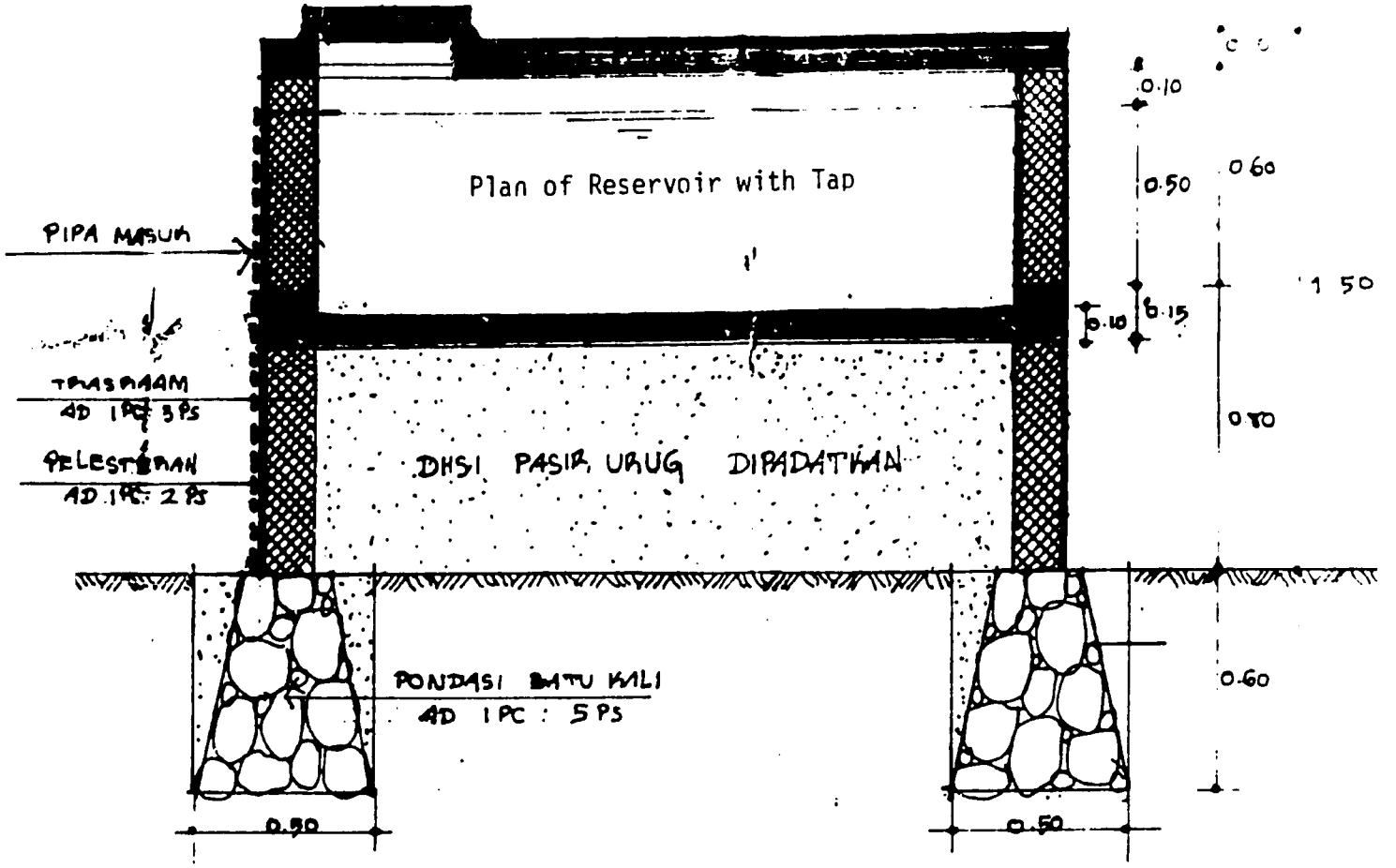
1. Program Memorandum - whom - us
2. Job description of field office
3. Criteria site selection
4. Use water wheel - system hydraulics
5. Standard design for gravity system emphasis
6. Health education and community development
7. Lamtoro - Planting trees as spring protection
8. Health Education- social contacts
9. "Where There is No Doctor"
10. Pipe installation - trenches, land crossing, river crossing
11. Population increase - 10 - 15 years - 2 to 3 %
12. Health education - methods, posters
13. Standard design of GM3 reservoir
14. Reservoir
15. Difference between gate valve and a globe valve
16. Stressing use of program memorandum
17. Gravity system - problem solving
18. Evaluation - check list reservoir, user information, capturing checklist
19. Valve monitoring in community participation
20. Improvement of GM3 reservoir hangers
21. Community participation



APPENDIX C
Profile of Typical Spring Capping in Indonesia



Plan View of Typical Spring Capping



POT A-A

SKALA 1 : 20