A.I.D. Project Impact Evaluation Report No. 3

The Potable Water Project in Rural Thailand

May 1980

Agency for International Development

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THE POTABLE WATER PROJECT IN RURAL THAILAND

PROJECT IMPACT EVALUATION NO. 3

by

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PREFACE

In 1978, the Studies Division of the Office of Evaluation, Bureau for Program and Policy Coordination, undertook to appraise the impact of development projects in several sectors of A.I.D.'s program, including the rural water supply sector. This report is one such appraisal, conducted in Th -week period (from October 29 to December 4, 1979). The ev Previous Page Blank isted of a geographer and a medical anthropologist, both fr :es; it was assisted throughout the field study by Thai sanitarians. This report is being issued as part of a larger series of impact evaluations requested by the Administrator of A.I.D. in October, 1979. Together with other impact evaluations of water supply projects, the findings will be considered in the preparation of a final analytic evaluation report on the sector.

The evaluation team was assisted by a great many people. It wishes to acknowledge in particular the assistance of Vernon Scott, Chief, and Henry Merrill (both of the Office of Health, Population and Nutrition, USAID/Thailand), Chit Chaiwong (Director, Sanitation Division, Thai Ministry of Public Health), Sanguan Prathani (Chief of Sanitation Operations, Khon Kaen), Term Tavecodtr (Sanitarian, Nakon Phanom), and Nart Gsairong (Sanitarian, Lampang).

The chief provincial medical officers of the 11 provinces visited, the district health officers, sanitarians, midwives and nurses provided valuable background information on health status and practices. The water plant operators and villagers were always willing and often eloquent in explaining the history of the water system in their community.

The team also wishes to express appreciation for the assistance of all those who commented on previous drafts of this report, in particular Melvin Thorne of the Johns Hopkins University and David Dunlop of Dartmouth College Medical School, both on contract with A.I.D. Sharon Isralow deserves special recognition for her patient assistance in the preparation of the report for publication.

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SUMMARY

Overview of Goals and Achievements. The Potable Water Project was implemented between 1966 and 1972 for $4.8 million ($2.9 million A.I.D. funds and $1.9 million Thai funds). Its goals were: 1) to help the Thai government win the loyalty of rural populations in the Northeast and other areas threatened by communist insurgency; 2) to help develop a Thai capacity to plan and administer a National Potable Water Program aimed at providing piped potable water in 10,000 to 12,000 rural communities during the coming 30 years; and 3) to improve health in 600 "security sensitive" communities through provision of potable water. Now, about a decade later, it appears: 1) that insurgency is considerably diminished, although much more due to political changes than to this single project; 2) that an effective organization has planned and built some 800 systems and has proved capable of administering a national piped water program; and 3) that most communities perceive a health improvement, even though many people do not drink the water. For villagers served by the project, however, the greatest impacts are economic benefits, outcomes not anticipated by project personnel.

Project Implementation. The project was implemented by the Sanitary Engineering Division of the Thai Ministry of Public Health (MOPH) through a contract with a New York engineering firm. The water system installed in each community consisted minimally of a water treatment plant with storage tower and piped distribution system; all the systems included chlorination. Systems were installed in two types of communities: villages and "sanitary districts" (rural market towns). Communities selected for the systems were supposed to be willing to assist in construction and to develop a rate structure that would pay for operation, maintenance, and future expansion. In most villages, villagers did make financial and labor contributions; sanitary districts, in contrast, contributed treasury funds but residents did not make direct contributions. In each community a person was chosen to be trained as plant operator and thereafter to maintain the system and collect water fees.

Evaluation Sample. A two-person evaluation team visited a stratified random sample of 52 systems over the course of five weeks between October 29 and December 4, 1979. The 52 systems serve 133 communities with a combined population of approximately 110,000 persons.

Project Effectiveness. Most of the systems built under the project continue to function more than ten years after the first systems were installed. Of those visited, only seven were not functioning. Provincial governments, sanitary districts, and village committees each generally provide the necessary fiscal and operational management for their respective systems. Most systems are financially self-sufficient, with users paying full costs of maintenance and operation. With only a few exceptions, operators appear competent and motivated and have received consistent support and supervision from the Rural Water Supply Section of the MOPH. In nearly all cases where systems have not continued to function, the problem appears to have been

managerial rather than technical. The piped systems installed by this project have been more effective than the handpumps installed by earlier projects, relatively few of which have remained operative.

Health Impact. Given the absence of initial baseline data and of village-specific health data today, no statistics exist to confirm improved health in project communities. Health officials assert, however, that health status has improved, even where villagers do not drink the water because they dislike the taste. Local perceptions are that improvements have resulted in large part because the increased quantity and convenience of piped water permits more raising of vegetables and small livestock for home consumption and for sale, more frequent bathing and washing of clothing and cooking utensils, and increased use of water-sealed privies.

Economic Impact. According to villagers' responses, the project's greatest impact has been economic. Villagers are enthusiastic about ample quantity of water being reliably provided close to their homes. This results in increased water use as well as time-saving, which in turn permit increased gardening, livestock raising, and crafts production.

Benefit Incidence. Initially, community-wide access to the piped water was provided by public taps, with flat fees being charged per household or person. Virtually all socioeconomic groups benefitted equally, but not enough revenue could be collected to sustain operations. Consequently, most systems changed to metered private connections and closed most public taps; they thereby gained financial viability but no longer served all the poorer villagers. There has since been a steady increase in the number of new metered connections. In addition, many systems are extending distribution lines to areas previously unserved. The systems have eased the physical burdens of village women and children--principal bearers of water in Thailand--and have given them more time for income-generating activities. In the sanitary districts, however, it is primarily the commercial sector that benefits.

Spread and Replicability. About 250 systems were installed under the project, and the Thai government has continued to build similar piped systems, about 550 since project completion. Thai authorities say that 17 percent of the rural population is now served by piped potable water as compared to only 3 percent prior to the project.

Lessons and Recommendations. The evaluation found that successful village water systems were characterized by a set of non-technical characteristics. These include: initial community contribution of time, labor and funds; training and subsequent support for local operators responsible for maintenance; and the gradual evolution, on a community-by-community basis, of viable rate structures for delivery of water to individual households. It is additionally recommended: that piped water projects should be planned so that intended beneficiaries perceive them as bringing improvements in convenience, water quality, or water quantity; and that water projects should be considered not just for possible health gains but for their economic benefits as well.

BASIC PROJECT IDENTIFICATION DATA

1. Country: Thailand
2. Project title: Potable Water Project
3. Project number: 493-11-590-186
4. Project implementation
   a. First project agreement: FY 66
   b. Final obligation: FY 70
   c. Final input delivery: FY 72
5. Project completion--final disbursement: FY 72
6. Project funding:
   a. A.I.D. $ 2,976,185 (grant)
   b. Other donor: none
   c. Host country counterpart funds: 1,900,651
   (= 38,013,020 baht)
   Total $ 4,876,836
7. Mode of implementation:
   a. Project Agreement between USAID/Thailand and Sanitary Engineering Division (SED) of Thai Ministry of Public Health;
   b. A.I.D.-financed cost-plus-fee contract ($617,626) between SED and Tippetts-Abbett-McCarthy-Stratton engineering firm; and
   c. PASA between USAID/Thailand and U.S. Public Health Service.
8. Evaluations
   a. Regular evaluation: PAR A-1283 (July 18, 1969)
   b. Special evaluations:
      *"Evaluation of the Potable Water Project," Royal Thai Government, Department of Technical and Economic Cooperation, with assistance of Dr. George Belknap, USAID/Thailand Research and Evaluation Division (May 1969);
      *Office of the AID Auditor General, Audit Report No. 69-12 (June 9, 1969); and
      *Office of the AID Auditor General, Area Auditor General for East Asia, Audit Report No. 8-493-73-3 (July 19,1972).
9. Responsible Mission officials
   a. Mission Director: Ray M. Hill, 1969-1972
   b. Project officers: Capt. William McQuary (sanitary engineer on PASA to USAID/Thailand from U.S. Public Health Service, 1965-1968), and John W. Neave, P.E. (direct-hire, sanitary engineering advisor, 1968-end of project)
10. Host Country Exchange Rates
   a. Name of currency: Baht (฿)
   b. Exchange rate at time of project: ฿20 = $1

THE POTABLE WATER PROJECT IN RURAL THAILAND, 1966-1972

I. PROJECT SETTING: THE HEALTH SECTOR BACKGROUND[1]

A.I.D.'s major early health activity in Thailand was a malaria program which by the late 1950s had helped bring the disease under control. Subsequently, gastroenteric and diarrheal diseases were identified as the greatest health problem in rural Thailand. Over 90 percent of the rural population was estimated to be infected by waterborne intestinal parasites and approximately 60 to 80 percent of all illnesses and 40 percent of all deaths were believed attributable to waterborne diseases such as cholera, typhoid, and dysenteries.

In 1960, therefore, A.I.D. launched the Village Health and Sanitation (VHS) project. Its objectives were to provide at least one source of safe water in each village, to improve premise sanitation, to promote health education, to provide training for a corps of environmental sanitation personnel, and to carry out research for sanitation programming.

The VHS project succeeded in installing 5,000 sanitary wells and 220,000 sanitary privies and constructing 61 village water systems in the Northeast and the South, conducting 48 provincial two-week workshops for 1,187 rural sanitation personnel, and establishing two training centers capable of training 50 additional junior sanitarians per year. The project also is reported to have given orientation in village sanitation to 542 other officials and to have started village health committees and VHS self-help activities in 6000 villages. Success was compromised, however, because health education lagged behind physical improvements with the result that fundamental outlook and health behavior of the villagers remained virtually unchanged. In addition, it became impossible for the government to keep the well pumps functioning.

The need for safe water had been dramatized by a cholera epidemic in 1958-59. In 1961 the Thai government requested U.S. help in producing a 15-year plan for providing piped water systems in 412 rural communities. The potable water project was an outgrowth of this request. It got underway

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[1]Material presented here is from John E. Kennedy, "A Brief History of USOM Support to Public Health Programs in Thailand" (October 1969), and Merrill Shutt, et al., "A Brief History of USOM Support to Public Health and Population Programs in Thailand" (December 1972), both USOM/Thailand. (USAID in Thailand is also known as USOM - United States Operations Mission.) These two end-of-tour reports present an excellent overview of A.I.D. activity in this sector. No other documents do so. Such end-of-tour reports frequently present more candid and comprehensive assessments of actual developments than present A.I.D. documentation. The effort to develop an A.I.D. institutional memory should consider their reinstitutionalization.

in 1966, with initial three-year funding, and was subsequently extended until 1972. Total project cost was $4.8 million, with A.I.D. providing $2.9 million and the Thai government $1.9 million.

II. PROJECT DESCRIPTION

A. Objectives

The potable water project was part of the A.I.D.'s Accelerated Rural Development program which began in 1964 as a method of winning the loyalty of rural villagers in the parts of Thailand threatened by insurgency. The specific objectives of this project were:

- to provide piped potable water to at least one principal community (of between 500 and 10,000 inhabitants) in each of the 473 subdistricts in the security-sensitive areas of Northeast Thailand and other selected strategic communities in the North and the South until a total of 600 communities received potable water;

- to improve the Thai capability to plan, construct, and maintain a network of piped potable water systems; and

- to serve as the "spearhead and pilot project" for a much more comprehensive National Potable Water Program aimed at providing piped potable water in 10,000 to 12,000 rural communities in the next 30 years.

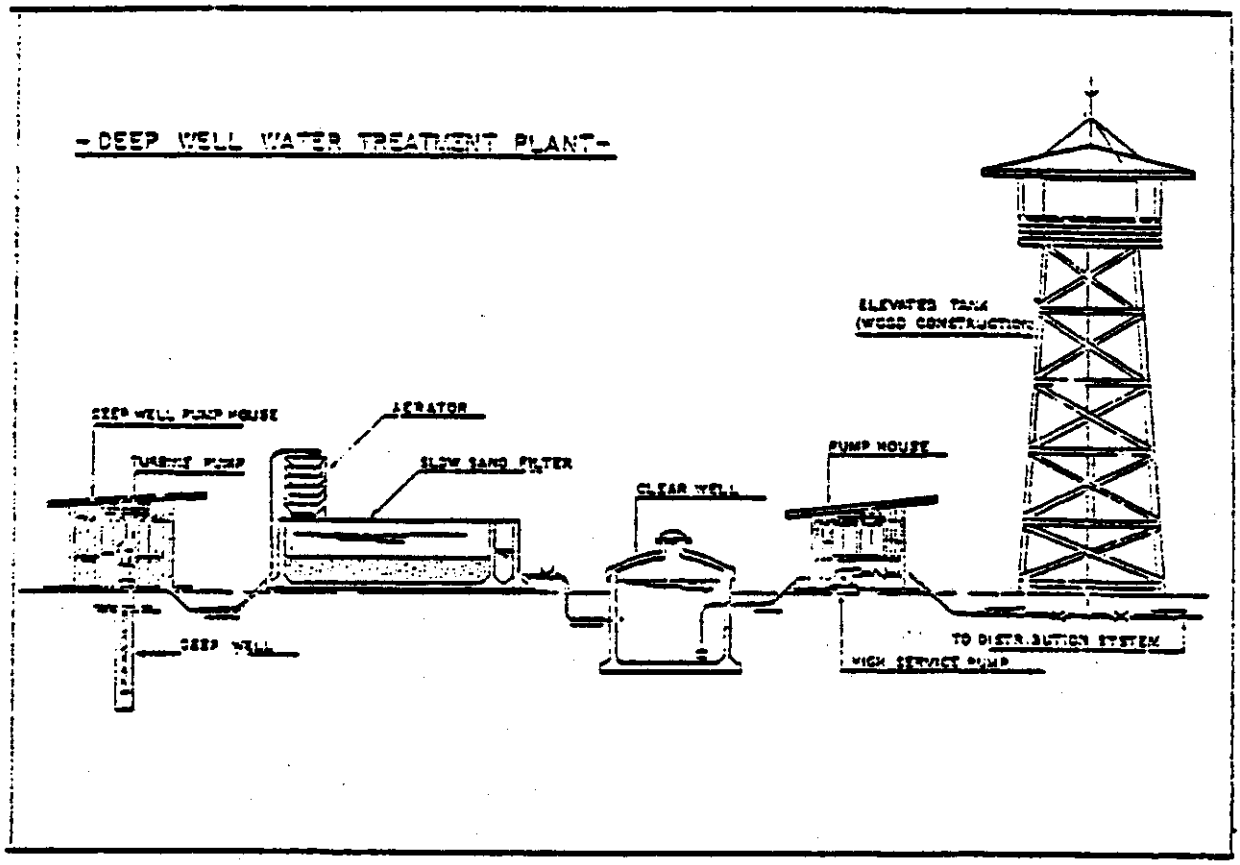
To achieve the objective of providing potable water, 250 treatment and distribution systems were to be built (some serving two or more villages in order to reach 600 communities). Each system would consist minimally of: 1) a source of water; 2) a water treatment plant providing chlorination; 3) a water storage tower; and 4) a distribution system. (See Plate 1.) The combined total population served by 1971 was to be 600,000 to one million persons. To help meet the objective of improving Thai capabilities in rural water supply, U.S. engineering training was to be provided for 10 Thai engineers and in-service training for 150 of the Sanitary Engineering Division (SED) of the Thai Ministry of Public Health (MOPH).

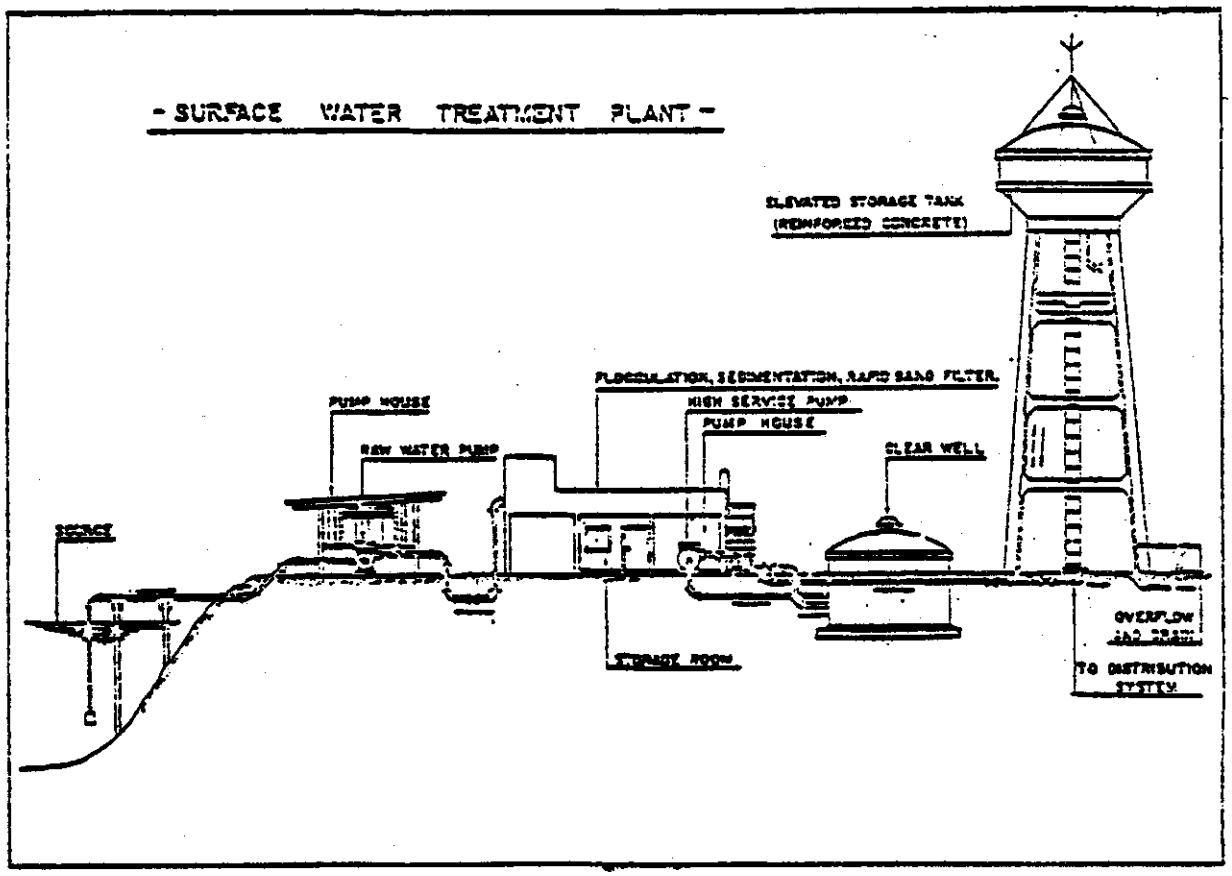
B. Implementation

In August 1966, SED signed an A.I.D.-financed contract with the New York engineering firm of Tippetts-Abbett-McCarthy-Stratton (TAMS) to provide services over the initial three-year project period. Fourteen U.S. Peace Corps volunteers, eight of whom were engineers, also collaborated in the project.

Following establishment of a field office in the Northeast municipality of Khon Kaen, 12 Thai engineers were recruited to direct operations in the six

Plate 1


- DEEP WELL WATER TREATMENT PLANT -
ELEVATED TANK
(WOOD CONSTRUCTION)
AERATOR
SLOW SAND FILTER
CLEAR WELL
PUMP HOUSE
TO DISTRIBUTION SYSTEM


- SURFACE WATER TREATMENT PLANT -
ELEVATED STORAGE TANK
(REINFORCED CONCRETE)
PUMP HOUSE
RAW WATER PUMP
HIGH SERVICE PUMP
PUMP HOUSE
CLEAR WELL
SOURCE
STORAGE ROOM
TO DISTRIBUTION SYSTEM

provinces. Six provincial teams provided technical assistance and supervision during construction and the initial period of operation. Standardized designs, based on American Water Works Association specifications were adopted for the water treatment plants. Plant capacities ranged from 10 to 50 cubic meters per hour.

Water systems were installed in two types of communities, villages and sanitary districts (rural market towns), at a ratio that was probably about two to one. Project documents state that initiative for obtaining a potable water system was to start with the villagers themselves. In fact, initiative appears to have come most often from district officials--the district officer, district health officer, or a local public health sanitarian. Villagers say that these officials held one or more meetings with the village chief and other villagers to discuss the proposed system. In the sanitary districts, district officials met with the sanitary district officials and sometimes, but not always, held a meeting to inform the general public. To be selected to receive a system a village was supposed to:

- have an existing but not potable source of water;
- be readily accessible by road;
- have a high interest in obtaining a potable water system as indicated by villagers' willingness to assist in construction; and
- be willing to develop a rate structure that would pay operation and maintenance costs and provide for future expansion.

The amount of financial contribution or self-help the villagers could provide was a significant factor in selection. By contrast, in the sanitary districts, which have taxing power, treasury funds were contributed.

In each selected village, community members chose a fellow villager to become the plant operator. Plant operators received two weeks training at one of the five potable water centers established by the project. When construction was completed, the plant and distribution system were turned over to the local government for operation and maintenance. The local government in turn usually delegated authority to the district officer or village chief or, where applicable, to the sanitary district. The newly trained operator was then responsible for proper operation of the system and, in most cases, for collecting water fees.

III. PROJECT EFFECTIVENESS

A. Functioning and Management of Water Systems

The evaluation team visited 52 communities (ranging in size from about 500 to 7,000 population) in which the project had installed potable water

systems; of these only one system no longer exists. It is difficult to determine the total number of systems ever built with A.I.D. funding. By 1972, when the project formally terminated, a total of 342 systems had been installed. Of these, perhaps three quarters were built under the A.I.D. project. The remaining one quarter, built under the Thai National Potable Water Program, nevertheless benefitted from A.I.D. standard designs, components, or trained personnel.

Most systems built under the project not only exist but continue to function effectively more than 10 years after the first systems were installed. This is contrary to previous evaluation findings that as many as half the systems were not functioning at all or were of limited use because of inability to maintain the technology or unwillingness of villagers to pay for the water. Of the 52 systems visited in this evaluation, only seven were not functioning. Of the 45 operating systems, eight no longer provide chlorination.

The provincial government agencies (PAOs), sanitary districts, and village committees each manage their respective systems and generally provide necessary fiscal and operational management.

B. Training of Community Operators

Until 1979, the Rural Water Supply Section of SED had continued to train community operators and to support and supervise them and their systems. With very few exceptions, the operators are qualified, competent, and motivated. Most were initially trained for two weeks and have received refresher training and important support and supervision, usually on a monthly basis, from Rural Water Section personnel. Nearly half of the original operators of the 45 working systems visited are still serving as operators today.

Where systems have not been effective, the reasons appear due not to technical shortcomings, but to underestimation by project planners of the importance of community participation and management aspects of maintaining and financing the systems. Technical training for operators was provided but no management training for either the operator or village leaders.

C. Financing

Most systems are completely self-sufficient financially, with users paying full maintenance and operating costs through fees collected for water delivered. Of the 45 working systems visited it was possible to obtain 1978 fiscal data on 35. Of these, 31 were operating at a profit while four were operating at a loss and had to be subsidized. Users all pay, although about 10 percent are one or more months delinquent. More meters were added last year, and at least one of the systems operating at a loss is now profitable. Water costs vary from two to five baht per cubic meter, with most systems charging three baht. This is higher than is currently charged in Bangkok but it is acceptable to users of the systems.

The users' willingness to pay the continuing monthly charges, as well as to make high initial investments for private connections, is evidence of value placed on receiving this water. Further evidence is provided by the fact that local communities have themselves evolved over the years a diversity of effective and innovative financial and operational strategies including credit plans and water-sharing schemes.

D. Per Capita Costs

The 52 systems evaluated serve 133 communities with an estimated total population of 110,000. Their cost when built was approximately 19,240,000 baht, or 175 baht ($8.75) per capita. At the conclusion of the project, A.I.D. and its contractor had estimated per capita costs at 136 baht ($6.80). The difference between the per capita cost estimates of this evaluation team and the contractor's can be explained by the decrease in the population served. The contractor assumed that the entire village population would be served by the system. This is no longer true since some persons were excluded when community taps were closed. (See Access and Equity, page 9.) Also, the contractor assumed that all systems were working. The evaluation team determined per capita costs by dividing the cost of all systems evaluated whether they were working or not by the population actually served.

E. Thai Capabilities

One project objective was to improve Thai rural water programming capabilities. This part of the project was highly successful. With A.I.D. training and related support, SED has developed the capacity to plan, design, and construct a network of potable water projects. Since project termination, at least 400 systems were completed under the national program. Most of this design and construction, as well as operator training and support, has been effectively managed by the Rural Water Supply Section established within SED. The A.I.D.-supported participant training of sanitation personnel has been a major element of this success.

Administration of rural water programs by a multiplicity of Thai agencies has caused problems. To eliminate some of the overlapping responsibilities the Thai government recently established a single coordinating body with wide powers, the Provincial Water Authority (PWA), which, over the next three years, will gradually assume responsibility for all piped water systems outside municipal Bangkok.

This new arrangement has both advantages and disadvantages. On the one hand, the fact that the central government has created such an authority, and is encouraging it to play an assertive role in providing safer water to all of Thailand during the International Drinking Water and Sanitation Decade, seems to indicate high level commitment that should assure increased fiscal continuity. On the other hand, the effectiveness of the rural piped systems has been in great part due to the continued high quality support and supervision provided by SED's Rural Water Supply Section, especially through

its monthly visits. The PWA does not have the resources to provide the same level of support. This may result in decreased effectiveness.[2]

IV. PROJECT IMPACTS

A. Health Impact--The Intended Outcome

> "Drinking shallow well water is like using heroin. Once you do it as a young boy, you become addicted for life."
>
> "It's okay to drink chlorinated water, just as long as you boil it first."

These responses by Thai villagers asked about their preferred source of water for drinking illustrate an ironic outcome of the project, namely that many villagers do not drink the water. The critical assumption on which design of this project was based was that rural people, once provided with potable water, would of course drink it. This did not always happen. Many people served by the system, including even those who have the potable water piped directly to their homes through private taps, still prefer traditional sources. This means rainwater collected from roofs into cisterns or water from open shallow wells. To most rural Thai, shallow well water tastes "heavy" and good but the piped water "too thin" and, because of chlorination, too mineraly to be potable. Boiling removes this bad taste, but water boiling is considered troublesome and according to health personnel, is not commonly done except during epidemics.

Of the 45 communities with functioning systems, there are 3 where nobody drinks the piped water. In another 11, only some of the users drink it. Younger people are more likely to drink piped water all year but older people only if traditional sources are not available, i.e., during the dry season. It is rather ironic that A.I.D.'s contractor detailed 25 specific steps leading to plant completion and then made a flying leap to a 26th step, "Villagers drinking the treated water." (See Appendix G.)

It was impossible to determine with precision the health impacts of the project. No baseline data was ever gathered for the purpose of measuring impact, nor do health statistics exist on a village-by-village basis from which judgments about impact can be made. At no level were health personnel

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[2]There is already some evidence that standards have deteriorated since the Rural Water Supply Section began discontinuing its monthly visits. In one system a small submersible pump has been installed to pump water into the distribution system prior to filtration. When asked why this was done, the plant operator indicated that he needed additional capacity because the filters were too slow. (An alternative would be to backwash the filters.) When asked if the Rural Water Supply Section had approved this, he stated that the practice had started only last month after the final visit of the Rural Water Supply Supervisor.

able to provide the evaluation team with figures on annual community-specific disease incidence for even the most recent years. Some rural facilities said they began keeping such records only in 1979. At the national level, health statistics are said to be poorer than those of other ministries.

Despite the absence of confirming statistics, the increased availability of water appears to have fostered sanitary practices that have had beneficial health impacts, including decreased skin disease and diarrhea. These sanitary practices include bathing, washing (clothes, utensils, and food before consumption), and improved infant and child hygiene.

The availability of piped water also encourages the use of water-sealed privies. In 10 of the 45 communities with operating systems all residents have (or use neighbors') water-sealed privies. In another 2 of the 45 communities, 80 to 90 percent of the population use water-sealed privies. In only 4 of the 45 do less than half the population use this method of excreta disposal.

B. Economic Impact--The Unanticipated Consequences

In the villages, the major changes brought about by the project have been economic benefits perceived by the villagers as deriving from the quantity of water delivered, directly and quite reliably, to their homes or nearby. This convenience has resulted in considerable time-saving and increased water use.

For example, a 47-year-old mother of nine related that she formerly made at least three 30-minute trips daily to haul water from a shallow well. Now, however, she pays 15 baht per month for water that is delivered directly to her home water jug and vegetable garden through a long plastic hose, which she bought for 80 baht and has ingeniously rigged up for attachment to a shared tap. Though very poor, she can afford the water fee because, with the time saved, she can weave mats that sell for an eight-baht profit.

While craft activities such as weaving were cited as a key economic benefit, increased gardening and farming was a more common response among villagers questioned about beneficial impacts of improved water systems. Responses appear in the following table:

Benefits Attributed by Villagers to the Piped Water Systems

Effects	Number of Times Mentioned		
	As First Answer	As Second	As Third
More gardening and farming	21	3	-
More "craft" activities	4	2	-
Increased convenience	4	1	1
Better health	3	-	-
Increased income	3	-	-
More animal raising	2	6	3
More outside jobs	1	1	1

In three communities respondents referred to piped water as insurance against loss of income during drought. In times of crop failure in non-irrigated areas of the Northeast, many male heads of households migrate to Bangkok for wage labor until the next planting season. According to villagers interviewed, the minor irrigation of high value crops, such as garlic and onions, as well as the increased amounts of animals raised, has had a cushioning effect and enabled more men to remain home rather than make the seasonal migration.

C. Social Impact--Changes Over Time

1. The counterinsurgency goal. Whether the project actually reduced insurgency requires more in-depth assessment than the present evaluation permits. Several earlier assessments assert, however, that A.I.D. may have conducted a "reasonably successful economic development program", but that no concete evidence exists that shows an direct relationship between economic development and villager loyalty.[3]

2. Women and children as beneficiaries. Women and children are the main bearers of water in Thailand. In those households served by piped water, women and children now have extra time that is generally used for activities--such as weaving and gardening--to either generate income or raise the household subsistence level. These activities were said to be less menial than waterbearing. "Women prefer raising vegetables and weaving," it was said, "because it is not so boring and it lets them use their brains." "Insufficient water" was the major work problem experienced by respondents in a recent survey of Thai women in two communities not served by the project.[4]

3. Access and equity. Originally, most of the systems provided community-wide access to water through public taps. Nearly everyone benefitted except those who lived far from the main distribution lines. The schedule for collecting revenues was usually a flat fee per household or person. Payments lagged, however, in most communities with the result that operating costs were not met. Consequently, in an effort to establish financial viability, the managers of most systems eliminated public taps in favor of metered private connections. These cost between 300 and 450 baht for installation and about 3 baht thereafter per cubic meter of water used. Conversion from public to private taps meant that some villagers originally served by the project no longer had access to the piped water. Not surprisingly, these were usually the poorer villagers.

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[3]R. Sean Randolph, "The Limits of Influence: American Aid to Thailand, 1965-70", Asian Affairs, vol. 6 No. 4, March/April, 1979, p. 251; and J. Alexander Caldwell, American Economic Aid to Thailand (Lexington, Mass.: Heath Lexington Books, 1974), p. 40.

[4]Nantanee Jayasut, et al., "Survey Report: Status of Thai Women in Two Rural Areas" (Bangkok: National Council of Women, Sept. 1977), p. 49.

Since the public taps were closed, the number of metered connections has continued to increase. Almost all systems visited report annual increases in the number of meters and amount of water delivered. In addition, in many communities distribution networks are being extended to areas previously unserved. Finally, some communities still retain some public taps, and formal or informal meter-sharing does take place. Approximately half the systems visited by the evaluation team serve between 90 to 100 percent of the community through a combination of meter-sharing and a few public taps.

D. Environmental Impact

The provision of domestic water supply has facilitated a more hygenic household environment, encouraged the use of water-sealed privies, and permitted more household gardens. No drainage or water stagnation problems were encountered. Sanitary districts where population density is high and where waste water might be expected to be a problem all have surface water drains.

V. SPREAD AND REPLICABILITY

In addition to the above findings, it should be noted that the Thai government has adopted the goal of installing piped water systems in rural villages throughout the country. Since completion of the 250 or so systems installed under A.I.D.'s potable water project, the Thai National Potable Water Program has brought this to nearly 800 systems, of which a large proportion were built according to the A.I.D. contractor's basic designs. As already noted, benefits are now spreading within the earlier A.I.D. project communities as more and more people continue to hook up privately to the now largely financially viable and effectively functioning systems. It is said that 17 percent of rural Thais are now served by piped systems, most providing chlorinated water, in contrast to only 3 percent prior to the project.

VI. LESSONS LEARNED

A. Sources of Success

1. Prior sectoral activity and training. A.I.D.'s previous health activity in rural Thailand, especially its support to village health and sanitation, was a major element in this project's achievements. The participant training in U.S. institutions given to Thais under this and the earlier projects provided an important cadre of highly motivated, well-trained professionals eager to work with A.I.D. and committed to improving health and the

quality of life in rural Thailand. Of Thais sent to the U.S. for training related to sanitation, virtually 100 percent have returned.[5]

2. Community participation. Systems for which communities contribute substantial amounts of money and labor generally succeeded, whereas those for which contributions were only minimal, or were made by government bodies, tended to fail or to meet needs of only the community elite. District officers appear to have played key roles in stimulating the interest of village chiefs, which then resulted in participation of villagers.

3. Supervision and support. The high continuation rate of community operators has been critical. Essential for this have been decentralized support systems. This includes both the regional field headquarters established for systems design, personnel training, water testing, and warehousing of commodities, and also a hierarchy of district, provincial, and regional health, sanitation, and local government offices with good communication networks from which the operators can secure advice, assistance, and equipment. The Rural Water Supply Section of SED has been extremely effective in providing support and is probably responsible for the improvements that have occurred since previous evaluations.

4. Appropriate Technology. Appropriate technology does not always mean "low-level" technology. Complex water treatment and distribution systems are working while few handpumps provided under a previous project are still functioning. One reason why the relatively complex technology succeeded and a simpler solution failed is perceptions of the users; the piped systems are seen as an improvement over more remote sources whereas few users regard the handpump as an improvement over the commonly used rope and bucket.[6]

5. Local initiative and innovation. Many project villages have demonstrated considerable innovativeness in coming up with and sustaining various credit, sharing, and distribution schemes. Villagers' primary motivation was the potential convenience and economic gain of piped water. Both this innovativeness and the underlying motivation were apparently unanticipated by project planners but were crucial in offsetting the weaknesses in project design described below.

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[5]Throughout, the present evaluation was assisted by Thai graduates of U.S. degree programs. Conversation over tea one morning in an outpost north of Bangkok found eight U.S. universities represented by Thais present. They noted that sanitation is a field in which trainees studying in the U.S. return, whereas those sent to the U.S. in medicine frequently do not.

[6]For a more complete disscusion of the subject, see Appendix I, "Suggestions to A.I.D. for Future Water Activity in Thailand."

B. Negative Findings

1. Equipment. The A.I.D.-furnished Onan engines proved to be a disaster. They broke down, and spare parts were difficult to obtain. Many have since been replaced by Japanese or British engines.

2. Maintenance. Failure to include an adequate maintenance component in the project design resulted in failure or inferior performance of systems that were essentially technically sound.

3. Financing. Failure to base project design on any reasonable plan for post-project financial viability also resulted in the inferior performance of systems that were technically sound. The assumption that operating costs could be met by collecting revenues from public facilities proved wishful thinking. It resulted in difficult periods for communities as they converted to private metering to achieve financial viability, which in turn deprived poorer villagers of access to the water that originally had been made available to them by the project.

4. Beneficiaries. In the market towns systems were frequently superimposed by external authorities with the result that the commercial sector and community elites captured the benefits of the systems to the virtual exclusion of the poorer majority. Poorer villagers were also excluded when wealthier villagers captured the benefits during conversion to individual metering.

VII. RECOMMENDATIONS

A. General Recommendations

1. Training. The value of U.S. participant training should be assessed according to established "rates of return"--e.g., nearly all Thai sanitation trainees have returned (and are active in the sector) whereas Thai physicians have not. At the community level, personnel responsible for sustaining operations must be adequately trained. Training cannot be a one-time event. Levels of performance after training must be monitored.

2. Community participation. Vague statements in project papers should be replaced by strategies, based on firm socioeconomic analysis of community decision-making and resource allocation, for ensuring that community members will actually perceive there is something to be gained by giving time and money to the project.

3. Supervision and institutional support. Functioning and effectiveness must be supervised at all levels. Supervisors should be equally prepared to praise good performance as to correct inadequate performance. Supervision must be regular and frequent. Given that the Rural Water Supply Section of SED no longer has supervisory responsibility, those interested in the continued functioning of the piped water systems should monitor effectiveness during the transition to management by the Provincial Water Authority.

4. Commodities. U.S. commodities furnished should be equal to or better than their equivalents manufactured in other countries; otherwise A.I.D. should allow purchase of foreign commodities.

5. Impact. A.I.D. and Congress should recognize that project termination is frequently, if not usually, too soon to be able to see impacts upon beneficiaries. Time lapse is necessary for project outputs to adjust themselves and become part of community life; only then can more definitive impacts be observed, even if not directly measurable. This means recognizing the need for ex-post evaluation.

6. Institutional memory. Missions should be encouraged to develop libraries such as USAID/Thailand's. End-of-tour reports should be reinstitutionalized--not as an onerous requirement, but as a means to improve professionalism and learning from past experiences.

B. Recommendations Specific to Water Projects

1. Convenience. Water provided by A.I.D.-supported systems should always be more convenient than sources already in use. Likelihood of acceptability is otherwise low.

2. Quantity. Abundance of water should be recognized as a major benefit that permits improved diet and sanitary practices leading to better health--even if the water is not used for drinking.

3. Evaluating health impact. While the health of a population may improve as a result of a particular intervention, the difficulties and cost of accurately measuring the improvement are certain to be great. Proving health impact will remain impossible unless data are systematically gathered on a village-by-village basis rather than only at the clinic or health post level.

4. Rationale for water projects. The present A.I.D. rationale for financing rural water supply projects on the grounds of improved health should be reexamined given the difficulty of accurately proving health impact. It may be that economic impact may be a stronger justification and that water should be considered instead as an investment in rural infrastructure.

5. Financing and Equity. All project papers for A.I.D.-installed water systems should include carefully detailed plans that will assure the meeting of recurrent costs after A.I.D. funding has terminated.

These plans should also ensure not only the necessary funds for operation of the system, but also assure that the entire community is serviced. Planners should consider universal metering coupled with an increasing block rate tariff schedule, which would provide the first units of water at low prices and increasing costs per unit for increased volume delivered. The poor of the community would thus receive service at low prices while those who wanted and used larger amounts would pay the major part of the costs.

Credit programs permitting poorer community members to partially defer payment for meter installation should also be considered as should metered water-sharing schemes.

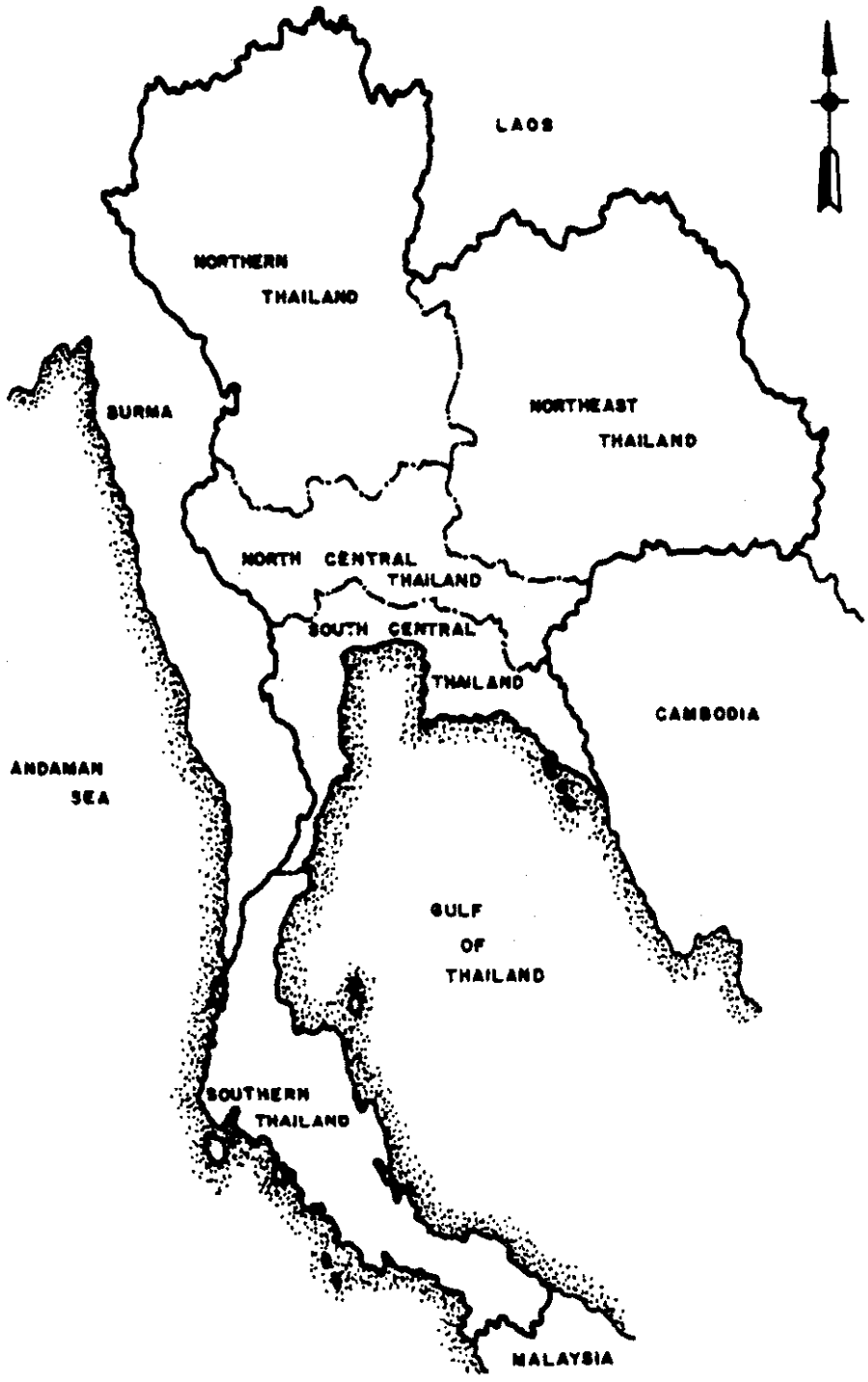
6. Incremental Steps. Planners should seek to develop projects in which the technology represents an incremental improvement over the existng level and can offer the prospect of further step-by-step progress. Any system that would offer an incremental improvement would need to displace a present source and be perceived as offering either better quality, greater quantity, or more convenience. It may be, for example, that hand pumps for shallow wells are not perceived as enough improvement to warrant the effort to keep them functioning--in contrast to the systems installed by this Thai water project.

APPENDIX A

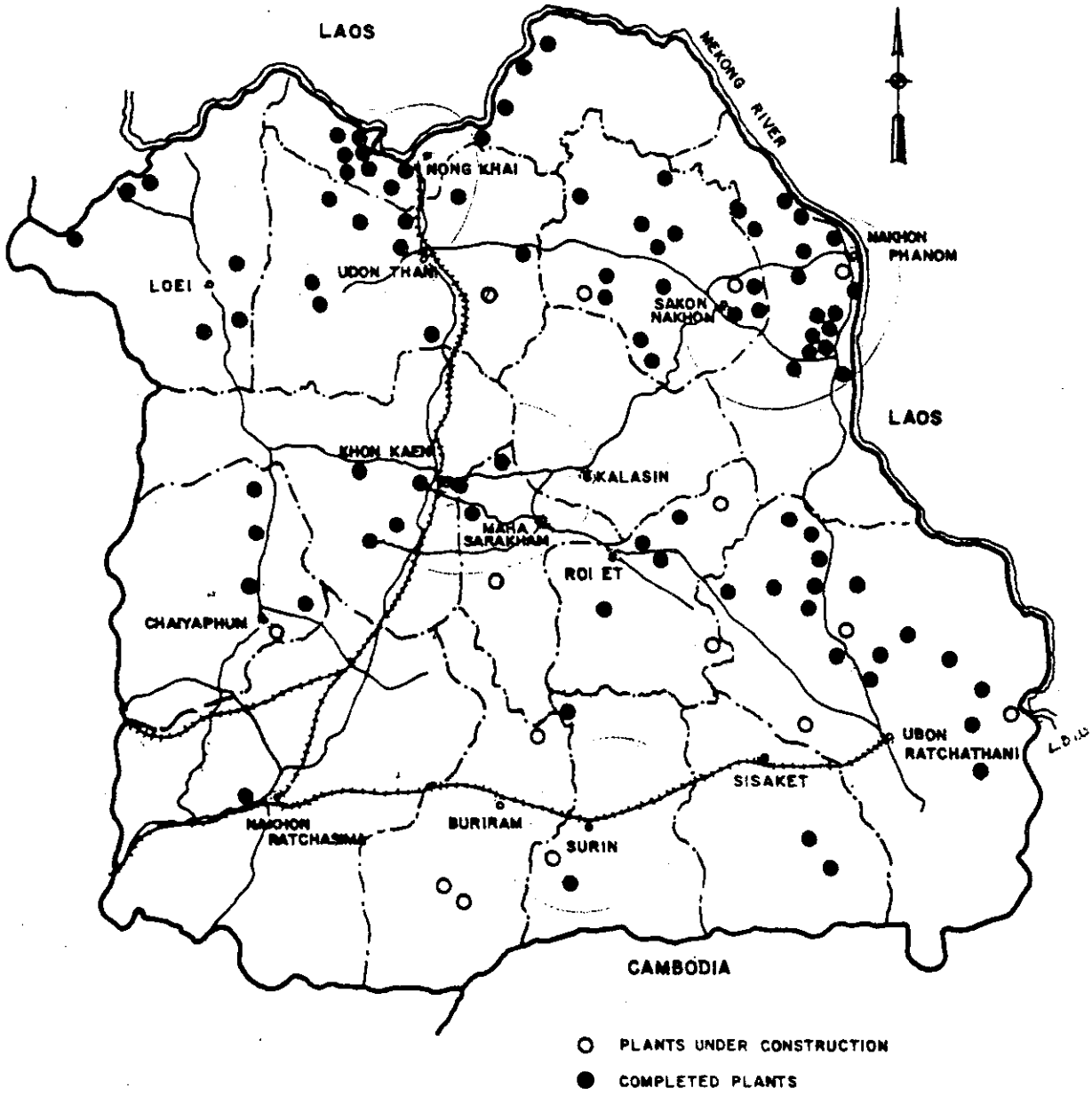
MAPS:

LOCATION OF SYSTEMS INSTALLED BY THE PROJECT

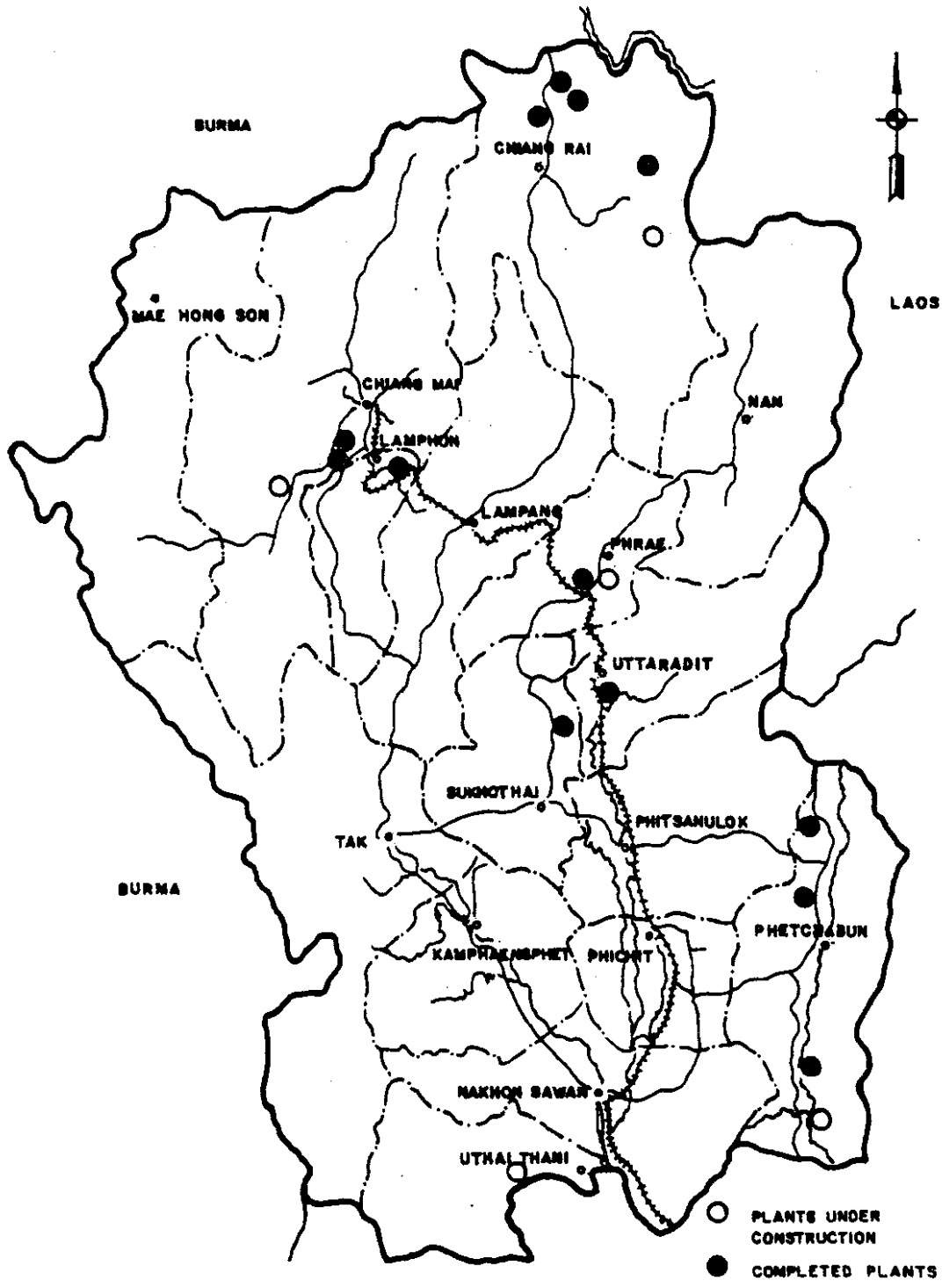
Source: Tippetts-Abbett-McCarthy-Stratton, "Community Potable Water Project Final Report, August 1969," New York and Khon Kaen.



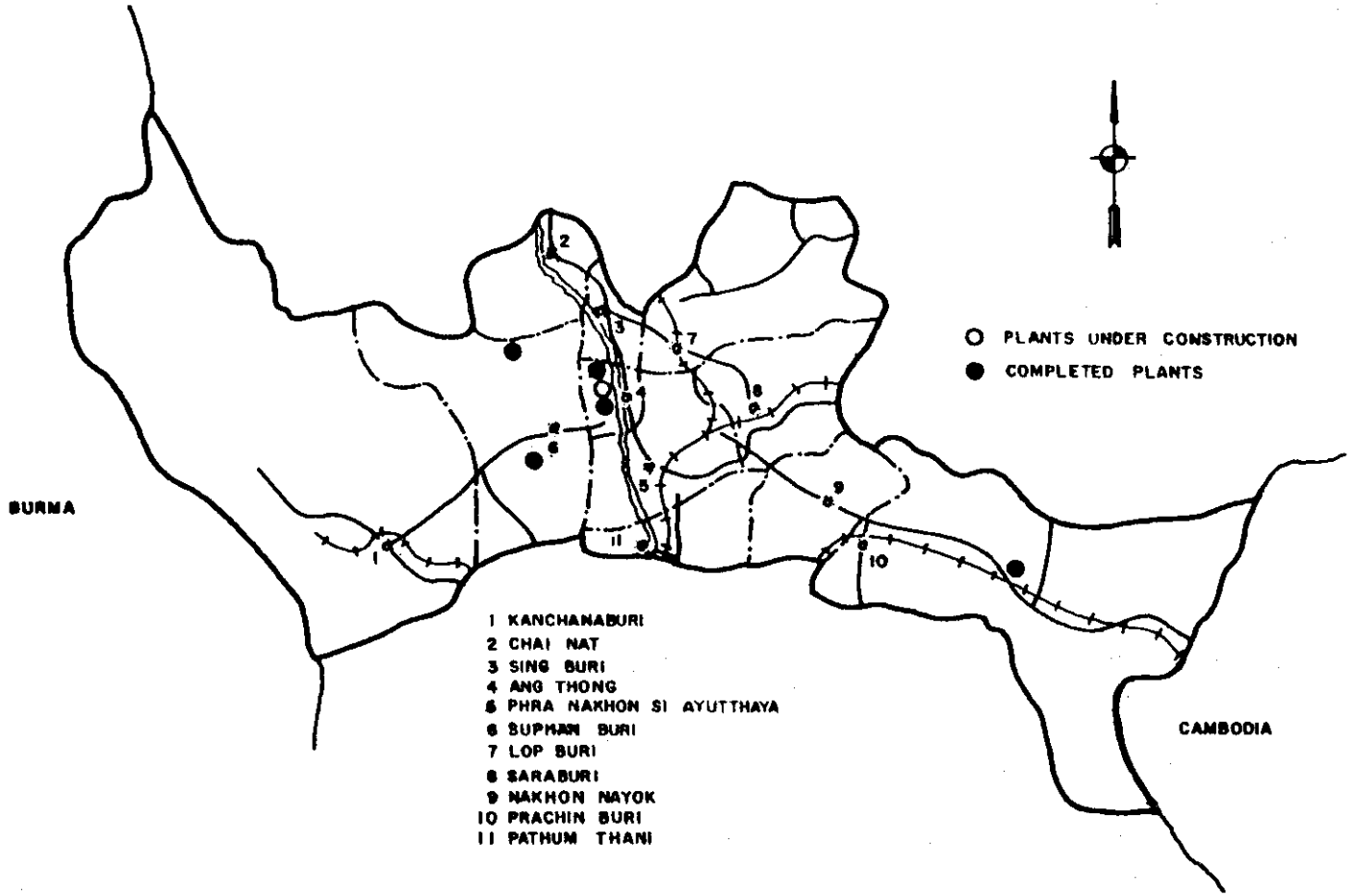
MAP OF THAILAND



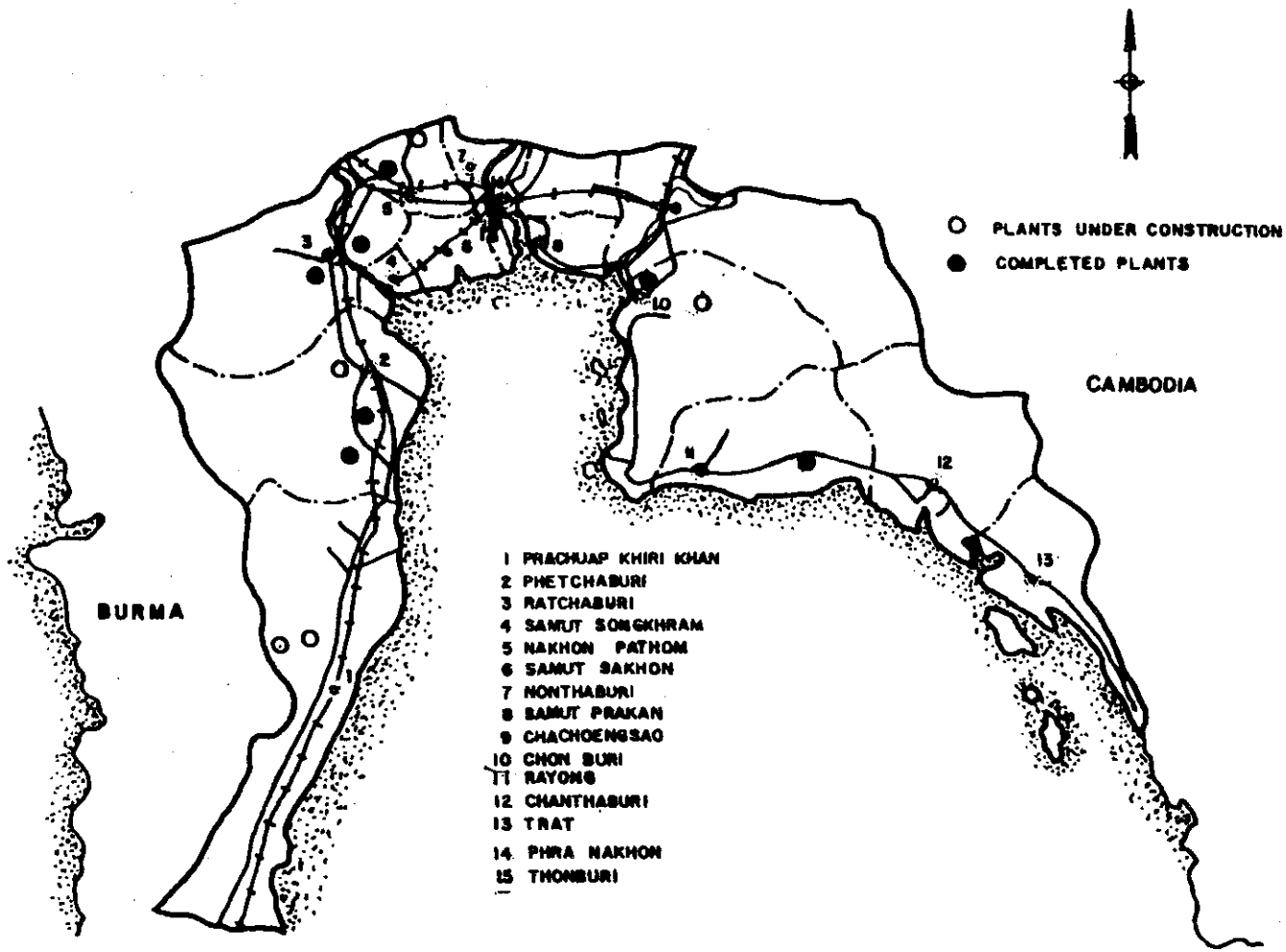
MAP OF NORTHEAST THAILAND



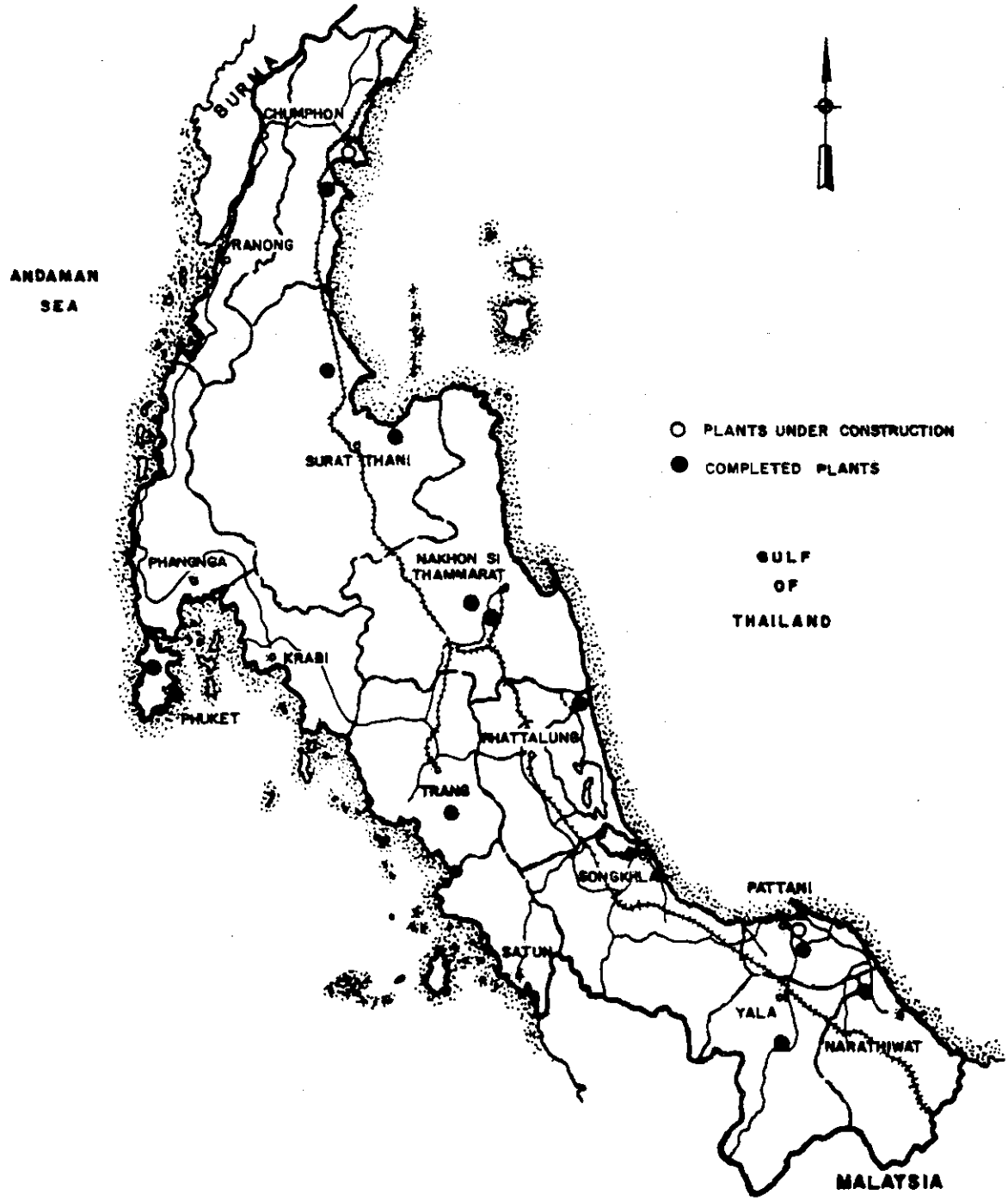
MAP OF NORTHERN THAILAND



- MAP OF NORTH CENTRAL THAILAND -



- MAP OF SOUTH CENTRAL THAILAND -



MAP OF SOUTHERN THAILAND

APPENDIX B

SYSTEMS VISITED

Appendix B

SYSTEMS VISITED

Province	Community	Date of Visit
Khon Kaen	Ban Tha Phra	November 3
	Ban Kut Kwang	November 3
	Ban Phra Ku	November 4
	Ban Fang	November 5
	Ban Nong Ta Kai	November 5
	Ban Nong Rua	November 5
	Ban Lawa	November 5
	Ampur Mancha Kiri	November 6
	Ban Phong Sawang	November 6
Sakon Nakon	Ban Tha Rae	November 7
	Ban Ba Hi	November 8
	Ban Kok	November 8
	Ban Phang Khon	November 8
	Ban Rai	November 8
Nakom Phanom	Ban Na Khok Kwai	November 9
	Ban Atsamarat	November 9
	Ban Tha Champa	November 10
	Ban Tai	November 10
	Ban Phon Swan	November 10
	Ban Tha Kho	November 11
	Ban Saen Phan	November 11
	Ban Nam Kham	November 11
Ubon	Ban Yang Cha	November 12
	Ban Amnat	November 12
	Ban Khamin	November 13
	Ban Don Wai	November 14
	Ban Nam Plick	November 14
	Ban Dong Bang	November 14
	Ban Non Pho	November 14
	Ban Koeng Nai	November 15
	Ban Tha Hi	November 15

Province	Community	Date of Visit
Chiang Mai	Ban Khun Kong	November 18
	Ban Hat Sai Thong	November 18
Lamphun	Ampur Mae Tha	November 19
	Ampur Uwar	November 19
Chiang Rai	Tambon Mae Chan	November 20
	Ban Mae Suai	November 20
	Ban San Sai	November 21
	Ban Mae Kham	November 21
	Ban Tha	November 21
Prayao	Ampur Chaing Kum	November 21
Rayong	Ban Tang Kuien	November 26
Udon Tbani	Ban Non Sa-at	November 28
	Ban Muang Phruk	November 28
	Ban Na Kha	November 28
Nong Kai	Ban Wiang Khuk	November 29
	Ban Thon	November 29
	Ban Kong Nang	November 29
	Ban Mo	November 29
	BAn Nong Sawang	November 29
Pretchup Kiri Kan	Ban Rai Bon	November 30
	Ban Phrong Kasang	November 30

APPENDIX C

METHODOLOGY

APPENDIX C

METHODOLOGY

The evaluation team consisted of a geographer and a medical anthropologist from AID/Washington, and a sanitarian from the Thai Ministry of Public Health. It was assisted throughout and accompanied for part of the field visits by a Thai national, assistant project officer of USAID/Thailand. In each region the team was joined by a chief regional sanitation officer, who provided local transportation and spoke the local dialects. The field portion of the evaluation lasted six weeks. Vehicle fuel costs were paid by AID/Washington.

The selection of systems visited by the team was made from the final report of the U.S. consultants to the project.[1] This report listed 212 systems completed, under construction, approved, or with the design completed as of 1969. A random sample was drawn from these 212 systems and stratified by province. Whether or not the system had actually been constructed was determined by consulting a list compiled by the Ministry of Public Health of all rural water systems built in Thailand.[2] Sample selection was modified to eliminate those systems that did not cluster geographically for daily visits. Fifty-two systems serving 133 communities with a total population of approximately 170,000 persons were evaluated. Of these, 15 were located in sanitary districts and 37 in villages.

A standardized interview schedule (Appendix D) was administered at each of the sites. Respondents usually included the system operator, the village chief, village leaders, and other villagers.

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[1]"Community Potable Water Project Final Report," Tippetts-Abbett-McCarthy-Stratton Engineers and Architects, August 1969, New York and Khon Kaen.

[2]"List of Rural Water Systems, B.E. 2509-2521 (1966-1978)," Rural Water Division, Ministry of Public Health, Bangkok.

APPENDIX D

VILLAGE-LEVEL DATA SCHEDULE

Appendix D

VILLAGE-LEVEL DATA SCHEDULE[1]

Date of field visit: Country
Team:
Project name:

Village Data:
Name
Region
District
Other designation
Population: Families Persons:

Physical Characteristics:
Elevation
Terrain
Rainfall amount (specify units)
Rainy months (circle) J F M A M J J A S O N D
Dry months (circle) J F M A M J J A S O N D

Settlement Patterns:
Discrete village
Discrete village and dispersed population
Dispersed population and rudimentary village
Dispersed population
Other (specify)
Segment served by improved supply

1. Describe each improved source of supply (include source, distribution, number of taps, accessibility, water quality, and present use).

2. Describe the traditional water sources (include accessibility, reliability, water quality, and present use).

3. For each improved source:
    a. Source of idea:
        1. villagers
        2. local leaders
        3. government officials
        4. foreign project personnel
        5. other (specify)
    b. Who did planning?
    c. Was community involved and how?

[1]Actual schedule was 15 pages in length thus allowing space for answers.

d. Major issues?
e. Did the community understand what was going to happen?
f. How long after planning did project start?
g. When completed?
h. Did beneficiaries make any commitment?
i. Is water quality good, acceptable, poor?
j. Are water outlets convenient?

4. What is the planned availability of water at individual taps?

5. How does this differ from original project plans?

6. What is the percentage of time water was not available (during scheduled periods of availability) last year?

7. What percentage of the time (on the average) is water not available (during scheduled periods of availability) on a daily basis?

8. What percentage of the taps are currently working as scheduled?

9. Functioning of taps:
   a. Percentage of taps that are always working
   b. Percentage of taps that are never working
   c. Percentage of taps that are operating some of the time
   d. Percentage of taps that are functioning on a regular basis for only some part of the day.

10. Reasons for non-functioning taps (as percent of time not functioning):
   a. Lack of pressure
   b. Broken distribution pipe
   c. Broken tap
   d. Other

11. Describe the maintenance procedure and problem history of each improved source.

12. Who has the primary responsibility for maintenance of system?
   a. Local person_____
   b. Water committee_____
   c. Government_____

13. Is there a local maintenance person?

14. How is the person paid?
   a. Paid for each job _____
   b. Paid salary _____
   c. Not paid _____
   d. If "c", what was the incentive offered?

15. Is there a local supply of spare parts?

16. If maintenance of system requires outside help, how is this paid?
    a. Not paid_____
    b. Paid for by job_____
    c. Part of government service_____

17. If maintenance requires spare parts, how are these paid for?
    a. Not paid_____
    b. Paid by item_____
    c. Part of government service_____

18. How often is maintenance done?
    a. Routinely_____
    b. When there is a breakdown_____

19. If a problem occurs, how is the person or agency responsible for maintenance informed?

20. If spare parts are required, where are these obtained?

21. How long does this take?
    a. On the average_____
    b. As a maximum_____

22. Is there a charge for water?

23. What is the charge (or tax) for water by household and per year?
    a. In the case of a public source_____
    b. For private connection_____
    c. There are no charges_____

24. How are the charges calculated?
    a. By the cost of the installations_____
    b. By the ability of the villagers to pay_____
    c. By the quantity of water used_____
    d. By predetermined standards_____
    e. By the type of service obtained_____

25. Last year, what percentage of the charges was collected?

26. Source of water

	Wet Season		Dry Season	
Use	Actual	Preferred	Actual	Preferred
Drinking				
Cooking				
Bathing				
Laundry				
Water for Animals				
Minor Irrigation				

27. Explain difference between actual and preferred.

28. How has improved water source(s) affected community water use? (Include time saving and increased use.)

29. If there is time saving, how is it used?

30. How is waste water used or disposed of?

31. Have the villagers been instructed on the health benefits of clean water? If so, by whom?

32. Has the health of the community changed since the improved water source was provided? (Note particularly skin and intestinal problems.)

33. Are there other project benefits or disbenefits?

34. How is excreta disposed of?
    a. Are there latrines?
    b. Are they used?

35. How important do villagers regard organization activities?
    a. Very important
    b. Somewhat important
    c. Not important

36. Was a distinct formal organization developed for the project?
    a. Name of organization
    b. Starting date

37. Is this organization still active? If not active, ask for:
    a. Past function
    b. Past membership structure
    c. Reason for not being active

38. List active organizations (include formal water organization)

Organization	Function	Leadership	Structure	No. Members	
				M	F

39. Which were most valuable in initiating or supporting the project? (Probe if there were other organizations not active today but important formerly; get function and reasons for not being active.)

40. When did the organization(s) get involved in the project? Specify which organization(s) and which project, if more than one.
    a. At planning stage
    b. At start-up stage
    c. At implementation stage (specify construction, maintenance, etc.)
    d. Other:

41. What is the composition of the organization? (Probe to get characteristics of participants and leader(s) in terms of economic status, ethnicity, political power, education, and age.)

42. What is the organization(s) specific function? (Maintenance, supply, etc.)

43. Does the organization(s) keep records?

44. How often has the organization met in the last six months?

45. How does the organization relate to other sources of authority in the village?

46. What ethnic, religious or other similar distinctions exist in the village?

Note: the objective of 47 and 48 is to determine distribution of economic resources. Obtain data for total landholding, agriculture machinery, and livestock from regional authorities.

47. Landholding (specify units)
    Largest_____
    Smallest_____

48. Livestock (specify types and units)
    Most_____
    Least_____
    Most_____
    Least_____
    Most_____
    Least_____
    Most_____
    Least_____

49. Does largest landholder(s) or livestock owner(s) have particularly desirable location vis-a-vis the improved water source?

50. Does above person(s) have ability to control distribution of water?

51. How important is this project for the villagers?

APPENDIX E

PERSONS CONSULTED

Appendix E

PERSONS CONSULTED

Term Taucodtr
Chief of Sanitation Section
Nakon Phanom

Dr. Banyat Atiburanakul
Provincial Chief Medical Officer
Nakon Phanom
Nakon Srisuwan
Deputy District Health Officer
Amnatjairon District
Ubon Ratchathani

Previous Page Blank

Dao Keokraisorn
Sanitarian Region 3
Nakon Ratchasima

Dr. Bonkit Prapaprasurt
Deputy Provincial Chief Medical Officer
Ubon Ratchathani

Dr. Yanyoong Pootrakul
Provincial Chief Medical Officer
Ubon Ratchathani

Pateep Siribodhi
Director of Sanitation Center Region 5
Health Department
Ministry of Public Health
Lampang

Dr. Anam Rabsompop
Deputy Provincial Medical Officer
Chiang Mai

Chetpan Karnkaew
Director
Rural Water Supply Division
Department of Public Health
Bangkok

Catherine Deaks
UNICEF
Bangkok

Csusakdi Wongsuwan
Chief of Operations and Promotion
Sanitation Division Region 4
Department of Public Health
Khon Kaen

Sanguan Phrathani
Chief of Sanitary Operations
Sanitation Division Region 4
Department of Public Health
Khon Kaen

Suchin Yoosawatdi
Director of Sanitation Center Region 4
Health Department
Ministry of Public Health
Khon Kaen

Sarasin Adyyanondha
Chief of Water Supply Section I
Sanitation Center Region 4
Khon Kaen

Uathana Kammuang
Chief of Administration Section
Sakon Nakon

Dr. Chana Kumboonrat
Deputy Director General
Department of Health
Ministry of Public Health
Bangkok

Chit Chaiwong
Director Sanitation Division
Ministry of Public Health
Bangkok

Previous Page Blank

Pricha Chulauachana
National Officer
UNICEF

Dr. Swish Rasdjarmreansook
Provincial Health Officer
Rayong

Dr. Kujchai Yingsery
Provincial Health Officer
Chiang Rai

Charles S. Pineo
Consultant
Bethesda, Maryland

Rifat Barokas
New World Planning Corporation
Newton-Upper Falls, Massachusetts

Suang Liamrangsi
Sanitation Scientist
Sanitation Division
Ministry of Public Health
Bangkok

Arthur Bruestle
World Bank
Washington D.C.

J. K. Robert England
Assistant Regional Representative
UNDP Bangkok

Chatchai Ppongprayoon
Chairman Department of Geography
Chulalongkorn University
Bangkok

Maximiliano Cox
World Bank
Washington D.C.

Boleslaw Jan Kukielka
WHO Team Leader
Environmental Health Project
Bangkok

Lert Chainarong
Deputy Governor
Provincial Waterworks Authority
Bangkok

Vernon R. Scott, Chief
Office of Health, Population
and Nutrition
USAID/Thailand

Henry D. Merrill
Office of Health, Population
and Nutrition
USAID/Thailand

David Oot
Office of Health, Population
and Nutrition
USAID/Thailand

Somchit Yatarohit
District Health Officer
Maesuai
Chiang Rai

Charus Tebboon
Deputy District Health Officer
Maesuai
Chiang Rai

Swai Sungsiri Pong
District Health Officer
Terng
Chiang Rai

Dr. Anan Fongsri
Provincial Chief Medical Officer
Pra Yao

Thongyoad Promsen
District Health Officer
Dok Tum Tai District
Pra Yao

Kumjohn Yongyut
District Health Officer
Klang District
Rayong

Surachard Suriyachot
Director of Sanitation Center
Region 2
Chon Buri

Dedduong Intaro
Sanitarian, Region 2
Chon Buri

Dr. Tatan Phunpoo
Provincial Chief Medical Officer
Udon Thani

Niponth Sriboonroung
Chief of Sanitation Section
Nong Kai

Suwan Ngamsutdi
Acting Director of Sanitation Center
Region 7
Rat Buri

Saman Koolat
Sanitarian
Region 7
Rat Buri

Dr. Charoong Charoenpitaks
Regional Health Inspector
Eastern Region

Nart Gsairong
Sanitarian
Lampang

Bonson Pondi
Provincial Chief Medical
Officer
Nong Kai

Charon Benchawisanu
Acting Director
Provincial Water Authority
Khon Kaen

Richard J. Frankel,
SEATEC International
Consulting Engineers
Bangkok

Khun Palibool
Director of Rural Water
Supply Region 4
Khon Kaen

Uinai Manakics
Deputy District Health
Officer
Phang Khon
Sakon Nakon

A-ngoon Hongnuson
Senior Geologist
Department of Mineral
Resources

APPENDIX F

AUDITOR GENERAL'S 1972 REPORT, AND COMMENTS

Appendix F

AUDITOR GENERAL'S 1972 REPORT, AND COMMENTS

One of the documents reviewed prior to field visits was the 1972 Terminal Audit Report by AID's Office of the Auditor General for East Asia. The auditors report having visited 22 systems of which 11 were found inoperative. The present evaluation team visited 7 of those 22 systems. Of the 11 systems identified in the 1972 audit as out of order or abandoned, 4 visited by this evaluation team are currently functioning. For example, Ban Amnat in Ubon Province, which was listed by the auditors as abandoned in 1971, is currently providing water on a regular basis to residents in five villages. According to the Ban Amnat operator and villagers, the longest this system was ever out of operation since its inception was one month. Likewise, the other three systems (Ban Phra Kue, Ban Kud Kwang, and Ban Na Kok Kwai), are also now operating. Three systems listed in the 1972 report as being in only limited operation (Ban Rai, Ban An Yor, and Ban Pang Kone) are now in full operation. Sections of the 1972 report which discuss the Potable Water Project constitute the remainder of Appendix F.

AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

OFFICE OF THE AUDITOR GENERAL
AREA AUDITOR GENERAL - EAST ASIA

AUDIT REPORT

USOM/THAILAND

WATER RESOURCES PROJECTS

POTABLE WATER PROJECT
NO. 493-11-521-186

LABOR INTENSIVE WATER RESOURCES PROJECT*
NO. 493-11-120-206

Period Covered by Audit: Terminal
As of March 31, 1972

Audit Report No. 8-493-73-3

Date Report Issued: JUL 19 1972

*Sections concerning this second project, which was not included in the present evaluation, have been deleted.

AUDIT REPORT

USOM/THAILAND

WATER RESOURCES PROJECTS

POTABLE WATER PROJECT
NO. 493-11-521-186

LABOR INTENSIVE WATER RESOURCES PROJECT
NO. 493-11-120-206

I. SCOPE OF EXAMINATION

We have performed a terminal audit of two water resources projects, Potable Water Project No. 493-11-521-186 and Labor Intensive Water Resources Project No. 493-11-120-206, both administered by the USOM Office of Field Operations (O/FO). The audit was performed in accordance with the provisions of AID Manual Order No. 793.1, "Audit of Technical Assistance", for the purpose of reviewing project implementation, verifying compliance with agreement terms and applicable AID regulations. The audit included a review of records maintained by USOM and Government of Thailand (RTG), discussions with USOM and RTG officials, visits to various project sites and other audit procedures deemed necessary. We visited a total of 30 RTG offices and establishments located in three major cities (Bangkok, Khon Kaen, Nakhon Ratchasima) and throughout nine changwats (provinces): Nakhon Ratchasima, Khon Kaen, Udon, Sakon Nakhon, Nakhon Phanom, Ubon, Yasothron, Roi Et, and Maha Sarakham. The audit covered the periods January 1, 1969, to March 31, 1972 (Potable Water Project) and June 30, 1968, to March 31, 1972 (Labor Intensive Water Project).

Significant matters disclosed by the audit are presented in Section V, Findings and Recommendations. Major findings are summarized in Section III.

II. BACKGROUND INFORMATION

Potable Water Project No. 493-11-521-186

This project was initiated April 27, 1966, for the purpose of assisting the Sanitary Engineering Division (SED), Ministry of Public Health, to develop the capacity to plan, design, construct and maintain a network of potable water systems in the Accelerated Rural Development (ARD) changwats. The project aimed to construct, by 1971, approximately 250 water systems reaching 600 villages and a population to 600,000 to 1,000,000.

Since inception, the project has been administered by three USOM offices: Office of Health and Population Planning (O/HPP), April 1966 through CY 1967; Office of Economic Development and Investment (O/EDI), CY 1968 through the first quarter of 1970; and Office of Field Operations (O/FO), since the 2nd quarter of 1970. U.S. dollar assistance to the project ended with the FY 1970 Project Agreement (ProAg). AID assistance to the project consisted of U.S. advisory services, participant training, commodities, and an AID-financed contract (No. AID-493-14) with Tippets, Abbett, McCarthy, Stratton (TAMS). The AID-financed, cost-plus-fee contract ($617,626) was executed August 17, 1966, between the RTG and TAMS for the purpose of TAMS providing engineering advisory training to SED personnel, and was completed on August 16, 1969.

The financial status of the project as of March 31, 1972, was:

	Obligated	Accrued Expenditures	Balance
U.S. Contribution	$ 2,992,253	$ 2,976,185	$ 16,068

	ProAg Budget	Withdrawn	Expenditures
RTG Contribution - Counterpart Funds (฿20 equals $1.00)	฿42,915,274	฿42,646,596	฿38,013,025

Exhibit I contains additional financial information on the project.

III. SUMMARY OF MAJOR FINDINGS

Audit findings are discussed in detail in Section V. We summarize below those findings which we consider most significant.

Potable Water Project:

The SED has fallen behind in its effort to sustain the potable water systems after the phase out of U.S. dollar assistance (Para. V, A); and legal problems, RTG funding limitations, and SED operating conditions and practices have hampered the usage of AID-financed commodities (Para. V, B).

IV. FOLLOW-UP ON PRIOR AUDITS

There are no recommendations outstanding from the last prior Audit Report No. 69-12 of the Potable Water Project issued on June 9, 1969, which covered the period April 7, 1966, to December 31, 1968.

V. FINDINGS AND RECOMMENDATIONS

A. Continued Operations of Potable Water Systems

SED efforts to sustain the potable water program since the phase out of U.S. dollar assistance have been unsatisfactory. Maintenance and repair problems stemming from a shortage of mechanics, insufficient operating funds, and inadequate support by villagers have contributed to this condition. As a result, numerous water treatment plants were inoperative, minimizing accomplishment of the project objective to provide villagers with potable water for betterment of their health.

We visited 22 water treatment plants and found 11 inoperative, and six operating on a limited basis, see Exhibit III. SED officials in Khon Kaen told us that there were at least another 31 inoperative water plants of the 116 under their jurisdiction. As was the case at water plants visited, mechanical breakdowns and problems in collecting water fees were the prime causes for systems not operating.

The acute shortage of plant maintenance technicians is a factor contributing to the inoperative water systems. In Khon Kaen, SED officials stated that as a minimum, a maintenance team consisting of one technician and one mechanic helper was required for each of the nine changwats under their jurisdiction. Currently, staffing is 55% below the desired level, consisting of only four teams for the nine changwats. Our review at SED Headquarters in Bangkok revealed that SED lost many field personnel when counterpart funding was discontinued after U.S. assistance was ended. Although 17 additional field operations personnel were hired by SED to be funded from its regular RTG budget, 36 field operations personnel previously funded out of counterpart funds were dismissed. Dismissal of engineers, construction technicians, mechanics, mechanic helpers and laborers that are needed in plant operations undoubtedly contributed to the problems of plant maintenance. In this connection, we noted that USOM issued a Staff Notice (No. 71-261 dated April 9, 1971), listing criteria that should be kept in mind by drafters of ProAgs to ensure that a continuance of project activities are accomplished by the RTG after U.S. assistance ends.

Another factor hampering the potable water program is the lack of villager support of the water systems. Failure to adequately pay plant operators and maintain plants continues to plague the program. A limited number of water users and difficulties in collecting water charges, due to poor village economic conditions, have precluded the generation of sufficient revenue to operate and maintain the water plants. In one instance, an operator received no monetary compensation over a two-year period. In another instance, the

amount of an operator's salary payment was dependent upon availability of funds. Villagers also told us that operators have left after breakdowns at water plants because of dissatisfaction with their meager salaries. Maintenance teams told us that their pleas to villagers to purchase lubricating oil, oil filters and other necessary items for preventative maintenance were frequently ignored. As a result, preventive maintenance was unsatisfactory, as evidenced by the excessive amount of inoperative equipment.

There is no easy solution to these maintenance and operation problems of water plants, especially when causes are varied. Nonetheless, there is a need to provide guidance to SED in the area of operation and maintenance of water plants.

Recommendation No. 1

We recommend that USOM/Thailand review, with SED, problems relating to operation and maintenance of water plants for the purpose of advising SED on possible solutions to these problems.

B. Commodities - Potable Water Project

Legal problems connected with payment of sales commission, RTG funding limitations, and SED operating conditions and practices have hampered the effective usage of AID financed commodities totalling $629,894. Details of problems related to commodity utilization are as follows:

1. ONAN Engines

There were $348,782 of commodities consisting of 360 ONAN engines, 28 ONAN generating plants, and related parts in storage at a local distributor's warehouse (United Machinery) since March 16, 1970, over a dispute regarding sales commission to the distributor. This situation was reported in our last prior audit of Port Clearance Operations, Audit Report No. 8-493-72-42

issued on September 14, 1971. Our review disclosed that the RTG was preparing the necessary documents for initiating legal action against the distributor to have the commodities released to the project. Meanwhile, SED officials informed us that, the overhauling of over 300 engines has been unduly delayed, since the above distressed engines were intended to be used while old engines were being overhauled, and diesel engines in many cases were to replace gasoline engines for heavy duty service.

Although USOM has been working vigorously on this problem, there has been no significant progress to get the engines released to the project. We were told that the Department of Technical and Economic Cooperation turned the matter over to the Public Prosecutor's Office over a year ago to initiate legal action against United Machinery Co. for possession of the engines. We understand a good portion of the delay is caused by the necessity for translating the bid documents and relevant correspondence, including portions of Regulation 1, into Thai, as this is the official court language.

We further understand that the action, proposed to be taken by the Public Prosecutor's Office in its case against United Machinery, includes the filing of an urgent motion for possession of the engines on grounds of public interest pending resolution of the issues in the main case relating to the wrongful withholding of the engines by United Machinery. This action, if successful, will enable the Thai Government to get the engines immediately upon filing of its suit, rather than await the results of what might be a long and protracted period of litigation. Accordingly, no recommendation is deemed necessary at this time.

2. Water Pumps with Electric Motors

When we visited Khon Kaen in March 1972, 132 water pumps with electric motors, cost $74,686, had been in storage in Khon Kaen for 15 months or more because of a lack of RTG funds necessary to make them

operational. There were 68 Westinghouse Centrifugal pumps and 48 Westinghouse Submersible pumps in storage since November 1970; and 16 Peerless Centrifugal pumps in storage since December 1968.

This equipment, intended for converting certain deep well pumps from diesel drive to electric drive, had never been used, because local currency funds to purchase necessary transformers to operate the equipment have not been made available. A SED official told us that, approximately ฿30,000 to ฿50,000 ($1,500 to $2,500) was required to purchase and set up a transformer, and until such time as RTG provides such funds, this equipment cannot be used.

3. Water Pumps with Engines

Warehouse records showed that there were 175 Peerless pumps with Wisconsin gasoline engines and 77 ONAN pumps with diesel engines, cost $206,426, stored in Khon Kaen. At the time of our visit, the warehouse was in an untidy condition and we were unable to verify the exact number of pumps stored.

Only 87 of the 262 Peerless deep well pumps that arrived in country on June 30, 1969, have been issued because of the limited use of deep wells as a source of water. SED officials told us that usage of deep well pumps in the future would be limited, since few of the newly constructed water plants use deep wells.

We were told by a SED official at the warehouse that 44 of the 77 ONAN pumps that arrived in country during November 1970, have been set aside for newly constructed water plants and will be used in the near future. SED Bangkok told us that of the remaining 33 pumps, an undisclosed number were not usable as units, because the engine components had been removed to replace broken engines in the field. During the audit we informed O/FO of this condition and O/FO is now investigating the matter in detail to determine the basic cause leading to the condition.

Recommendation No. 2

We recommend that USOM/Thailand review with SED, plans for utilizing pumps in storage identified above and initiate action to have pumps that are not to be used in the near future transferred to another area where they can be effectively used.

POTABLE WATER PROJECT
NO. 493-11-521-186

EXHIBIT I

FINANCIAL STATUS AS OF MARCH 31, 1972

U.S. Contribution

	Obligated	Accrued Expenditures	Balance
Personal Services:			
Direct Hire	$ 88,033	$ 88,033	$ -
PASA	59,506	59,506	-
Contract:			
Tippets, Abbett, McCarthy, Stratton	617,626	617,626	-
Other	6,796	6,796	-
Participants	152,096	136,028	16,068
Commodities	2,068,196	2,068,196	-
Total	$ 2,992,253	$ 2,976,185	$ 16,068

RTG Contribution (฿20 equal $1.00)

	ProAg Budget	Withdrawn	Expenditures
Trust Funds 1/	฿ 3,222,108	฿ 2,953,430	฿ 2,953,430
Project Account Fund 2/	39,693,166	39,693,166	35,059,595
Total	฿42,915,274	฿42,646,596	฿38,013,025

1/ To pay local currency support cost of U.S. employed technicians.

2/ To pay all approved local currency costs (other than Trust Funds) for the project.

SOURCE: USOM/Thailand financial records.

VISITS TO WATER TREATMENT PLANTS
During March 1972

Location	Operating	Limited Operation	Not Operating	Comments
Khon Kaen:				
Ban Phra Kue			X	Engine (ONAN) breakdown - March 1972.
Ban Kud Kwang			X	No water - canal embankment damaged - March 1972.
Udon:				
Ban Nakha			X	Cylinder ring broken (ONAN) - February 1972.
Ban Tong		X		Limited water distribution. Main distribution pipes broken.
Ban Nong Swan			X	Crank shafts broken (2 ONAN) - October 1971 and February 1972.
Nakhon Phanom:				
Ban Takor	X			
Ban Na Kok Kwai			X	Pump (Farriman) broken - 1970.
Ban Nong Yang Chin			X	Pump piston ring (Farriman) broken - January 1972.
Ban Kok Swang			X	Engine (ONAN) and pump (Ruston) broken - April 1971. Also, water distribution pipes broken extensively.
Ban Tong			X	Abandoned - 1971.
Ubon:				
Rai Srisook	X			
Muong Samsib	X			
Ban Amnat			X	Abandoned - February 1971.
Ban Kueng Nai		X		Only 45 out of 697 families use this water system. Water salty and yellowish. Needs filtering unit. Village encountering financial difficulty in supporting this system.

POTABLE WATER PROJECT
NO. 493-11-521-186

EXHIBIT III
Page 2 of 2

VISITS TO WATER TREATMENT PLANTS
During March 1972

Location	Operating	Limited Operation	Not Operating	Comments
Mahasarakham:				
Ban Hua Kwang			X	Engine breakdown - March 1972.
Ban Pang			X	No water distribution pipes.
Sakon Nakhon:				
Ban Rai		X		Operating only 1 hour a day. Broken deep well pipe is too short to pump sufficient water.
Ban Tarrea		X		Only 170 out of 1,300 families use this water system. Villagers cannot afford pipe installation costs. 13 public faucets closed since May 1971 due to difficulty in collecting water fee.
Ban Pang Kone		X		Newly opened water system in March 1972. Only 15 out of 250 families were able to afford water distribution pipes. No public faucets.
Ban Yor		X		Only 140 out of 400 families use this water system. Water salty and yellowish. Filtering unit now under construction. Plant operator, a school janitor receives no pay for plant operation.
Nakhon Rajsima:				
Ban Gudjig	X			
Roi Et:				
Ban Klang	X			
Total	5	6	11	

APPENDIX G

CONTRACTOR'S CHECK LIST

Appendix G

CHECK LIST—OPERATING PLANT INSPECTION

(From contractor's report: Tippetts-Abbett-McCarthy-Stratton, "Community Potable Water Project Final Report. August 1969," New York and Khon Kaen. Note assumption that once items 1-25 have been achieved 26 will follow.)

1.	Operator on duty at plant?						Yes ____	No ____		
2.	Operator interviewed if not at plant?						Yes ____	No ____		
3.	Intake pump in operating order?				Yes ____	No ____	N/A ____			
4.	Treated water pump in operating order?				Yes ____	No ____	N/A ____			
5.	Chlorinator in operating order?						Yes ____	No ____		
6.	Chlorination being practiced?						Yes ____	No ____		
7.	Lime solution being batched correctly?						Yes ____	No ____		
8.	Lime solution being fed properly?						Yes ____	No ____		
9.	Alum solution being batched correctly?						Yes ____	No ____		
10.	Alum solution being fed property?				Yes ____	No ____	N/A ____			
11.	Floc formation:		Good ____		Fair ____		Poor ____	N/A ____		
12.	R.S. filter being backwashed regularly?				Yes ____	No ____	N/A ____			
13.	S.S. filter being cleaned as needed?				Yes ____	No ____	N/A ____			
14.	Fuel supply adequate?				Yes ____	No ____	N/A ____			
15.	Chemical supply adequate?						Yes ____	No ____		
16.	General appearance of plant:				Good ____		Fair ____		Poor ____	
17.	Chlorine residual in dis. sys.	None ____	0.1 ____		0.2 ____		0.3 ____	>0.3 ____		
18.	Samples of influent & effluent sent monthly to Khon Kaen						Yes ____	No ____		
19.	Operator trained?						Yes ____	No ____		
20.	Operator being paid regularly?						Yes ____	No ____		
21.	Operator maintaining daily log?						Yes ____	No ____		
22.	Valves operating properly?						Yes ____	No ____		
23.	Flocculator being cleaned as needed?				Yes ____	No ____	N/A ____			
24.	Sedimentation tank being cleaned as needed?				Yes ____	No ____	N/A ____			
25.	Appearance of water in clearwell:				Good ____		Poor ____	N/A ____		
26.	Villagers drinking the treated water?						Yes ____	No ____		

Where answer no, none or poor is checked, explain below

Other remarks:

(Sign) Engineer_____

Date_____

APPENDIX H

SANITATION DIVISION: YESTERDAY, TODAY, AND TOMORROW

Issued under title page "Sanitation Division: Now and Then" by the Ministry of Public Health of the Royal Thai Government

Appendix H

SANITATION DIVISION: YESTERDAY, TODAY, AND TOMORROW

Issued under title page "Sanitation Division: Now and Then" by the Ministry of Public Health of the Royal Thai Government

Since the pilot program for Rural Health Development (RHD) had been terminated in 1960, and due to its remarkable success, the Health Department in cooperation with USAID launched the continual project called "Village Health and Sanitation Project" (VHS) which utilized the RHD as a model.

The VHS project had two major objectives. The first objective was to reduce the mortality and morbidity due to gastro-intestinal diseases. The second objective was to improve and promote the basic sanitation condition of all rural villages, which would cover 80 percent of the total population of Thailand.

had been in action for six years, 1960-1965, when to the Comprehensive Rural Health Project (CRH). d the same objectives as the VHS project, but the sites of implementation were concentrated in the northeastern provinces of Thailand. The financial assistance from USAID for CRH ended in 1974, but the project was carried on until 1976.

The Public Health goals which have been set forth in the Fourth Plan of the National Economic and Social Development Plan, have strong influence on the CRH. The CRH project laid the groundwork for the development of the Sanitation Division, established in 1976, with its main function that of providing good health and life in a decent environment through better sanitation. As an organization, this division is under the Department of Health, Ministry of Public Health. The Sanitation Division is responsible for all activities concerned with environmental sanitation, which is part of the Environmental Health Protection Project (EHP). This project has two objectives. The first one is to reduce the mortality caused by water and food borne disease by 50 percent. The second objective is to reduce morbidity due to water and food borne disease by 30 percent. (These two figures are based on the vital statistical data of 1976.)

Right after the Environmental Health Protection Project is completed in 1981, the Sanitation Division intends to divide into two subdivisions, namely, the Urban Sanitation subdivision and the Rural Sanitation subdivision.

The Urban Sanitation subdivision will be concerned with the problems of urban communities, such as food sanitation and solid waste disposal and management. To prepare for such a situation, the Food Sanitation Project is now being undertaken as a pilot project in the Sanitation Division.

The Rural Sanitation subdivision will be more or less interested in the appropriate health development system that will be suitable and practicable for the socio-economic situation as well as the culture of each village. In order to fulfill this goal, many programs of sanitation establishment are now being studied, including the School Sanitation program, the Sanitation Acceleration Village program, and the Follow-up or Monitoring Network program.

Appendix H (cont.)

THE SUMMARY OF VHS, CRH, AND EHP PROJECTS

PROJECTS	OBJECTIVES	TARGETS	METHODS OF OPERATION	SOURCES OF FINANCE	ACHIEVEMENTS
1. Village Health and Sanitation (VHS) Project 1960-1965	1. To reduce the mortality and morbidity rate of gastro-intestinal diseases. 2. To improve and promote sanitation of the rural area.	1. Privy installation and use by each household. 2. Village water supply will be constructed in every village. 3. Improvement of premise sanitation.	1. Conduct in-service training to sanitarian and health workers. 2. Create "Health Development Village" 3. Health educate and encourage people to install and use water-sealed latrines. 4. Assist in the construction activities in terms of technical and financial assistance.	1. Royal Thai Government (8,981,060 ฿) 2. USAID (28,411,616.76 Baht)	1. Health Development Village 7,118 villages. 2. Construction activities: Water-sealed latrines-- 249,019 units Small scale rural water supplies-- 287 units
2. Comprehensive Rural Health (CRH) Project 1966-1976	The objectives are still the same as the VHS project but the implementation are concentrated in the northeastern provinces of Thailand.	Same as VHS Project	The methods of operation follow the pattern of VHS Project.	1. Royal Thai Government (214,598,500 ฿) 2. USAID (1966-1974) (65,311,430 ฿)	1. HDV 31,873 villages 2. Construction activities: Water-sealed latrine-- 1,741,327 units Small scale rural water supplies-- 10,770 units

Appendix H (cont.)

PROJECTS	OBJECTIVES	TARGETS	METHODS OF OPERATION	SOURCES OF FINANCE	ACHIEVEMENTS
3. Environmental Health Protection (EHP) Project 1977-1981	1. To reduce the mortality due to water and food borne disease by 50% 2. To reduce the morbidity due to water and food borne disease by 30% (based on the rate of 1976)	1. Construction activities: Small scale rural water--supplies 10,000 units Water-sealed latrine--2,360,000 units Cestern 50,000 units Refuse container 50,000 units Incinerator 500 units 2. Population coverage: Water supply program must cover 25% of the rural population Excreta disposal program must cover 50% of rural population Refuse disposal program must cover 50% of rural population	1. To conduct conferences, in-service training to local personnel, volunteers, and local leaders. 2. Give financial assistance on the basis of community participation. 3. To provide equipment and technical assistance for construction activities 4. Health educate school children as well as public 5. Demonstrate all responsibility activities in the demonstrating villages	1. Royal Thai Government 2. USAID in 1977 granted 4 scholarships for Food Sanitation program and 10 study tours for Rural Sanitation program	Achievement in 1977 1. Construction activities: Water-sealed latrine 172,113 units Small scale rural water supplies 1,500 units Cestern 3,162 units Sanitary wells 295 units Incinerator 120 units 2. Training Health personnel 700 persons Local leader 1,756 persons Food handler 8,968 persons

THE SUMMARY OF URBAN SANITATION AND RURAL SANITATION PROJECT

Appendix H (cont.)

PROJECT	SUBPROJECT	ACTIVITY
Urban Sanitation	1. Food Sanitation 2. Solid Waste Management 3. Vector Control	1. Training of food handler 2. Demonstrate the Solid Waste and Vector Control system
Rural Sanitation	1. School Sanitation 2. Sanitation Acceleration Village 3. Follow up or Monitoring Network	1. Health Educate school children and public 2. Demonstrate the construction activities in the selected villages 3. Set up Follow up or Monitoring system 4. Training of local personnel to continue the program

APPENDIX I

SUGGESTIONS TO A.I.D. FOR FUTURE WATER ACTIVITY IN THAILAND

Appendix I

SUGGESTIONS TO A.I.D. FOR FUTURE WATER ACTIVITY IN THAILAND

The following is a brief outline of findings presented December 4, 1979, to USAID mission director, Mr. Donald Cohen. Several qualifications should be considered when reading this outline.

* First, it as been prepared by one of the team members and, while it is believed to represent collective conclusions, it should not be considered as such until review by both of the AID/Washington team members.

* The statistics have been drawn from 60 separate interview forms; a more careful review may alter some of the figures. The sample of 60 systems was developed in Bangkok based on Ministry of Public Health documentation that indicated A.I.D. support to all 60 systems. Visits to the systems revealed, however, that eight had not been A.I.D. although they may have been among communities

esignated for survey by A.I.D.'s contractor, TAMS.

* The evaluation team's assignment was to evaluate only one specific A.I.D. project. The team therefore defers to the judgments of others specifically charged with project design.

There are at present over 600 piped water systems serving communities in Thailand that are classified as rural. Of these, A.I.D. funded the construction of approximately 250. The evaluation visited 60 systems serving 125 communities. The smallest was less than 500 and the largest had over 7,000 persons. The medium size was 850.

The systems were sophisticated piped water systems using both surface and ground water. All systems included chlorination of water prior to distribution although a few of the communities have discontinued this practice. The systems are built to U.S. design criteria established by the American Water Works Association. The following outlines a debriefing by one of the team members with the USAID/Thailand mission director; the chief of Health, Population, and Nutrition Office; and the officer who coordinated the team's activities in Thailand. Three questions were addressed: (1) What is going on? (2) Why? and (3) What does this mean for USAID/Thailand.

1. What is Going On?

Of the 60 systems visited, 53 were currently working, 2 were recently rehabilitated and are in working order but are awaiting a trained operator and 5 are failures.[1] The working systems are in most cases delivering

[1]Of the five failures one is under review by the Ministry of Public Health for rehabilitation.

water to individual users through metered connections. In almost all cases they are self-sufficient not only in ordinary operating costs but have also paid for replacement of major components that have failed.

The average cost of water is three baht per cubic meter. Users all pay although about 10 percent are one or more months delinquent. A few systems are not metered and a variety of methods are used to assess charges. A minority of systems used public taps, some of which provide free water. Approximately 40 percent of the systems provide water for nearly the entire community. The rest exclude some portion either because the distribution line does not reach the entire community or because the poor do not have money for a private connection which usually costs about 300 to 400 baht.

In addition to the piped water system, the evaluation team was interested in two aspects of another USAID project: water-seal privies and shallow wells with handpumps. The communities visited had a high percentage (nearly 80 percent) of use of water-seal privies. This indicates wide acceptance and spread of this technology.

On the other hand, the team failed to find any AID-funded handpumps in operation with the exception of one demonstration pump in the Rural Water Supply Section compound at Khon Kaen.[2]

2. Why?

One simple program--provision of handpumps--was a complete failure and yet a much more sophisticated water supply program was successful. In addition, residents in 11 communities with piped water systems had an over 80 percent rate of use of water-seal privies. The reasons why a simple technology has failed and a complex one succeeded, and also why there is widespread use of water-seal privies, are not completely clear. Three reasons seem relevant, however: community acceptance, financial support, and institutional support.

a. Community Acceptance

Communities have accepted the piped water systems because they view piped water delivered to the house as an incremental improvement over more remote sources. In response to the question, "Does the system save time or provide more water?" the answer is nearly uniformly that

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[2]The Rural Water Supply Section has a program designed to support handpump maintenance which is under test in the Khon Kaen area, but the team did not visit the site.

there is both time-saving and more water use. When asked what is done with the time saved and the extra water used the responses are predominately economic. Villagers cite in particular the use of extra water for raising additional animals, for raising more market crops, and for providing more time for home crafts. The estimate of increased income provided because of the water system ranged from 5 to 200 percent.

In addition to the obvious advantages of increased income, the water systems are seen by some to provide economic protection in times of drought and rice crop failure. The income from the animals and cash crops, it was pointed out, means that heads of households can remain in the village rather than going to Bangkok for jobs to tide them over.

There is no evidence that handpumps on shallow wells represent an improvement over the commonly used rope and bucket. Indeed, there are supplies of both handpumps and water-seal privies available in all market centers. Villagers buy the privies but not the handpumps. Faced with the economic choice, the consumers opt for privies. The lesson seems clear, that privies are more highly valued.

b. Institutional Support

However great the desire for piped water, the systems would not operate unless operators and maintenance people were trained and there was an adequate supply of spare parts and a system to deliver them when and where needed. Indeed, an evaluation by AID's Auditor General in 1972 reported that only half the systems were operating and the others abandoned, out of repair, or operating on a limited basis.

The story of how the systems have improved over time is really a story of the growth of one of the most effective institutions in the rural water supply field, the Rural Water Supply Section of the Ministry of Public Health. This organization has over the past years trained and retrained every rural water supply operator, has visited each system (usually on a monthly basis) to take water samples and to inspect the operation of the system, and has provided maintenance support for problems beyond the capability of the local operator. The Rural Water Supply Section is now being relieved of responsibility for piped water systems; this now is under the control of the newly formed Provincial Water Authority.

c. Financial Support

The systems visited are for the most part economically self-sufficient. In the past the systems were run by either the village committee or a tambon (district) committee. In the sanitary districts, the sanitary district committee was in charge of the systems. Funds collected were used

to pay for fuel, chemicals, and spare parts or component replacements. A single operator ran the system and in the rural communities often was a volunteer when collected revenues failed to provide an excess over costs.

Providing funds for fuel and the need for replacement of major components led to a change from public taps to private metered connections. Revenues are now usually more than adequate to run the systems. The financial support is, of course, additional evidence of community acceptance.

3. What Does This Mean for USAID/Thailand?

There is ample evidence that a previous handpump program in Thailand was a failure. Furthermore, were the mission to consider such a program, it would be in conflict with WHO which is planning to serve the entire country by 1991. On the basis of past performance the team would strongly recommend for communities of approximately 400 to 500 persons systems using ground water and chlorination. Power for the system should be electric motors, windmills, or handpumps. Diesel power should not be used. Each residence should have a private metered connection. Rates should be based on increasing block rate pricing, set to provide adequate basic water for washing and sanitation at low rates to everyone with increasing unit costs for additional water. The rate structure should cover all operating, maintenance, and depreciation costs.

Such a system would provide economic and health and nutrition benefits--and the experience has shown it will be supported by the users. The community should be involved in the system and commitments of labor or cash should be a prerequisite. Advantages are:

a. Increased economic potential for the community.

b. Increased health through:

   i. an improved source of water,

   ii. better nutrition,

   iii. increased use of water-seal privies as a result of easier availability of water, and

   iv. more water for sanitary practices.

c. The maintenance of the Rural Water Supply Section as a functioning organization.

In addition to a simple transfer of resources USAID/Thailand can provide:

a. engineering expertise in the design of simple "packaged" water plants;

b. advise on the gathering of small area health statistics that will enable evaluation of the effectiveness of this and other health programs;

c. participant training in the United States for degree candidates (the record of return of Thai sanitation students is claimed to be 100 percent); and

d. work-study training in other Asian countries.

Addendum Regarding Financial Sustainability

The Thai government has decided to incorporate the responsibility for all piped water systems (except that serving municipal Bangkok) into a new para-statal organization, the Provincial Water Authority (PWA). While the desire to nationalize the supervision of piped water is understandable, the immediate effect is detrimental and in the long run promises to prove disastrous for the systems serving the smallest communities.

Piped systems that effectively serve small rural communities of as few as 500 persons are not usual in the developing world and their technical and financial success in Thailand is in great part due to the training, management, and supervision provided by the Rural Water Supply Section. This section was set up to manage a joint Thai-USAID project. The project had as an objective the provision of piped water supplies to 600 rural communities in the areas designated as targets for an Accelerated Rural Development Program. While the project failed to serve the number of communities projected and fell behind in the schedule, the achievements in terms of lasting impact, growth, and spread have been impressive.

The main report outlines the results of the evaluation in detail and it is sufficient to indicate that there are now nearly 600 systems serving over 1,500 rural communities with piped water supplies. The systems are reliable, and in most cases provide water that meets all WHO standards. Most operators have been trained, some as many as three times, in the operation of the systems which provide full treatment for surface supplies and in most cases chlorination of water from deep wells.

The Rural Water Supply Section has in the past visited the systems on a monthly basis checking the operation and maintenance of the system, providing on the job training of the operator, and drawing samples of water for physical and chemical testing. In addition it provided parts and emergency maintenance in the case of breakdowns. For small systems it also delivered chlorine. The RWS no longer has official responsibility for the systems. In some cases it is responding to emergency needs, but no longer provides the regular monthly or bi-monthly supervision. In some cases deterioration is already taking place. One system is using

some of the filtered water for irrigation of the operator's gardens while unfiltered water is being distributed to the public. The use of excess filtered water for irrigation is not new, but by-passing the filter for the potable water has only been done after the RWS supervisor stopped his regular visits.

There are three levels of piped supplies in Thailand which can be distinguished by the population served. These are: (1) urban systems, (2) systems serving sanitary districts, and (3) systems serving villages. It is the intention of the PWA to make all the systems economically viable. Most now are, but in some villages the operators are volunteers who run the systems as a community service. In others the operators are paid considerably less than the minimum civil service pay scale. If pay scales are raised to the level of PWA operators interviewed (3000+ baht), fewer systems will be able to be self-supporting at present water rates--which are for the most part already higher than rates in Bangkok.

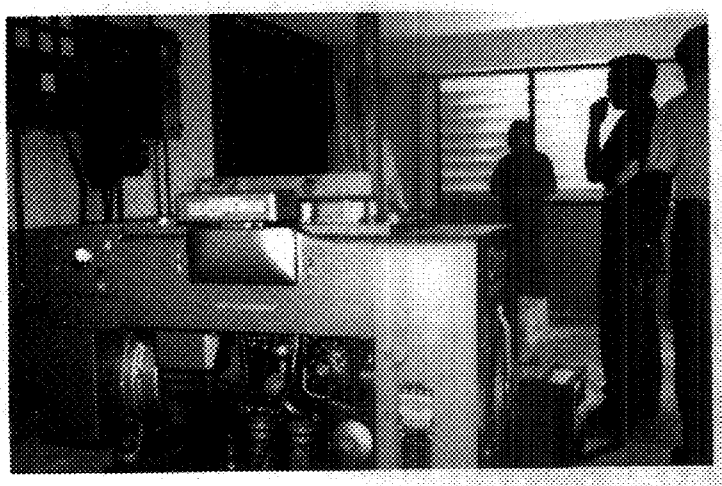
APPENDIX J

PHOTOGRAPHS

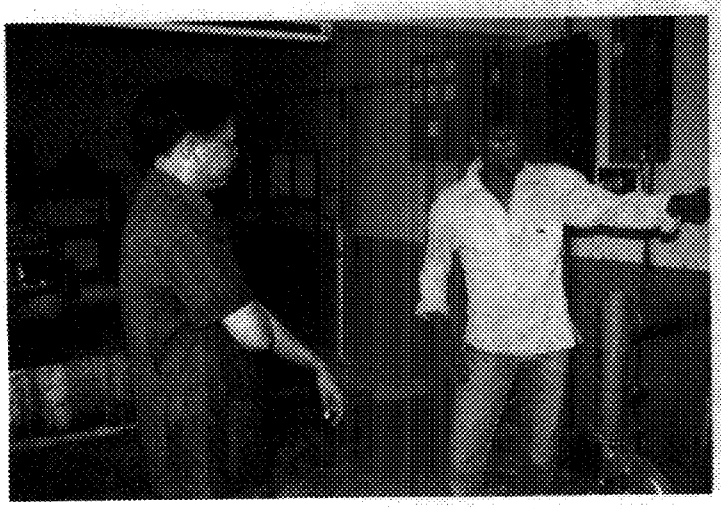
Water Project in Rural Thailand

When asked whether he knew what the clasped hands on the engines meant, a monk at one of the village systems responded, "Of course. The people of the United States and the people of Thailand are friends."

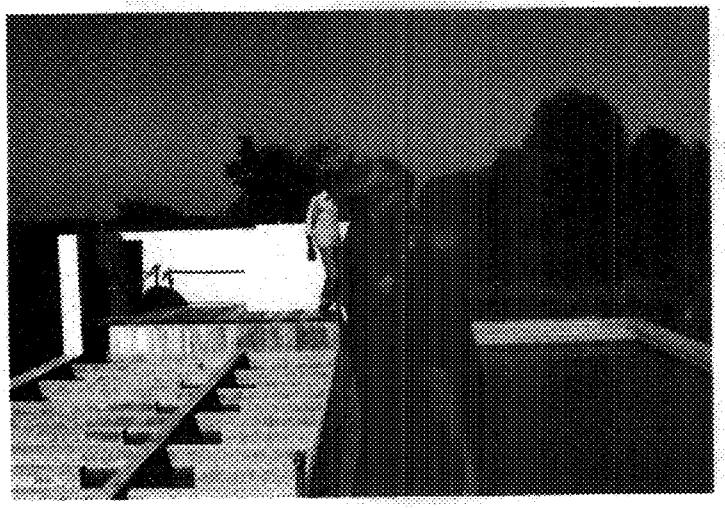
The Prize Plant



This system was built 12 years ago. It is unusually well-maintained, but others approach this standard.

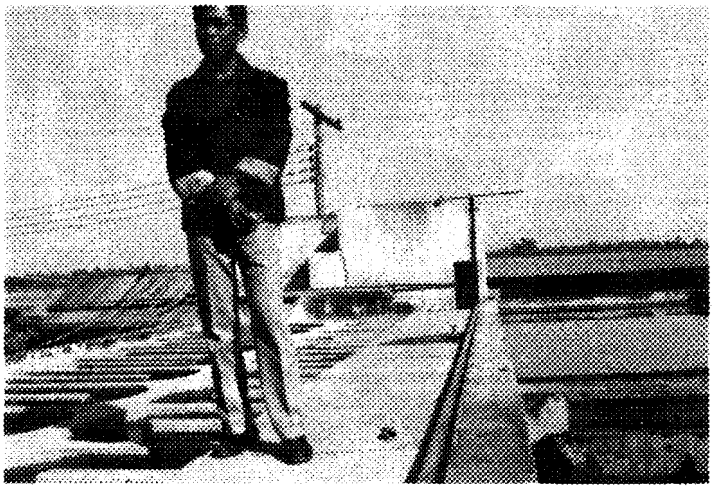


The operator says that the health of the community is in his hands and so he is completely committed to tending this plant.



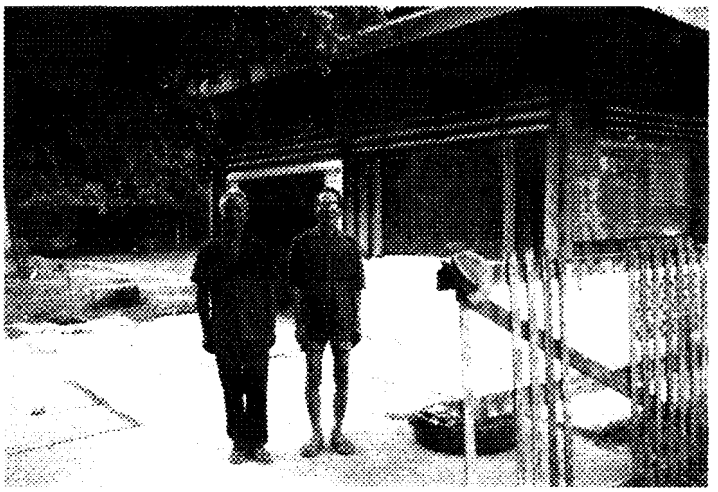
The tasks include a weekly scrubbing of the building and equipment.

System Personnel



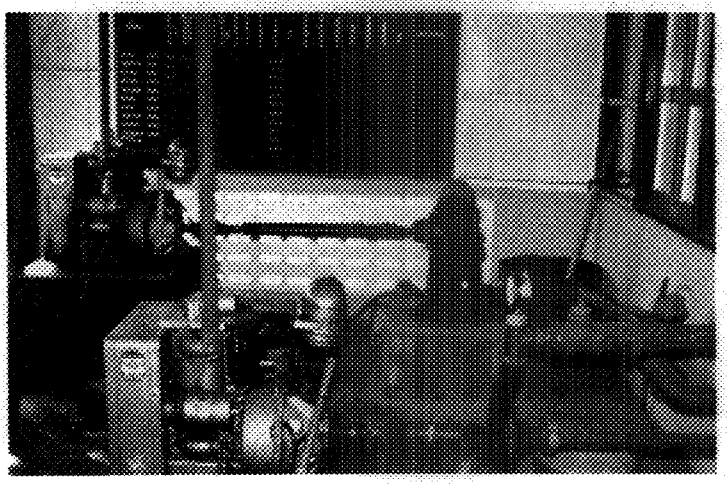
The operators are proud of their role. This man replaced wooden walkways with concrete in his spare time (left background).

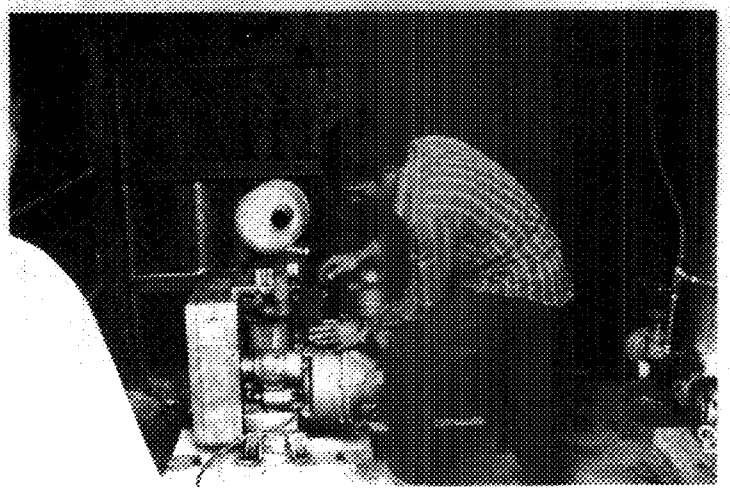
The plaque indicating details of the funding was presented at the dedication of the system.

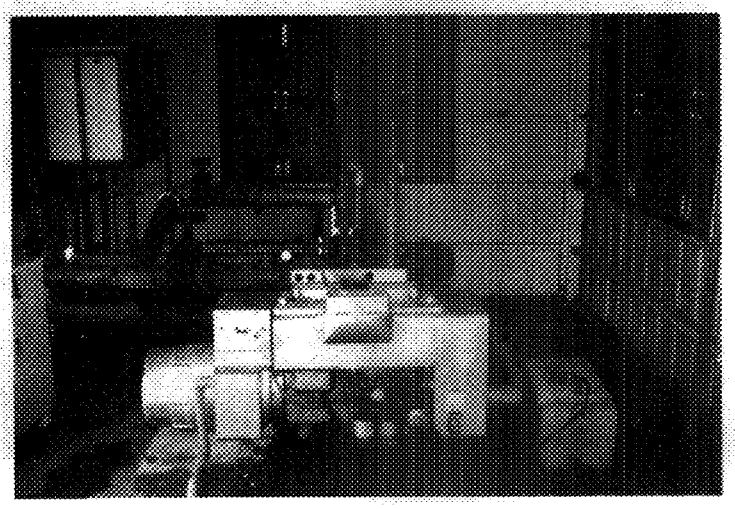


Two village elders pose beside the system they were instrumental in bringing to their community.

Onan Engines

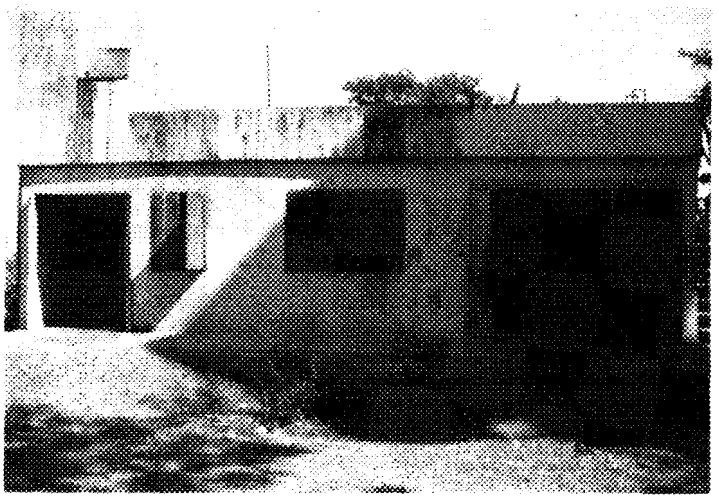


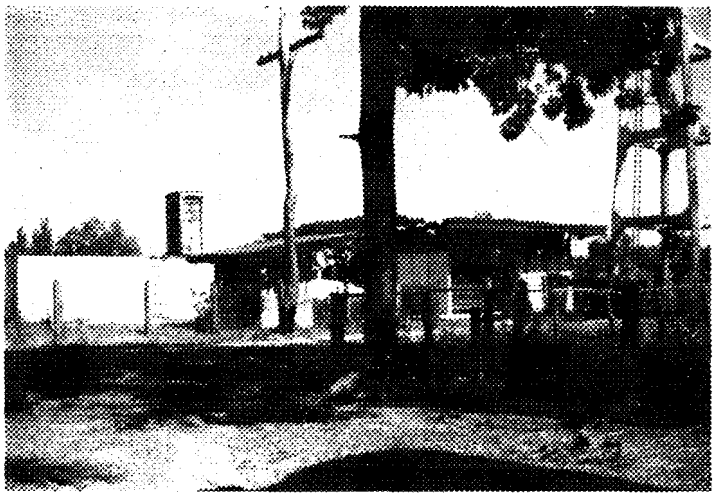




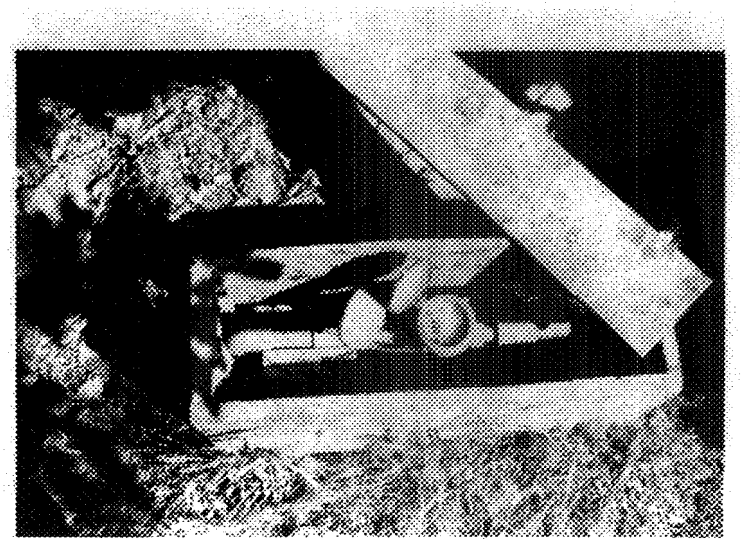
Evidence of the value placed on these systems by the community is apparent from the care lavished on the Onan engines. One would not suspect that these are 10 — 12 years old and that must have required extensive repairs. Note the A.I.D. logo which people recognized and associated with U.S. assistance.

Treatment Plants



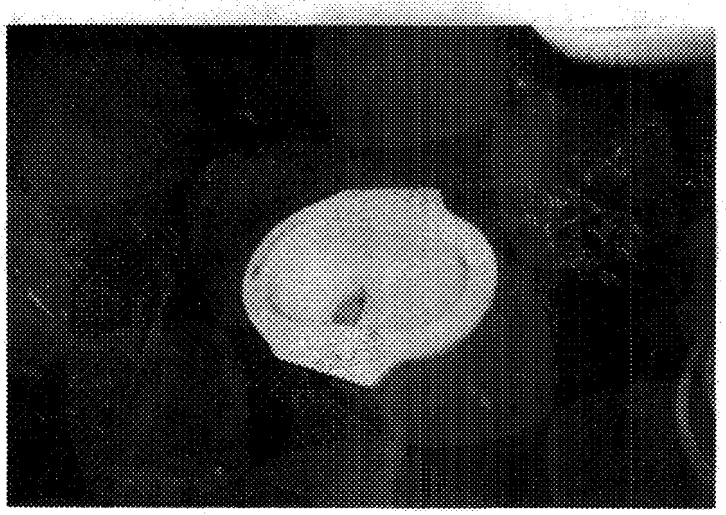


The standardized design of treatment plants made it possible to build sophisticated systems rapidly. At these plants, water is filtered and chlorinated prior to distribution.



Water Uses

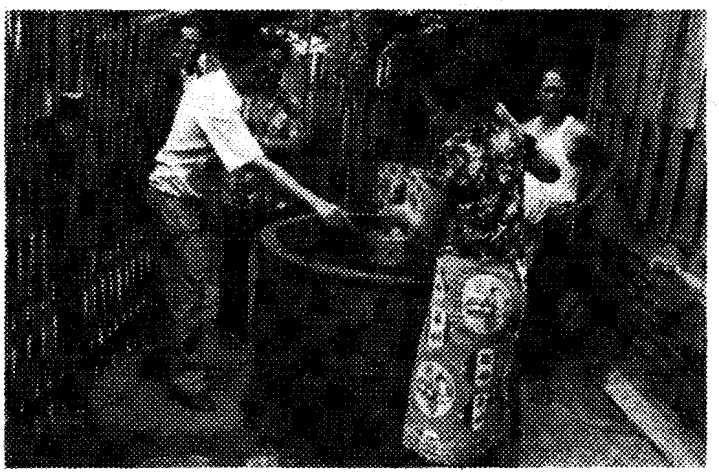
There are many uses for the water. Protected from the elements, one household stores laundry detergent and a bar of soap in the box they built to protect their private metered connection.



The water seal privy is facilitated by the availability of piped water - - and is also a good place to grow flowers.

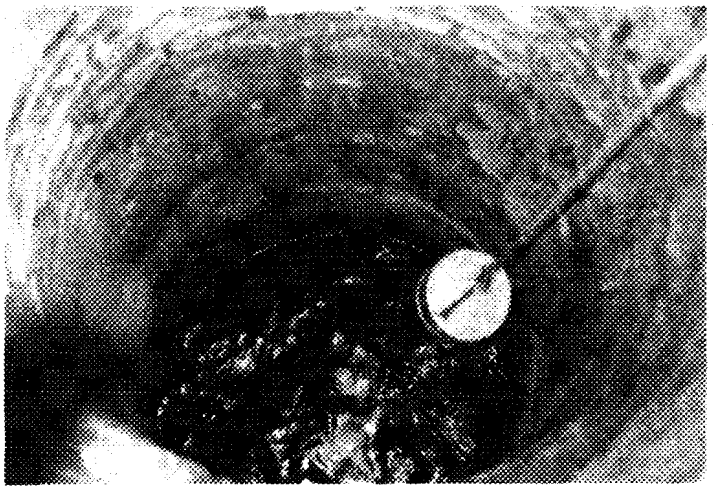
The task of gardening and watering individual plants by hand, a task of the women, is also made easier by the greater availability of water.

Shallow Wells



One alternative to piped systems is the shallow well.

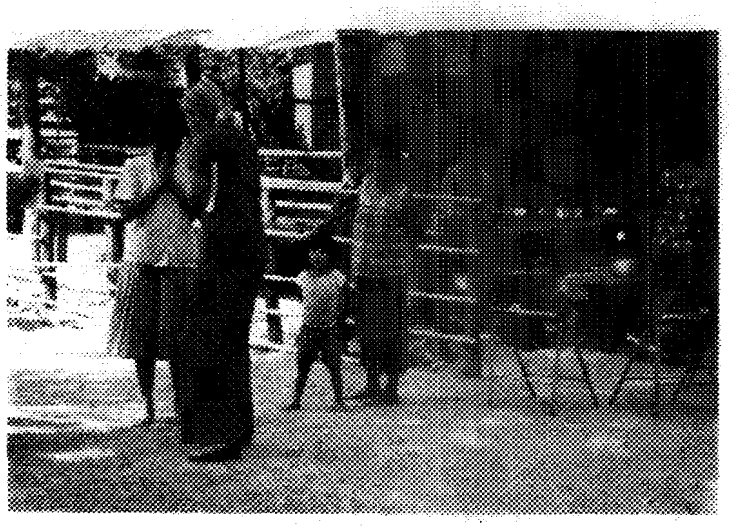
The handpump on this A.I.D. - funded well has long ago disappeared. This well is in a public area and is used by villagers in communities without piped water systems.



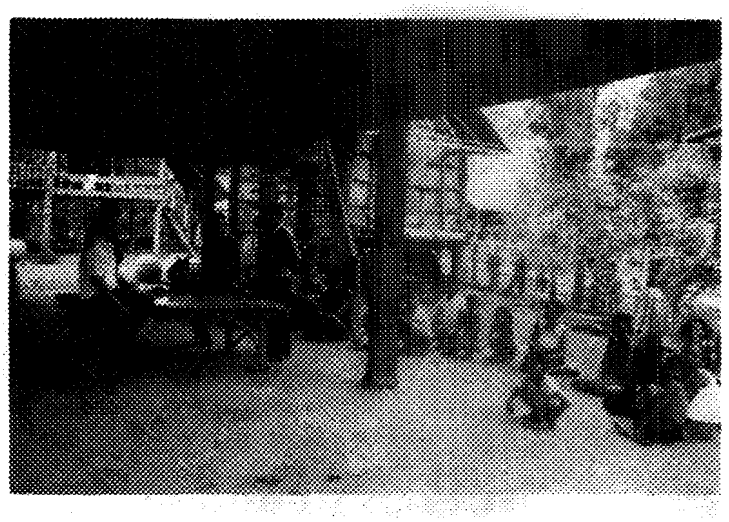
The community may not regard hand-pumps as much of an improvement over an open bucket.

Village Interviews

People were very willing to discuss their systems, even in this village which was one of the few where the system had not been successful.

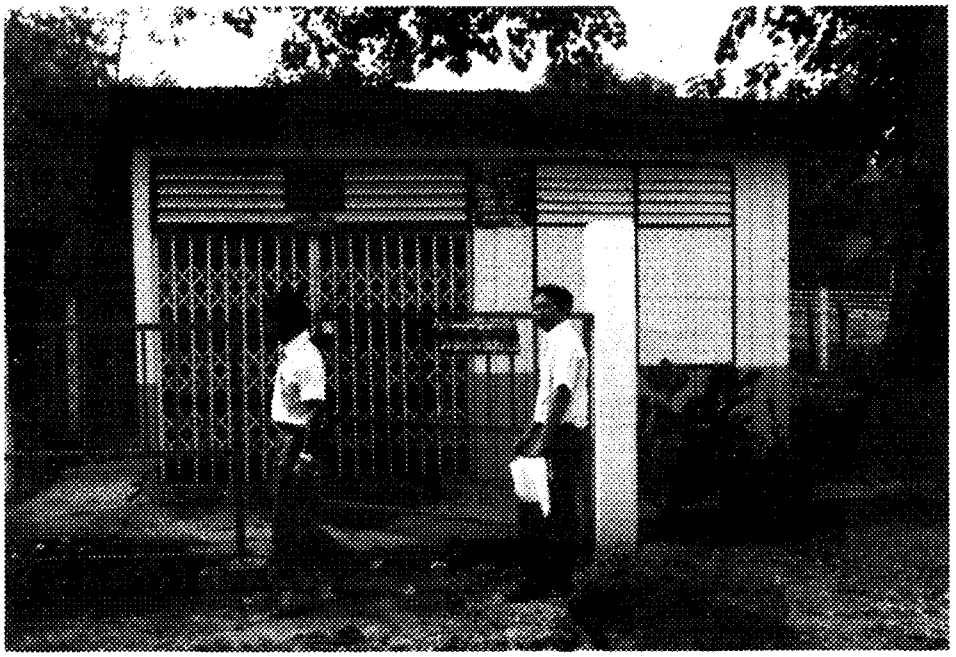


Before the interview begins, villagers make the team welcome, and as an expression of their hospitality set out an ornate bowl of water. Sometimes the welcome includes betel leaves, salt and cigarettes.



An interview in progress. Note the ever-present bowl of water on the table.

Villagers appreciate USA Assistance



There is no question that the villagers know of the source and appreciate the funding of this water system. The sign wired to the fence above is shown in close-up below. Note the ship "USA" carrying materials to Thailand.