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TRAINING PROGRAM IN VILLAGE WATER SUPPLY PLANNING, MANAGEMENT, DESIGN, CONSTRUCTION, AND MAINTENANCE IN NEPAL: MAY 25 TO JUNE 13, 1986

WASH FIELD REPORT NO. 190

AUGUST 1986

Prepared for
Save the Children Federation, Inc. (USA)
Office in Kathmandu, Nepal, and the USAID Mission to Nepal
WASH Activity No. 226

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Training Program in Village Water Supply Planning, Management, Design, Construction, and Maintenance in Nepal: May 25 to June 13, 1986

Prepared for Save the Children Federation, Inc. (USA)
Office in Kathmandu, Nepal, and the USAID Mission to Nepal
under WASH Activity No. 226

by

Carl R. Johnson

August 1986

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ACRONYMS

FORS	Field Office Reporting System
lpcd	liters per capita per day
lps	liters per second
PVO	Private voluntary organization
RCC	Reinforced concrete
SATA	Swiss Association for Technical Assistance
SCF	Save the Children Federation
USAID	United States Agency for International Development
VDC	Village development committee
WASH	Water and Sanitation for Health Project

Currency equivalent

RS 20 = $1.00 U.S.

ACKNOWLEDGMENTS

The success of the training program described in this report is due to the efforts of the USAID Mission to Nepal and the Save the Children Federation, Inc. (USA) field office in Nepal. For USAID, particular acknowledgment is given to Dr. David Calder, director of the Office of Health and Population; Barbara Spaid, deputy health officer; and Benjamin Stoner and Harsha Bajracharya of the Rural Development Office for their important contributions to the initial planning and scoping of the training assignment.

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In the final planning and execution of the training, the help of Mark Williams, water program advisor to Save the Children, and James Wodrich of the U.S. Peace Corps was key to the success of the program. Finally, the efforts of Padam Prasad Regmi in setting up the training site and sharing the experience of his water supply construction projects in Takukot with all the training participants were especially appreciated. His practical experience was extremely beneficial to both the participants and trainers.

EXECUTIVE SUMMARY

A training program, conducted in Takukot Panchayat (village), Nepal, from May 25 to June 13, 1986, consisted of two training workshops: one in village water supply planning and management and one in village water supply design, construction, and maintenance. Save the Children Federation, Inc. (USA) of Nepal sponsored the training and, through the USAID Mission to Nepal, requested the Water and Sanitation for Health Project (WASH) to provide the training design and a technical consultant-trainer. The WASH consultant, an environmental engineer, had previously performed a training needs assessment for SCF in September 1985, which became the basis of the curriculum.

The training team consisted of three persons: the SCF Nepal water program advisor, the WASH consultant, and a U.S. Peace Corps Volunteer engineer who is assigned to SCF for the construction of a water supply project in a village neighboring the training site.

In addition to their own staff, SCF had invited a number of organizations constructing rural water supply systems in Nepal to participate in the training; and in total, 50 participants attended the training workshops.

The objectives of the training were threefold:

1. To improve the understanding of gravity-flow water supply systems--including the source protection requirements, physical limitations, implementation steps, and maintenance needs of such systems--among the SCF field coordinator and assistant field coordinator staff, so that these staff can more effectively communicate these ideas to the village beneficiaries of the water systems.

2. To increase the technical skills of the overseers, sub-overseers, and construction coordinators from SCF and other invited organizations, with particular emphasis on the design and maintenance of gravity-flow water supply systems.

3. To strengthen the training abilities of the overseers, sub-overseers, and construction supervisors from SCF and other invited organizations in training village maintenance workers and village maintenance committees in their respective responsibilities and duties for preventive maintenance and repair.

While the training workshops dealt with all aspects of gravity-flow water systems, the underlying theme was the maintenance of these systems, including design concepts that simplify maintenance; construction techniques that promote easy access to water system structures for inspection, cleaning, and repair; and maintenance training for village maintenance committees and workers that emphasizes preventive maintenance and attention to the proper functioning of the water systems on a daily basis. SCF has taken a leading role in Nepal with respect to rural water supply maintenance as demonstrated through this training and invitations to other organizations to participate.

The participation of the other organizations promoted very valuable sharing of experience and ideas for improving the maintenance of rural water systems. All participants and trainers found the training to be successful in meeting its objectives. The success of the training was due in large part to the planning and organization of the program by SCF and to the opportunity that SCF and the USAID Mission to Nepal provided to the WASH consultant to perform the earlier training needs assessment. The training needs assessment resulted in the development of a curriculum that was closely tailored to the training needs of the SCF staff and the invited organizations.

The following general recommendations are made to SCF as a result of the training. (A number of additional project-specific recommendations are presented in Chapter 5.)

1. SCF now has a group of freshly trained administrative and technical staff knowledgeable in village water supply planning, management, design, construction, and maintenance requirements. Also, as a result of the training and the earlier training needs assessment, SCF has a workable step-by-step approach to initiating, implementing, and handing over completed projects to village beneficiaries. Expectations are now very high among the field staff and village beneficiaries for successful completion and hand-over of water projects now being finalized. Thus, SCF should take advantage of this time to begin formal hand-over ceremonies and maintenance guidance with the smallest, simplest water projects. After smaller projects are successfully handed over, SCF should work toward the completion and testing of larger, complex water projects and then have official hand-over ceremonies for these.

2. In many cases, the village development committees in the SCF impact areas have viewed the development of additional water supply projects of greater importance than the maintenance of functioning water systems or the finishing of functioning systems with respect to proper source protection, taps and drainage, and preventive maintenance actions. The demand for new water systems to serve additional areas is understandable given the acute need for convenient water supplies in the hill villages, but the longer-range goals of SCF are best met by water systems that provide safe, clean water from reliable systems. Such systems would serve as examples for new water projects in other areas. Thus, the construction of new projects should be linked with the completion of functioning, but as yet incomplete systems on a one-to-one or one-to-two basis. For example, one new system could be built in Takukot for every two functioning systems that are completed and handed over to the village maintenance committees.

3. The concept and magnitude of work required for source protection to provide safe, clean drinking water is now better appreciated by the SCF training participants. The training participants developed specific recommendations for improving and protecting the Banspani, Bahakot, and Ritepani water system sources; and these recommendations are presented later in this report. To

promote effective source protection measures, SCF should include in its budgeting and estimating for new water supply projects a line item for source protection--the cost of which would be shared by SCF with village contributions.

4. The use of the small, clear transparent pipe model water system to demonstrate gravity-flow water system operation was well received during the training by all participants. SCF field coordinators, overseers, and sub-overseers believed that the model would be effective in explaining gravity-flow system operation to village beneficiary committees prior to construction when the water project is being planned. The model was left in Takukot for the future use of SCF which should consider fabricating similar models for its other impact areas.

5. Follow-up training was suggested by several participants. The participants suggested that after one year, the progress made as a result of the training described in this report be evaluated and then additional training be planned. SCF should again review the participants' training needs after one year and assess the need for further training based on the results of that review.

Chapter 1

INTRODUCTION

1.1 Background of SCF in Nepal

Save the Children Federation, Inc. (USA) of Nepal (SCF) operates a community-based, integrated rural development program in the Gorkha District of Nepal. The SCF program is operated in collaboration with the Nepal Social Services National Coordination Council, and it receives a Private Voluntary Organization (PVO) Co-financing Grant from the USAID Mission to Nepal. The goal of the SCF program, begun in 1981, is to improve the social, economic, and environmental conditions of children and families in selected rural areas of Nepal. SCF currently works in five panchayats--Deurali, Dhuwakot, Takukot, Majlakuribot, and Pandrung--which have a combined total population of about 17,000. Figure 1-1 shows the location of these impact areas.

The scope of SCF's work includes:

- health care
- water resource and physical infrastructure development
- human resources development
- agriculture and economic development
- resource conservation and appropriate technology.

SCF's goal is to work in a village impact area for five to ten years, during which time the village is to become self-sufficient in continuing to pursue its development needs.

1.2 Background of Training Program

The background of the training program stemmed from SCF's earlier water supply work in Nepal and from the training needs of its staff. SCF has assisted in the construction of rural village water supply projects since 1981, but most water supply construction has been in the years since 1983.

Since 1983, SCF has hired Nepali overseers, sub-overseers, and construction supervisors for the design and construction of its water supply projects and for the training of village maintenance workers. An overseer is a Nepali engineering technician position requiring three years of specialized instruction and completion of an examination (roughly equivalent to an associate degree in the United States). A sub-overseer is a technical staff person who has completed some or all of the overseer specialized instruction but who has yet to take the overseer examination. A construction supervisor is a technical staff person who has construction experience but does not necessarily have specialized education (roughly equivalent to junior high school training in the United States). A village maintenance worker, also called a special plumber, is a person selected from the village served by an SCF water project and is generally age 25 or older, a resident of the village (preferably a life-long resident), able to perform pipe repair and maintenance tasks, and has related experience (roughly equivalent to primary school education in the United States).

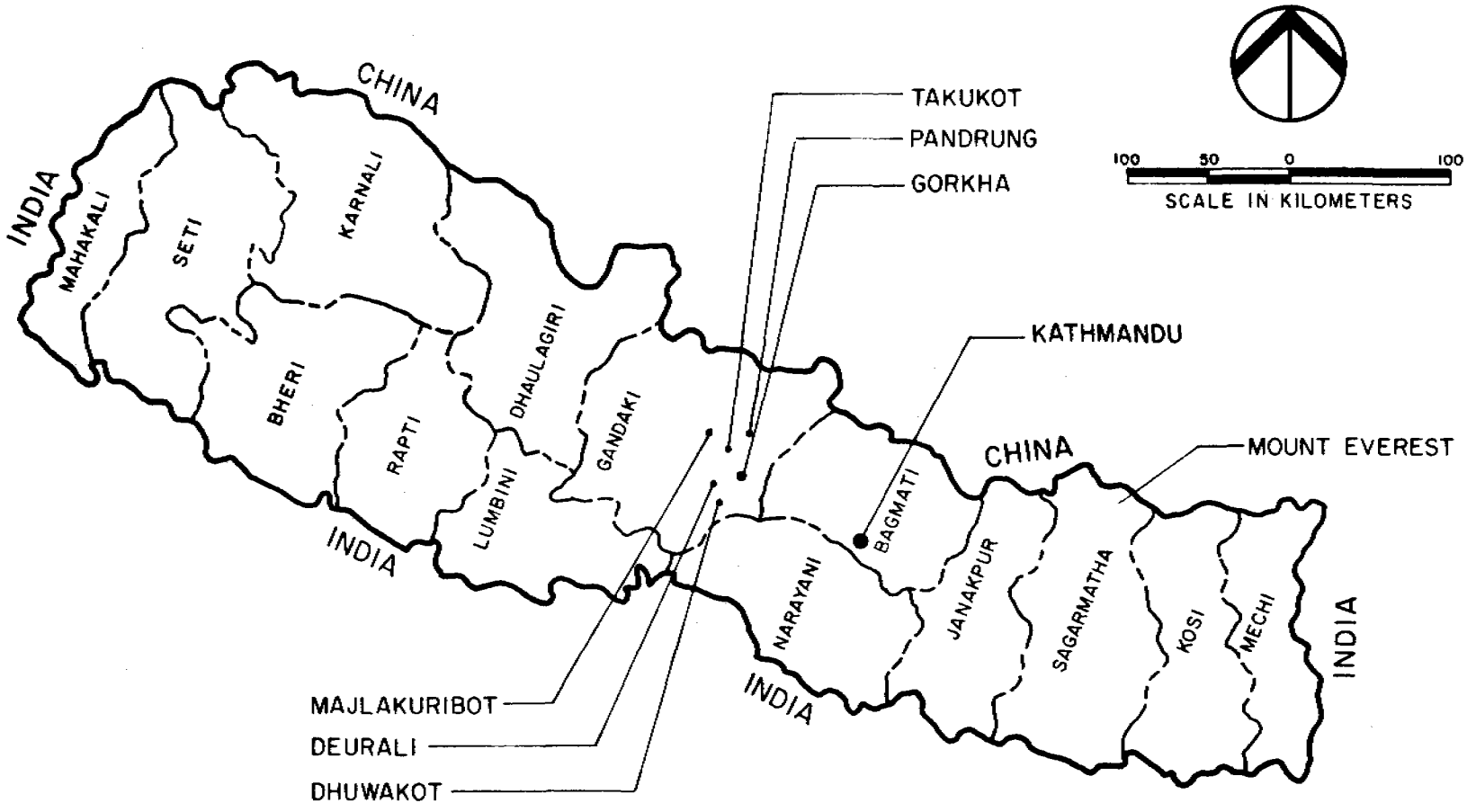

FIG. I-I MAP OF NEPAL SHOWING
ZONE BOUNDARIES AND SCF IMPACT AREAS

Currently, the SCF staff incudes two overseers, two sub-overseers, and four construction supervisors; all participated in the training. Sixteen village maintenance workers also participated in the training.

Since early 1985, SCF has taken steps to improve the construction and maintenance of its water projects and the skills of its technical staff. SCF had its water supply program reviewed by a Nepali engineering consultant and also sought the assistance of the USAID Water and Sanitation for Health (WASH) Project in 1985. The request to WASH was to carry out a training needs assessment in September 1985 followed by a training in early 1986. WASH provided a consultant to perform the training needs assessment in September 1985 and prepared a report entitled: "An Assessment of the Save the Children Federation, Inc. (USA) Rural Water Supply Systems and Training Needs in Nepal. WASH Field Report No. 157. October 1985.

That report recommended a training program that would encompass SCF's field administrative staff (field coordinators* and assistant field coordinators), the SCF technical staff (overseers, sub-overseers, and construction supervisors), and the village maintenance workers. That report also recommended a preliminary curriculum and schedule for the training, subject to refinement in the detailed planning for the training.

SCF and the USAID Mission to Nepal reviewed the proposed training program and approved its implementation. A formal request to the WASH office was made in December 1985. The training, originally scheduled for a start in mid-January 1986, was rescheduled to start on May 25, 1986. The rescheduling allowed the WASH consultant who had performed the training needs assessment to return to Nepal to conduct the training. Also, the rescheduling avoided significant conflicts with the SCF village water supply construction season which was ending in June as the monsoon season began.

1.3 Purpose of Training Program

The training was designed to fulfill two basic purposes within SCF's community-based, integrated development program. These purposes follow from two of the SCF program goals:

- water resource and physical infrastructure development
- human resources development.

The first purpose of the training was to improve the design, implementation, and maintenance of the water supply projects constructed with the assistance of SCF. The second purpose was to assist SCF in its goal of human resources development. To this end, the training was designed to improve the water

*Field coordinators are the impact area project managers. They are responsible for management of all projects constructed in their impact area. Projects range from water supply to agriculture to health and adult literacy classes. These individuals must be capable managers and decision makers; and their education reflects a generalist background, rather than a specialty.

supply planning and management skills of the field coordinators and their assistants and to improve the design, construction, and maintenance skills of the overseers, sub-overseers, and construction supervisors. Also, the training was designed to improve the role clarity between the administrative and technical staff with respect to the implementation of water supply projects.

Chapter 2

PLANNING

2.1 Training Staff

The training staff for the SCF village water supply training consisted of three persons:

Mark Williams.....water program advisor for SCF in Nepal
Carl Johnson.....WASH consultant
James Wodrich.....U.S. Peace Corps Volunteer engineer for SCF

Mark Williams managed the training. Carl Johnson performed most of the technical instruction, except in the sessions on the Abney Level survey, ferrocement tanks, and irrigation which were conducted by James Wodrich, based on his recent construction experience in these areas.

2.2 Initial Planning in the United States and Nepal

Directly after completing the training needs assessment in October 1985, the WASH consultant met with Mark Williams in Boston, Massachusetts, before Mr. Williams began his work with SCF in Nepal. General objectives for the planning were discussed, and a line of communications was opened for further planning prior to the start of the training.

During December, January, February, and March, there was telex, telephone, and letter communication between SCF, the USAID Mission to Nepal, and the WASH office. During this period, the schedule, location, and number of trainees were finalized. An earlier plan for holding the training twice, once for SCF in Takukot and once for USAID in the Rapti area, was revised in favor of one training to which SCF, USAID, and other organizations would be invited. The scope of the training as outlined in the WASH consultant's earlier report was further reviewed by all parties; and the SCF overseers, sub-overseers, and construction supervisors were asked to identify specific topics to be included in the training.

During February to May 1986, the WASH consultant developed the training materials and refined the curriculum in the United States, based on the recommendations of the earlier report and the listing of other topics identified by the SCF overseers, sub-overseers, and construction supervisors. The WASH consultant's work included a three-day planning session at the WASH office with a training specialist from the WASH Project, Wilma Gormley. The focus of this meeting was the translation of the technical curriculum into discrete training sessions and the development of each session with the use of effective participant-oriented training techniques.

The WASH consultant's planning culminated in the preparation of two training manuals and a training work plan. The two training manuals were titled:

- TRAINING MANUAL: Village Water Supply Planning and Management
- TRAINING MANUAL: Village Water Supply Design, Construction, and Maintenance.

Ten copies of the first manual and 30 copies of the second manual were prepared in the United States and brought to Nepal. The training manuals were put into three-ring looseleaf binders so that new material developed during the final planning period in Nepal could be added.

While the training manuals were being developed in the United States, SCF made logistical arrangements for the training in Takukot Panchayat. Takukot was recommended by the WASH consultant and chosen by SCF because there are about 20 water projects within one-hour's walk of the SCF field office in Takukot. Takukot is situated in Gorkha District and is about a 12-mile walk from the town of Gorkha. Gorkha is about 100 miles northwest of Nepal's capital, Kathmandu, and is accessible by motor road. It is about a 4-hour drive from Kathmandu to Gorkha, then a six- to seven-hour walk from Gorkha to Takukot.

SCF chose an excellent training site about a 15-minute walk downhill from the Takukot field office. See Figure 2-1. The site was close enough for daily trips to the village of Takukot, yet far enough away to maintain a distinctly separate area for training classes. Tents were erected to house the trainers and participants, and a canopy was set up to create a classroom area. The training site was on a terraced hillside used for grazing cattle, goats, and water buffalo; and part of the site was to be planted with rice after the training was completed. A small source of water near the training site was fitted with a temporary pipe to provide water for cooking needs. Another source of water, about a 10-minute walk downhill of the training site, provided water for bathing and laundering clothes. The first two weeks were sunny and dry, with temperatures in the 80s and 90s (degrees Fahrenheit); and only during the last four days of the third week did the daily monsoon season rains begin.

SCF contracted with a trekking agency--Asian Trekking Ltd.--to provide tents, mats, and food. In writing invitation letters to other organizations to attend, SCF advised each of the accommodations and logistical and transportation aspects and requested that each participant bring a sleeping bag, pens, writing paper, UNICEF handbook on gravity-flow water system, and calculator if available.

Fifty participants attended the training workshops and representation is shown below:

SCF Nepal	22
SCF Bhutan	3
USAID Rapti Integrated Rural Development Project	3
Lutheran World Service	2
CARE	1
UNICEF	1
Redd Barna (SCF of Norway)	1
United Mission to Nepal	1
Village Maintenance Workers from SCF Nepal Impact Areas	16
TOTAL	50

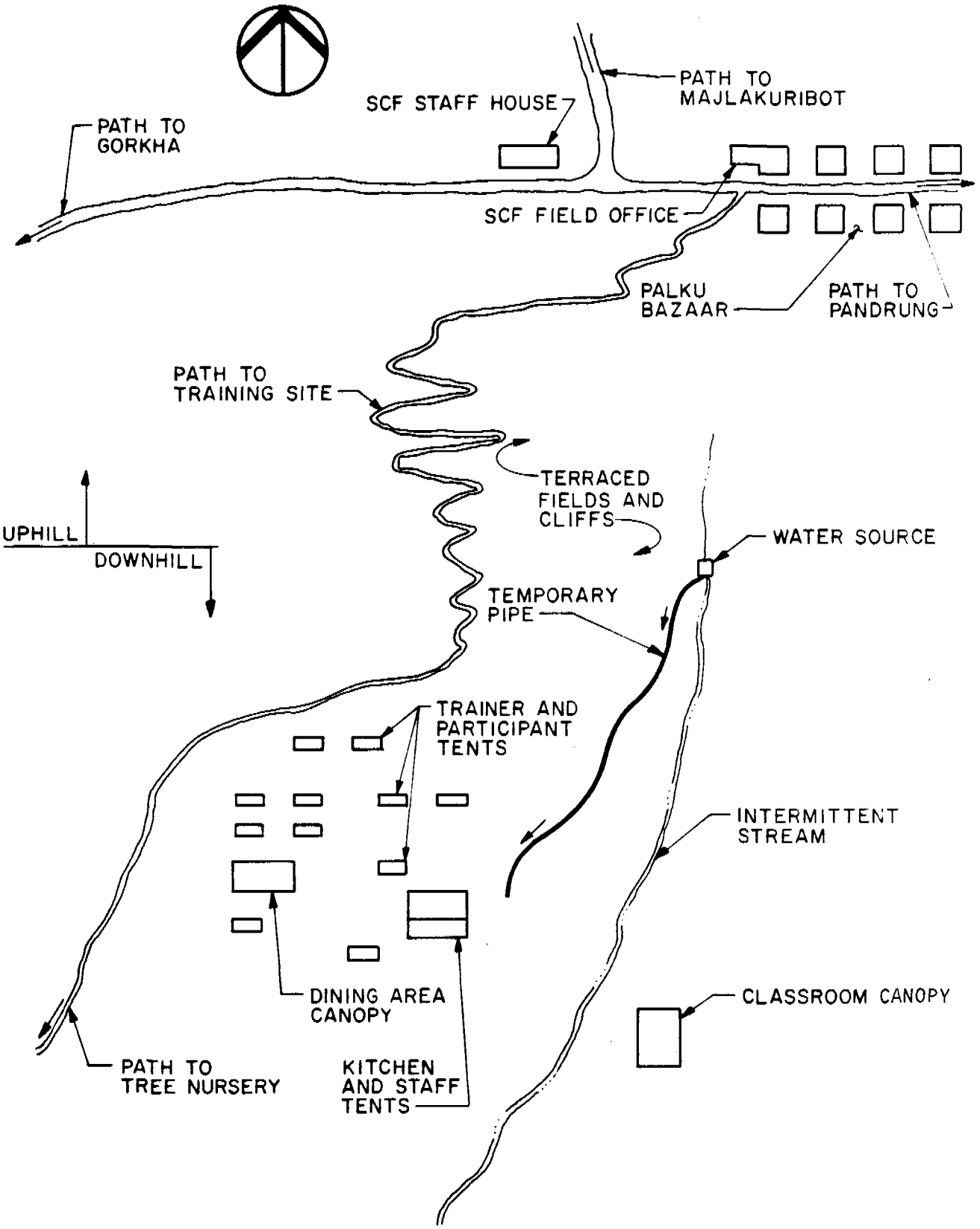

FIG. 2-1 TRAINING SITE AT TAKUKOT

2.3 Final Planning in Nepal

Final planning in Nepal took place from May 19 to 23, 1986, after the WASH consultant arrived in Nepal. The final planning consisted of meetings and telephone conversations among the WASH consultant, SCF, and the USAID Mission in Nepal. The training manuals were reviewed in-depth with the SCF water program advisor and U.S. Peace Corps engineer co-trainers. Translations from English to Nepali language were done for certain of the training materials.

Chapter 3

IMPLEMENTATION

3.1 Methods

The training methods were based on using adult learning theory, being participant-oriented, featuring active involvement by the participants, and assuming the responsibility for learning is shared between the trainers and the participants. The specific methods of training included:

- brief technical lectures
- group discussions
- individual problem-solving
- group problem-solving
- group planning
- role playing
- practical field assignments in groups
- individual presentations to the class
- group presentations to the class
- class analysis of group presentations.

The application of these various methods in the respective sessions is discussed in this chapter. The training was conducted in the Nepali language, except when English-language technical terms were necessary where no Nepali-language equivalent exists. Participants knowledgeable of English were asked to help in translation on occasion.

3.2 Training Objectives

The training objectives were directed towards the respective groups being trained:

- field coordinators and assistant field coordinators
- overseers, sub-overseers, and construction supervisors
- village maintenance workers.

3.2.1 Field Coordinators and Assistant Field Coordinators

The training objective for field coordinators and assistant field coordinators was to improve their understanding of gravity-flow water supply systems--including the source protection requirements, physical limitations, implementation steps, and maintenance needs of such systems--so that the field coordinators and assistants could effectively communicate these ideas to the village beneficiaries of the water systems.

At the end of the training workshop, the field coordinators and assistants will be able to:

- assist the overseers and sub-overseers to form a village construction and maintenance committee

- work with the village construction and maintenance committees in planning the water project under the technical direction of the overseer or sub-overseer

- help the overseer or sub-overseer to resolve disputes or problems related to water system implementation and maintenance.

3.2.2 Overseers, Sub-overseers, and Construction Supervisors

The first objective for the overseers, sub-overseers, and construction supervisors was to increase their technical skills in the areas of water supply system design and maintenance along with certain types of specialized design and construction, ferrocement reservoir tanks, suspended cable crossings, retaining walls, and irrigation. The second objective for this group was to strengthen their training skills in instructing village maintenance workers and village maintenance committees regarding their respective maintenance responsibilities and duties.

At the end of the training workshop, the overseers, sub-overseers, and construction supervisors will be able to:

- complete surveys and designs for new water systems and designs for the repair of malfunctioning water systems

- know when to seek the advice of other overseers on technical questions

- complete the implementation, construction, and testing of new water systems and repairs to older systems

- conduct training for village maintenance committees and village maintenance workers

- guide village maintenance workers and maintenance committees for the period in which SCF provides maintenance guidance to the village after official hand-over of completed water projects.

3.2.3 Village Maintenance Workers

The training objectives for the village maintenance workers stem from the fact that their training was a by-product of the training-of-trainers given to the overseers, sub-overseers, and construction supervisors. The amount of time devoted to instructing the village maintenance workers was necessarily brief in the context of a training-of-trainers format. However, the training objectives were to introduce the maintenance workers to proper quality control techniques for joining plastic and galvanized iron pipe and to introduce routine preventive maintenance measures for water system inspection, cleaning, and flow control.

At the end of the training, the village maintenance workers will:

- be aware of proper quality control measures in pipe joining and repair

- be familiar with preventive maintenance measures
- be prepared for more detailed training conducted by overseers, sub-overseers, and construction supervisors in their own villages.

3.3 Training Schedule and Overview

A complete schedule of the training workshops is presented in Figures 3-1 and 3-2. The daily schedule during the three-week period was as follows:

Breakfast.....7:00 to 7:30 a.m.
Morning Training Session.....8:00 to 11:00 a.m.
Lunch.....11:30 to 12:00 a.m.
Afternoon Training Session.....1:00 to 4:00 p.m.
Dinner.....8:30 p.m.

Within the three-week period, there were two separate workshops and three principal groups of participants. The first workshop--Village Water Supply Planning and Management--was held primarily during the mornings of the first week, and the participants at this workshop were field coordinators and assistant field coordinators. During the afternoons of the first week, these participants returned to their normal jobs; or they worked independently in study groups without training staff. This first workshop was finished in the first week, and the participants departed.

The second workshop--Village Water Supply Design, Construction, and Maintenance--extended over the entire three-week period. It was held in the afternoons of the first week and in the mornings and afternoons of the second and third weeks. In the mornings of the first week, the participants were under the direction of one trainer, while the other two trainers conducted the other workshop in Village Water Supply Planning and Management. The participants in the first two weeks of the second workshop included overseers, sub-overseers, and construction supervisors. During the third week these participants were joined by village maintenance workers who attended three days of training that involved maintenance work.

The number of participants in the workshops were as follows:

Workshop 1..... Field Coordinators and Assistant Field Coordinators	17
Workshop 2..... Overseers, Sub-overseers, and Construction Supervisors	17
Village Maintenance Workers...	16
TOTAL	50

3.4 Village Water Supply Planning and Management Sessions

The workshop on Village Water Supply Planning and Management extended for five days, including four half-day morning sessions and one full-day session and one evening session. The evening session was held at the request of the participants who needed to travel on Friday, May 30, to another SCF meeting in Gorkha.

TRAINING SCHEDULE: VILLAGE WATER SUPPLY PLANNING AND MANAGEMENT

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
May 25	May 26	May 27	May 28	May 29
Morning Session 1	**Morning Session 2**	**Morning Session 3**	**Morning Session 4**	**Morning Session 5**
• Training Goals	• Water Sources and Their Protection	• Reservoir Tanks and Water Conservation	• Forming a Water Project Beneficiary Committee	• Joint Session with Overseers on Implementation and Maintenance of Water Projects
• Role of Water Supply in SCF Development Projects	• Water Needs of a Village	• Planning a Water Supply Project	• Forming a Maintenance Committee	
Afternoon Session 1	**Afternoon Session 2**	**Afternoon Session 3**	**Afternoon Session 4**	**Afternoon Session 5**
• Participants Returned to Regular Jobs	• Policy Session on Rock Breaking and Fencing	• Participants Returned to Regular Jobs	• Policy Session on Reporting and Maintenance Guidance	• Continuation of Morning Session
				Evening Session 6
				• Water Rights Disputes

FIG. 3-1 TRAINING SCHEDULE FOR FIRST WORKSHOP

TRAINING SCHEDULE: VILLAGE WATER SUPPLY DESIGN, CONSTRUCTION AND MAINTENANCE

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
May 25	May 26	May 27	May 28	May 29	May 30	May 31
Morning Session 1	Morning Session 2	Morning Session 3	Morning Session 4	Morning Session 5	Morning Session 6	
• Abney Level Adjustment	• Topographic Surveying	• Plotting of Topographic Survey Data	• Pipeline Sizing for Survey Route	• Joint Session with Field Coordinators on Implementation and Maintenance	• Complex Water System Design	Free Day
Afternoon Session 1	Afternoon Session 2	Afternoon Session 3	Afternoon Session 4	Afternoon Session 5	Afternoon Session 6	Afternoon
• Training Goals • Demonstration of a Model Water System	• Reservoir Tank Design	• Pipeline Design	• Problem Solving in Reservoir and Pipeline Design	• Continuation of Morning Session	• Field Trip to Banspani Water System to Analyze Source Protection Requirements	• Special class for two new participants from CARE and UNICEF who arrived on May 30.

FIG. 3-2 TRAINING SCHEDULE FOR SECOND WORKSHOP

TRAINING SCHEDULE: VILLAGE WATER SUPPLY DESIGN, CONSTRUCTION AND MAINTENANCE

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
June 1	June 2	June 3	June 4	June 5	June 6	June 7
Morning Session 7	Morning Session 8	Morning Session 9	Morning Session 10	Morning Session 11	Morning Session 12	
• Solution of Complex Water System Problem Begun on May 30	• Design of Water System Structures for Simple Maintenance • Mid-Point Evaluation	• Ferrocement Tank Design and Construction	• Suspended Cable Crossing Design	• Spring Intake Repairs and Sedimentation Tanks	• Retaining Wall Design	Free Day
Afternoon Session 7	Afternoon Session 8	Afternoon Session 9	Afternoon Session 10	Afternoon Session 11	Afternoon Session 12	
• Practice in Layout of New Pipe at Bahakot	• Field Trip to Ritepani Water Project	• Field Trip to Satasidhara Ferrocement Reservoir Tank	• Field trip to observe pipe crossings of a stream and landslide	• Demonstration of Model Water System and Individual Question and Problem Session	• Survey of Village Water System Maintenance Practices	

FIG. 3-2 CONTINUED

TRAINING SCHEDULE: VILLAGE WATER SUPPLY DESIGN, CONSTRUCTION AND MAINTENANCE

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
June 8	June 9	June 10	June 11	June 12	June 13	June 14
Morning Session 13	Morning Session 14	Morning Session 15	Morning Session 16	Morning Session 17	Morning Session 18	
• Estimating Quantities	• Training of Village Maintenance Workers	• Training of Village Maintenance Committees	• Irrigation Water Requirements	• Irrigation Structures	• Final Evaluation	Free Day Travel to Kathmandu
Afternoon Session 13	Afternoon Session 14	Afternoon Session 15	Afternoon Session 16	Afternoon Session 17	Evening	
• Open Session for Solving Problems and for Individual Questions	• Training of Special Plumbers in Pipe Joining	• Training of Special Plumbers in Pipe Joining	• Training of Special Plumbers in Preventive Maintenance Procedures	• Session for Individual Questions	• Closing Ceremony	

FIG. 3-2 CONTINUED

An overview of the curriculum for this training workshop is presented in Figure 3-3. The complete training manual has been submitted under separate cover to the WASH office (and is available from the WASH library), and extra copies have been left with SCF and the USAID Mission to Nepal. All contents of the training course are not described in detail here, and the reader is referred to the training manuals for further description of the content of the workshop. The descriptions below focus on the training methods, significant feedback from the participants that will help SCF in the implementation and maintenance of its water supply projects, and new material added to the training manual during the workshop.

SESSION	TOPICS
1.	Training Goals Role of water supply in SCF community development projects
2.	Water sources and their protection Gravity flow water systems: basic technology Water needs of a village
3.	Reservoir tanks and water conservation Planning a water supply project
4.	Forming a beneficiary committee Forming a maintenance committee
5.	Joint session with overseers, sub-overseers and construction supervisors
6.	Water rights, and identifying and resolving water disputes

Figure 3-3. Curriculum Overview for Village Water Supply Planning and Management

3.4.1 Session 1: Training Goals and Role of Water Supply in SCF Development Projects

Participants were asked to write their major problems in doing their jobs: first, problems in getting agreement among village beneficiaries in starting a water project and second, problems in keeping water systems well-maintained. Participants then worked in teams to prioritize their problems and to identify learning goals for the training.

Major problems identified by the participants included:

Problems in Village Agreement When Starting a Project

- tapstand and reservoir location disputes
- water rights disputes
- village political influence
- landowners seek compensation for land to be occupied by reservoir tanks
- apathy of village development committee (VDC)
- village disagreement with overseer's technical recommendations
- misunderstanding of the limits of SCF's role in water supply construction
- arguments among village beneficiaries
- lack of technical knowledge by field coordinators when trying to arbitrate between overseer's and village's opinions
- lack of communication between VDC and village beneficiaries regarding important decisions
- equal sharing and distribution of water when the source is small and when the dry season occurs
- changes in SCF policy which impact the project costs or the village contribution
- village has high expectation of being paid for its contribution of work
- UNICEF standard of 45 lpcd is sometimes applied arbitrarily
- village attitude is often to bargain during water system planning
- disagreements over wage rates for skilled and semi-skilled labor.

Problems in Water System Maintenance

- collection of maintenance funds
- protection of the water source from contamination
- misunderstanding of the responsibilities of village in maintaining the water system
- village maintenance committee has no power of enforcement
- lack of training for village maintenance workers
- village maintenance workers have very low job status
- what should be done if a natural disaster (landslide) destroys part of the water system
- lack of a clear maintenance policy
- lack of well-maintained completed water systems to serve as models
- village bargaining in assigning maintenance responsibilities
- SCF has very high expectations for maintenance
- lack of women's participation in maintenance committees.

Goals of the Training as Expressed by the Participants

- know how and when to collect maintenance funds
- learn basic technical knowledge about gravity-flow water systems
- learn how to make water safe to drink using natural methods
- be able to improve the planning and implementation of water projects
- develop a policy for project hand-over and maintenance supervision

- Should the UNICEF standard of 45 lpcd be followed
- learn how to organize a construction and maintenance committee
- improve understanding among technical and administrative staff
- develop step-by-step method for project implementation
- learn infrastructure maintenance skills
- develop a more effective reporting system
- learn how to make meetings more effective
- learn how to use the good ideas of the village beneficiaries within the technical limits of a gravity-flow water supply system
- be able to evaluate infrastructure progress
- be able to build with local materials
- be able to explain the technical limitations of a gravity water supply to village beneficiaries
- learn environmental management concepts.

Most of the problems and goals of the participants in this first workshop had been anticipated based on the earlier training needs assessment conducted in September 1985. During the training sessions, the participants' problems and goals were specifically referenced to show how the training was meeting their goals. Certain goals expressed by the participants could not be fully met within the scope of the water supply training, and these are listed later in Chapter 5 for future training.

3.4.2 Session 2: Water Sources and Their Protection and Water Needs of a Village

The first part of this session stressed the need for protecting water sources from erosion and contamination. An SCF specialist in forestry from Pandrung Panchayat was brought to the training to describe trees that would be suitable for planting within a fenced area surrounding a water source to protect the area from erosion. The recommended trees, to be planted no closer than 10 meters to the source, are bamboo and "chilaune."

The recommended source protection method for SCF water supply projects is to fence an area up to 50 meters distance uphill of a spring water source. In a class discussion, the field coordinators agreed that stone wall fencing would be the best protection, with barbed wire a second choice, and planting a row of thorn trees the third choice. The field coordinators recognized that this degree of source protection is ideal but identified examples of sources where the surrounding land is used for agriculture, and the cost to purchase the land for source protection would be prohibitive. Also, with regard to fencing the source area, the field coordinators believed that a policy for the village contribution of labor and materials should be developed. The issues of land compensation and fencing were handled in subsequent sessions with the field coordinators and overseers, and the resolution of the issues is presented later in this report.

In the discussion of the daily water needs of a village, the trainer asked the participants to identify categories of water use and minimum daily requirements for each. As a result of the discussion, the participants developed the following minimum guidelines:

Water Use Category	Minimum Daily Requirement (lpcd)
Drinking Water	4
Cooking	4
Washing Face and Hands	2
Dishwashing	2
Bathing (once per week)	7
Lipne Water*	1
Clothes Washing	5
Latrine Cleaning	1
	26 liters per capita per day

The field coordinators believed that 25 to 30 lpcd would be a reasonable minimum allowance to consider when the UNICEF standard of 45 lpcd cannot be achieved.

In the afternoon session after the class, the field coordinators formed a study group to develop a policy for compensating semi-skilled labor for rock quarrying and stone wall construction.

3.4.3 Session 3: Reservoir Tanks and Water Conservation and Planning a Water Supply Project

The first part of this session dealt with the problem of how to share water equally among all beneficiaries during the annual dry season. The discussion was initiated by the trainer, explaining that presently the Bahakot system is supplying only about seven lpcd. The class was divided into small groups to plan strategies for conserving water. Among the major ideas reported back by the groups were:

- close the reservoir for all but two hours in the morning and two hours in the evening
- provide a watchperson from each beneficiary household for one day to enforce the reservoir closure
- use reservoir water only for drinking and cooking; use the other traditional sources downhill of the village for bathing and laundry
- fence the source catchment area and plant it with trees to prevent erosion
- adjust all tapstand control valves to assure equal flow among the tapstands.

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*"Lipne" is a Nepali word describing a traditional ritual of spreading a film of water, red clay, and cow manure on the floor of an entry way to a home.

In a related discussion, the field coordinators noted that sometimes a group of village beneficiaries chooses a location for a tapstand that, because of its high elevation, does not deliver the standard 0.225 lps flow. If the beneficiaries are satisfied with a smaller flow at the location of choice, then an agreement should be prepared that documents the fact that the user group accepts the small flow in favor of the more convenient location.

A model of a gravity-flow water system was then demonstrated to the participants to show the relationships between the numbers of tapstands, elevation, pipe length, and flow. The important features of a gravity-flow water system were discussed along with the key technical design criteria.

The step-by-step procedure adopted by SCF for implementing water projects was then discussed. The field coordinators agreed that the step involving maintenance guidance needed more definition, and assigned this issue to the policy development session on day 5 for further discussion.

3.4.4 Session 4: Forming a Water Project Beneficiary Committee and a Maintenance Committee

This session was designed to address the following goals set by the field coordinators in the first session:

- how to organize a maintenance committee
- how and when to collect maintenance funds
- how to make meetings (with the maintenance committees) more effective
- how to explain technical concepts to village beneficiaries.

The session began with the trainer asking the participants to identify why maintenance is important. The following points were made by the group:

- good maintenance provides long life to the water system
- the water will be clean and healthy to drink
- the water will be distributed equally to all beneficiaries
- a well-maintained system sets an example for new water projects
- conducting a maintenance program promotes self-reliance within the village
- preventive maintenance will minimize repair costs.

The trainer added the last point during the session after the participants' concluded their discussion.

The group discussed the collection of maintenance funds for the purpose of paying village maintenance workers. SCF had recently developed a policy for starting village maintenance committees and collecting Rs. 100 ($5 U.S.) per tapstand from the committee prior to construction, the proceeds to be deposited in a bank account to generate interest income for maintenance needs. The interest, however, is not meant to be sufficient to pay the wages of the village maintenance worker.

The field coordinators agreed that village maintenance workers should generally receive wages in payment-in-kind in the form of grain, because most

village beneficiaries do not have enough money to pay the maintenance worker. The maintenance committee should decide on the amount of payment, and payment would normally be made two times a year after the major harvests.

The participants were divided into four groups, and each group was asked to prepare a presentation to a new maintenance committee covering the following points:

- why is maintenance important
- what must be done to protect the source
- how should the village maintenance worker be selected
- how should the village maintenance worker be paid.

The trainer asked that the presentations be geared toward explaining the technical concepts in simple terms and toward promoting an effective meeting with the committee.

After the presentations and discussion of the presentations, the organization of a village maintenance committee was discussed. The field coordinators agreed that the committee should include a chairperson, a secretary-treasurer, and members representing each tapstand user group. The village maintenance worker should be a committee member also. These aspects of committee organization were offered in addition to the earlier guidelines developed by SCF.

The qualifications of a village maintenance worker that the participants identified included:

- ability to read and write
- honesty
- at least 25 years of age
- life-long resident of village
- related experience.

3.4.5 Session 5: Joint Session with Overseers on Implementation and Maintenance of Water Projects

This was a full day session divided into a three-hour morning part and a three-hour afternoon part. The training objectives for the morning included:

- role clarity between technical and administrative staff
- understanding between technical and administrative staff on water supply issues
- conveyance of basic technical knowledge on water supply from the overseers to the field coordinators
- use of local materials in rural drinking water projects.

The session opened with a presentation by the overseer from the United Mission to Nepal regarding the construction of tapstands using wooden timbers. Other overseers and field coordinators contributed their experience using wood, dry stone masonry, and mud mortar as opposed to portland cement mortar.

SCF's 12 steps in implementing a water supply project were reviewed. Also, the use of the demonstration model was discussed as a way of showing the technical limitations of gravity-flow water systems to village beneficiaries.

In the afternoon, the training was a practical policy development session. The agenda for the session was outlined by the trainer; but from that point, the participants led the discussion and concluded with the following policy recommendations to SCF.

Rock-Breaking

1. Definition: rock-breaking is the quarrying of rock or the splitting of large boulders; it is not the breaking of small rock into aggregate for concrete or stone soiling.

2. Rock-breaking requires semi-skilled labor.

3. At present, rock-breaking for schools is paid for; but there is no compensation for rock-breaking for water systems.

4. The participants recommended that all infrastructure projects have an equal policy for payment for rock-breaking and that rock-breaking be paid for at a semi-skilled wage rate.

Fencing for Source Protection

1. The participants agreed that the best type of fence is a stone wall; the second best is barbed wire; and the third best, the planting of thorn bushes.

2. Fencing is needed to protect a source from contamination.

3. Short stone wall fences might be contributed by the village, but the participants recommended that SCF consider paying for construction of long stone wall fences, given a reasonable level of community contribution.

Reporting Policy

The participants perceived a number of communication issues between the field and the Kathmandu office and reporting from the village beneficiaries to the impact area office. To address these problems, the participants recommended:

1. Information from the village should be based on facts derived in the field (such as actual house counts, population survey) for any new water project. The information should be independently corroborated by an overseer.

2. If outside technical consultants are hired to assist in project design or implementation in an impact area, then the respective field assistant in the project area should be consulted and have the opportunity to participate in discussions in the design and estimating of the project.

3. The requested budget figure in the Field Office Reporting System (FORS) form for implementing the projects should not

be reduced without consulting with the respective field staff for reasons or suggestions.

Guidance to Maintenance Committee

The participants discussed the meaning of maintenance guidance, a concept originated in the WASH consultant's earlier report on the training needs assessment. Recommendations of the participants included the following:

1. After construction and testing of the water system to the satisfaction of the village beneficiaries, there should be an official handing-over ceremony and presentation of tools to the maintenance committee. At this time, maintenance of the water system should become the prime responsibility of this committee.

2. For the next 24 months, SCF should guide the maintenance committee by monitoring the preventive maintenance work, giving technical advice on repair work, and helping the maintenance committee to resolve maintenance problems.

3. SCF should provide training to maintenance committees regarding their duties and responsibilities.

4. If a tank leaks during the two-year period, SCF should oversee the repair of the tank; and the cost of the work should be borne in the same ratio of SCF-to-village contribution as established during the construction phase.

5. For any technical defects that are not the fault of the village, SCF should buy and install replacement materials.

6. At the end of this two-year period, the full responsibility will belong to the maintenance committee.

Maintenance Fund Collection

SCF had previously developed a maintenance fund collection guideline providing for Rs. 100 per tapstand, as discussed previously in Section 3.4.4. The participants discussed this fund collection arrangement and the advantages of a matching grant system. The participants made recommendations that were discussed with SCF and the points below were agreed upon:

1. SCF will contribute an amount equal to 50 percent of the community maintenance fund (up to a limit of Rs. 100 per tapstand) after the following conditions are met:

   a. The two-year maintenance guidance period ends with successful acceptance of maintenance by the maintenance committee.

   b. The maintenance committee continues to replenish the additional funds to be placed in a regular savings account,

and these funds are adequate to maintain the system on a yearly basis.

c. The village development committee agrees to contribute an amount equal to 50 percent of the community maintenance fund, up to a limit of Rs. 100 per tapstand at the end of the two-year maintenance guidance period.

3.4.6 Session 6: Water Rights Disputes

This session involved a case study and role play of two sides of a water rights dispute. Disputes over water rights are not uncommon in the implementation of drinking water projects. The case study and role play are presented in Figure 3-4; and these involved a discussion between Ambika, the field coordinator for Aampchaur and Prakash, the ward chairman of Toraipaani. The role playing extended for about six minutes, after which the class discussed:

What was Ambika trying to achieve?
What was Prakash trying to achieve?
How did each affect the other in coming to a resolution?

3.5 Village Water Supply Design, Construction, and Maintenance: First Week Sessions

The workshop on village water supply design, construction,and maintenance extended for 18 days, six days per week for three weeks. The first week was devoted primarily to basic design principles, the second to construction, and the third to maintenance.

An overview of the curriculum is given in Figure 3-5. The complete training manual has been submitted to the WASH office under separate cover, and copies have also been left with the USAID Mission to Nepal and with SCF. All contents of the training manual are not described in detail in this report. Rather, the format of the descriptions of the individual sessions have the same focus as noted in the introduction to the previous workshop in Section 3.4.

3.5.1 Session 1: Training Goals, Demonstration of a Model Water System, Review of Available Technical References, and Project Implementation Steps

Similar to the opening of the first workshop, participants were asked to write out their problems in 1) designing water systems and 2) constructing water systems. Participants then worked in teams to prioritize their problems and identify learning goals for the workshop. Major problems identified by the groups are listed below:

Problems in Design

- selecting the correct pipe size
- designing a river crossing
- determining the size of a reservoir tank
- designing a pipeline, given a ground surface profile

CASE STUDY OF A WATER RIGHTS DISPUTE

Take some time to read the following case study. We will discuss the questions after reading it.

Ambika is the SCF field office coordinator in the village of Aampchaur. He is new to the job, and started work four months ago. He replaced another field office coordinator who had been at Aampchaur for two years.

Ambika is pleased with the progress of the SCF program in Aampchaur. He believes that steady progress is being made on several projects: construction of a new school is nearly complete, an important irrigation project is just beginning, a water supply system is in operation.

Ambika feels that he has an excellent suboverseer, Laal Bahadur, who is very efficient and hard working. Laal Bahadur must spend half of his time working in another village, Jangkot.

This morning, it is very hot, and there has not been any rain for many weeks. Ambika and the village development committee chairman arrive at the SCF office to find to members of the water system maintenance committee. The maintenance committee members are very upset. He begins to talk with them.

"There is a lot of damage at the water system. At least half of the taps have been broken, as if someone hit them with a hammer repeatedly," the maintenance committee people said.

"There are rocks and dirt dumped into the reservoir. Some one has destroyed our water system", they continued.

The maintenance committee members looked expectantly at Ambika, as if he ought to tell them what to do. Ambika begins to question them more carefully.

The two men explained that they had been special plumbers of the water system for the last year. The said that there had been minor vandalism to the system about once a month since it was built, but they had never experienced as much damage as there was today. When Ambika asked them who they thought was responsible, they repsonded quickly saying they were sure it was the people from the next village of Toraipaani.

FIG. 3-4 CASE STUDY

They said the people in Toraipaani had been angry from the beginning of the water system. Before the water system was built, the people of Toraipaani used the water source for irrigation and watering animals. Once the new system was built, their source of water was made smaller in the dry season. They felt that they had not been treated fairly in the planning of the water system.

Ambika thought to himself that because it is now the month of Baishek and very dry, the people of Toraipaani may have been very frustrated ans angry at the lack of water for their animals.

He thought: well, now what to do?, as he faced the two maintenance committee persons.

1. If you were Ambika, what would you do right now?

2. What would you do within the next two weeks?

3. What do you think was the cause for the vandalism?

4. What could have been done to prevent it?

FIG. 3-4 CONTINUED

THE WARD CHAIRMAN

Take some time to read the following description of Prakash, the Ward Chairman from Toraipaani. During the training session, we will enact a conversation bewteen Ambika and Prakash regarding their water problems.

You are Prakash, the ward chairman of the largest ward in the village of Toraipaani. You have held this position for five years. In general, you are happy with the progress that has been made in your ward in the time you have been ward chairman. The village has an increased sense of responsibility, there is a new school, a new walking path a new health post, and a good deal of work has been done to improve the water supply.

This morning, it is very hot, and it has not rained in many weeks. You have been requested to meet with two people from the village of Aampchaur. You know that they are from the village development committee, and that they want to talk with you about water supply issues. You have heard rumors that the water system in Aampchaur has been damaged by vandalism, and you suspect that they want to talk to you about the damage.

Relations between the families in Toraipaani and Aampchaur have been strained recently over the water problems. It began a year ago when the new water system in Aampchaur was completed. The Aampchaur system used a spring that families in part of your ward had used in dry weather for watering livestock. This was upsetting, but at the time the monsoon season had replenished many sources, and the loss of one source was not critical. Now, however, the dry season has caused a water shortage, land the families in your ward have to walk down to the river to water their livestock. The families have become increasingly angry over the loss of the nearby water supply that they had always used in dry weather.

You do not know if any of the people in your ward did the damage to the water system in Aampchaur, and you certainly hope that they did not do the damage. However, you are sympathetic to their concerns about water, and you think that it was unfair for the people in Aampchaur to take all of the water during the dry season, leaving the families of Toraipaani to struggle with their livestock.

FIG. 3-4 CONTINUED

SESSION	TOPICS
1.	Training Goals Demonstration of model water system Review of design, construction and maintenance manuals
2.	Reservoir tanks
3.	Pipeline sizing
4.	Design problem solving session
5.	Joint session with field coordinators
6.	Design of complex water systems
7.	Design of complex water systems
8.	Design for simple maintenance
9.	Ferrocement reservoir tanks
10.	Suspended cable crossings
11.	Spring repairs and sedimentation tanks
12.	Retaining walls
13.	Estimating quantities and costs and Survey of maintenance practices
14.	Training of Special Plumbers
15.	Training of Special Plumbers and Village Maintenance Committees
16.	Irrigation Water Requirements
17.	Irrigation Canals and Structures
18.	Final Training Evaluation

FIG. 3-5 CURRICULUM OVERVIEW FOR VILLAGE WATER SUPPLY DESIGN CONSTRUCTION AND MAINTENANCE

- the meaning of "residual head"
- construction of water supply structures on a steep hillside
- lack of design guidelines
- completion of designs before end of fiscal year to allow authorization in following year
- the Abney Level (surveying instrument) not sufficiently accurate for flat areas
- determining how many tapstands can be supplied from a source
- monsoon season flow measurements not a suitable basis for design.

Problems in Construction

- political pressure to move tapstands during construction in contradiction to the design
- getting materials (especially local materials) to the job site
- mobilizing and motivating volunteer laborers
- often dry season flow not sufficient for minimum daily water needs
- construction supervisors cannot understand design drawings
- delays in receiving construction materials
- air locks stop the flow of water
- unequal flow and pressure at the tapstands
- water leaks from air release valves
- water rights arguments
- village maintenance committees are not active.

Goals of the Training as Expressed by the Participants

- learn pipeline design procedures
- use the Abney Level surveying instrument
- construct a ferrocement reservoir tank
- design retaining wall
- design reservoir tank
- determine the correct locations for air vents and washouts
- calculate and estimate materials and costs
- use local materials in construction
- design break pressure tanks
- understand the residual head concept
- make an economical design
- determine how many persons can be served by a particular source
- determine how many tapstands can be supplied by a particular source
- learn to use plumbing fittings in alternative ways
- learn fundamental concepts of irrigation.

Following the identification of goals, a demonstration was given to show a model of a complex water system. The model was used to demonstrate problems such as:

- air blocks
- unequal flow at taps
- inadequate residual head
- clogging by sediment.

During the demonstration, the point was made that the training would give the participants the design skills to avoid these problems.

In discussing the available technical references for village water supply in Nepal, two newer Nepali-language manuals were identified by the participants. One is published by UNICEF, and it provides standard dimensions and material estimates for all basic gravity-flow water system structures. The other is published through the Pokhara Office of the Ministry of Panchayat and Local Development and the Swiss Association for Technical Assistance (SATA). It is geared toward village maintenance workers and covers such topics as pipe repair and maintenance of water systems.

In the morning period prior to session 1, the participants practiced the calibration and adjustment of the Abney Level surveying instrument. Individual guidance was given to participants not familiar with the instrument.

3.5.2 Session 2: Reservoir Tank Design and Topographic Surveying

This session featured a lecture on reservoir design procedures, problem--solving involving the entire class, and problem-solving in small groups of three to four persons. The training was in the tabular method of reservoir design, which involves the analysis of water supply and demand for various periods of the day.

In the morning period prior to Session 2, the participants performed a topographic survey using the Abney Level surveying instrument. The participants were divided into groups which included persons knowledgeable of the survey methods, as well as persons learning the methods for the first time.

3.5.3 Session 3: Pipeline Design and Plotting of Topographic Survey Data

Similar to session 2, the training in this session included a lecture on pipeline design procedures, problem-solving on pipeline design in the class, and problem-solving in groups. The demonstration model of the gravity-flow system was used again to show:

- hydraulic gradeline
- residual head
- relationship between flow rate, pipe length, and frictional headloss.

The use of tabulated friction headloss tables was thoroughly discussed, and all problems were solved using these tables.

During the morning period prior to session 3, the participants practiced plotting the survey notes from the day before. Persons not familiar with survey plotting procedures worked with groups that included persons knowledgeable of the procedures.

3.5.4 Session 4: Problem-solving in Reservoir and Pipeline Design and Pipeline Sizing for Survey Route

This session had originally been scheduled to provide time for participants who needed more practice in solving problems on pipeline and reservoir design to do so. Also, it gave an opportunity for more advanced participants to help others. During the session, the trainer created a series of design problems in reservoir and pipeline sizing ranging from very simple to more complex; and the participants worked individually and in groups on the problems of their choice.

3.5.5 Session 5: Joint Session with the Field Coordinators on Implementation and Maintenance

This session was previously described in Section 3.4.5.

3.5.6 Session 6: Complex Water System Design and Field Trip to Banspani Water System to Analyze Source Protection Requirements

This session began the schedule of morning classes for the overseers, sub-overseers, and construction coordinators, followed by afternoon practical sessions. The morning class dealt with the design of gravity-flow water systems having more than six tapstands and multiple reservoir tanks.

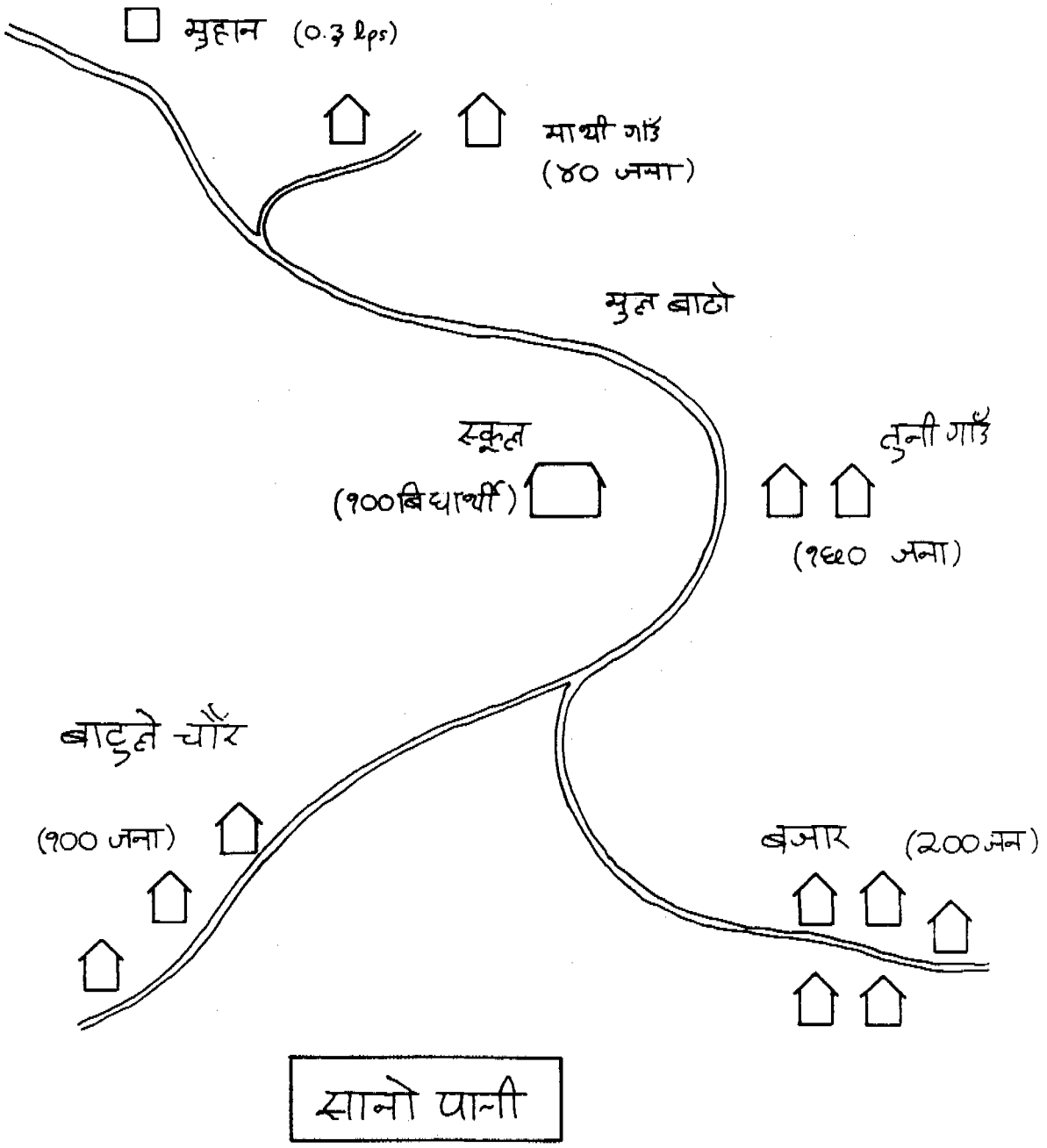
In this session, emphasis was placed on considering two or more smaller reservoirs located near tapstand groups rather than on building one large reservoir. Multiple reservoirs, while requiring slightly more stone masonry construction, have the following advantages:

- shorter length of larger diameter mains between reservoir and tapstands
- no break pressure tanks below the reservoir
- opportunity for easier implementation when smaller beneficiary groups build their own reservoir tank
- potentially more attention to maintenance when the reservoir serves a smaller group and is located close to the users.

The Kapedhara water system in Duerali Panchayat was analyzed as an example of a complex water system. The improvements recommended in the WASH consultant's earlier report were explained to the participants; and if the system were to be built again from the beginning, then three small reservoirs should be considered to replace the one large reservoir. A design problem involving a complex water system was given to the class for solution as homework. The problem is shown in Figure 3-6.

Also during this session, methods were taught to the participants for:

- determining how many people could be supplied by a water source with a given flow



NOTE:
SEE PROFILE ON FIG. 3-6B

FIG. 3-6A SAMPLE DESIGN PROBLEM

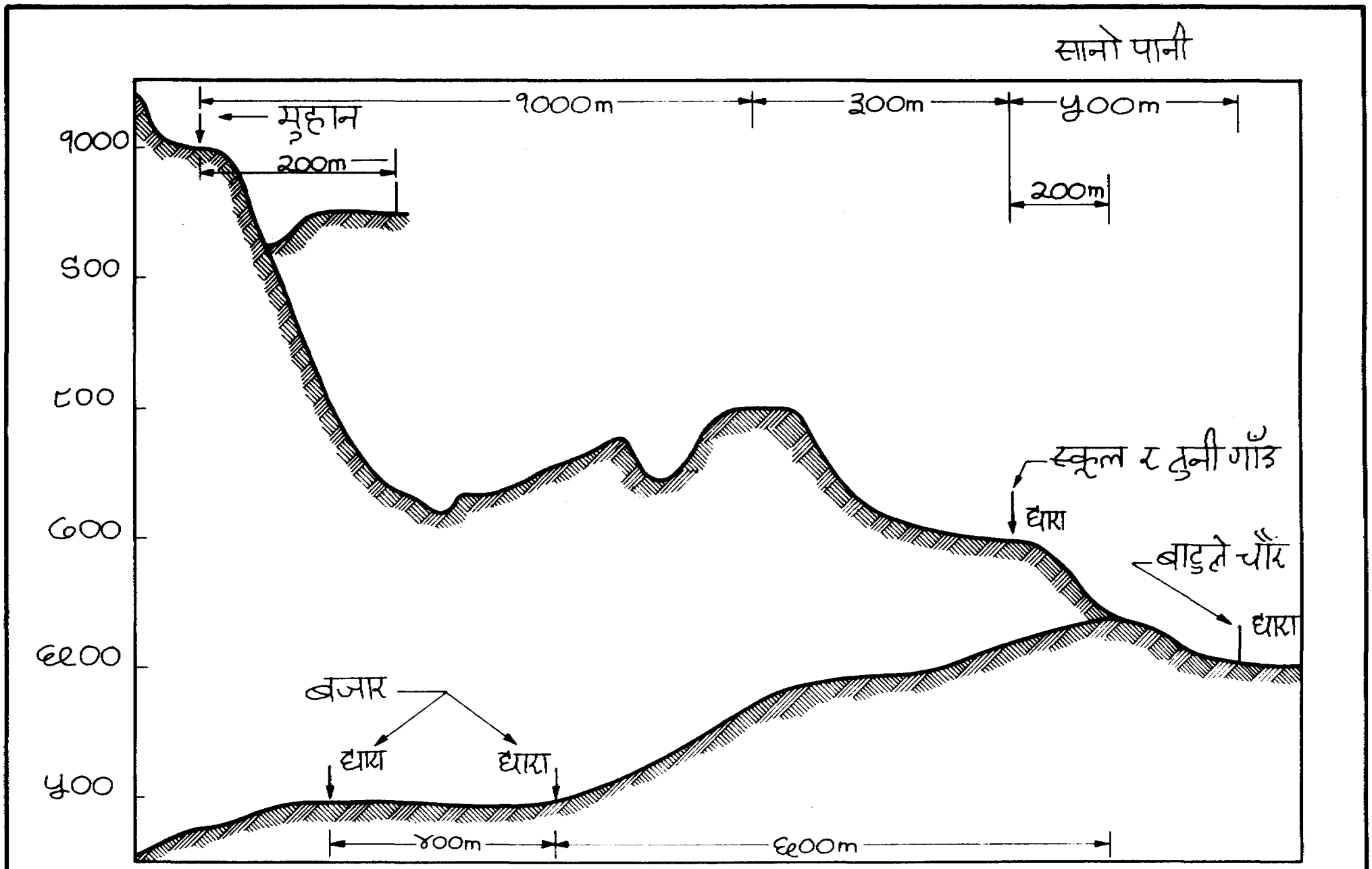


FIG. 3-6B SAMPLE DESIGN PROBLEM

- determining how many tapstands could be supplied by a source of a given flow.

In the afternoon of the sixth day, the participants and trainers visited the Banspani water project to investigate the water source and develop ideas for protecting the source from contamination. At present, agricultural land planted with corn drains into the source; and there is the potential for contamination by human and animal waste. The recommendations developed by the participants are presented below:

1. Hold a meeting among the village maintenance committee, the landowners abutting the source (there are three) and the SCF field coordinator and sub-overseer.

2. At the meeting, the SCF sub-overseer will propose:

   a. construction of a stonewall fence at a distance of 10 to 20 meters around the source

   b. annual compensation to the landowners from the village maintenance committee in the form of an equivalent amount of grain that could be harvested from the fenced-off area

   c. planting the fenced area within the fence with grasses near the intake tank and trees at the perimeter

   d. limited rights to the landowners to enter the fenced area to harvest the grass for cattle and buffalo fodder

   e. construction of a perimeter ditch to divert surface water flow in the monsoon away from the intake

   f. construction of smaller drainage ditches near the two catchment tanks to divert surface water that originates within the fenced area away from the source.

3. Implement a weekly program of preventive maintenance that includes inspection of the water source intake tank, cleaning, and repair as necessary.

4. Install a float valve in the small reservoir serving the tapstand at the source.

As part of the field trip to the Banspani water source, the participants practiced measuring the water flow and adjusted the flow between the main supply to the village and the single tapstand at the source.

On the evening of the sixth day, May 30, two new participants arrived at the training site. These participants were from CARE and UNICEF. The WASH consultant held a special class for these new arrivals on May 31, reviewing the first week of training. Individual instruction was continued with the overseer from CARE through June 1, since he had no previous experience in water supply work. The topics covered in the first week were generally familiar to the overseer from UNICEF.

3.6 Village Water Supply Design, Construction, and Maintenance: Second Week Sessions

During the second week, and after the seventh session, the focus of the workshop shifted away from design theory to construction and the design of water system structures so as to permit easy maintenance after construction.

3.6.1 Session 7: Solution of Complex Water System Problem and Practice in Layout of New Pipe at Bahakot

In this session, the solution to the homework problem assigned in session 6 was completed by the trainer on flipcharts with the participation of the class. The detailed solution and related questions and answers consumed the entire morning session. Also, the concept of residual head at a tap was explained with the detailed analysis of frictional headloss in a tapstand structure.

In the afternoon, the trainers and participants visited the Bahakot water project. The purpose of this afternoon session was twofold:

- to lay out a new route for a replacement pipe to connect the intake to the reservoir tank
- to develop recommendations for source protection and improvement.

In the WASH consultant's previous report, a new larger pipe connecting the intake to the reservoir was recommended. The SCF sub-overseer had subsequently acquired the new pipe, which was ready for installation. The participants were asked to survey and stake out a new pipe route that would avoid air blocks and minimize the number of washout points. The participants worked in teams of four. Also, each team developed recommendations for improving the source; and these recommendations included:

- reconstruct the intake structure to capture water that is now leaking from the bottom of the intake (The WASH consultant believes that the flow to the reservoir could almost be doubled, if leakage is eliminated.)
- construct a drainage ditch to divert surface runoff away from the source
- improve the fencing and tree planting that was started as part of an earlier forestry project
- build smaller, lighter-weight covers for the intake tank and valve box
- initiate a program of weekly inspection of the intake and clean and repair it as necessary.

The participants recommended that, after the source improvements are completed and there is more water supplying the reservoir, the valves on the tapstands be adjusted to equalize the flow among the four tapstands. As a water

conservation measure for the dry season, one team recommended that one of the four tapstands be closed for the duration of the dry season.

3.6.2 Session 8: Design of Water System Structures for Simple Maintenance and Field Trip to Ritspani Water Project

The morning session included a lecture, question and answer, and group idea-sharing pertaining to the design of the construction of water system structures in a way that permits easy maintenance. The objective of the session was to start the participants thinking about how structures (i.e., intake tanks, break pressure tanks, valve boxes, reservoirs, and tapstands) would be operated and maintained, rather than merely how to build the structures at the least cost, which has often been the main consideration.

The problem of broken tapstand faucets was discussed. The participants believe that the standard, good quality "Jayson Waste-Not" faucets are the best; but there are imitation manufacturers who supply inferior quality products. The participants proposed that SCF make a bulk purchase of authentic Jayson faucets directly from the manufacturer in India. Some villages prefer brass faucets that do not close automatically after use. These faucets are easier to use because one hand does not have to remain holding the faucet open. The participants suggested that the village beneficiaries should have their choice of faucets but should be responsible for replacing broken valves and seeing that water is not wasted by faucets left flowing.

In the afternoon, the trainers and participants visited the Ritepani water supply project to observe recent maintenance improvements and to develop recommendations for further improvement. The recommendations included the points listed below and are shown on Figure 3-7:

- increase the height of the intake tank walls by 50 cm to avoid surface water entering the tanks; install washout pipes; and build new, lighter-weight covers
- provide two or three dry stone access ports in the covered channel that collects the three springs and delivers the flow to the westerly intake tank
- construct a stone wall fence around the north and west sides of the reservoir and catchment area
- continue the fencing along the east and south with local thorn bush or wood fencing
- plant small trees and grass within the fence area
- construct a drainage ditch to divert surface water from the catchment area
- install locks on all tank covers
- complete the piping to the tapstand and backfill the pipe

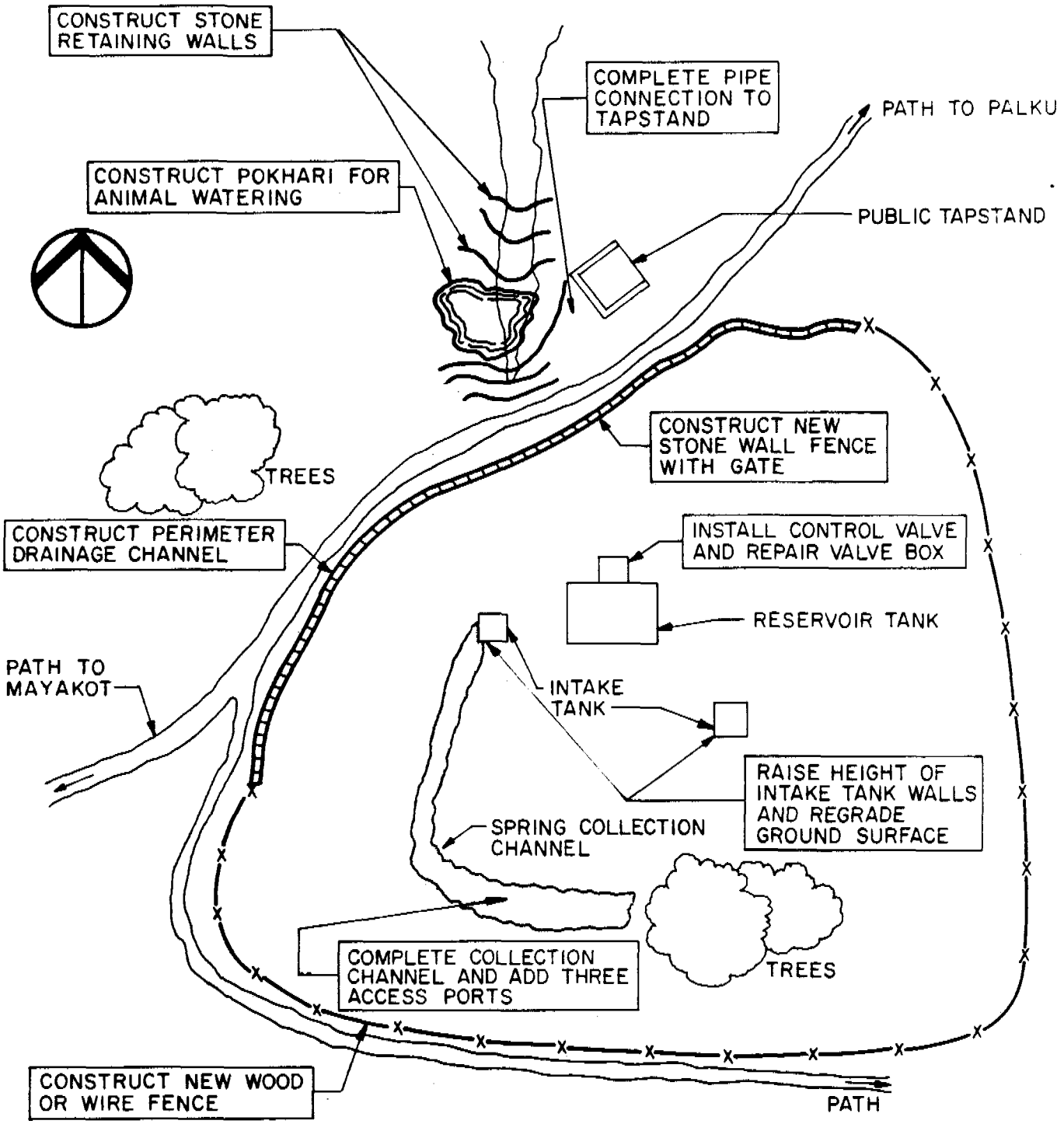


FIG. 3-7 PROPOSED IMPROVEMENTS TO THE RITEPANI WATER SYSTEM

- repair the washout pipe and outlet at the reservoir and add a control valve on the outlet pipe
- construct retaining walls to protect the tapstand from soil erosion damage
- construct a watering pond (pokhari) for cattle and buffalo behind the tapstand.

The sub-overseer for Takukot has started work on a number of these improvements; and as a result, Ritepani can become a model system for SCF in showing proper source protection and the benefits of constructing a system with its future maintenance in mind.

3.6.3 Session 9: Ferrocement Tank Design and Construction and Field Trip to Satasidhau Ferrocement Reservoir Tank

The training in ferrocement reservoir tanks included a guided classroom discussion in the morning followed by a field trip to a recently completed ferrocement reservoir tank in Majlakuribot in the afternoon. The morning discussion covered the advantages and disadvantages of stone masonry and ferrocement construction plus a step-by-step outline of the construction procedures. Then, individual participants who had previous experience with ferrocement tank construction shared their ideas with the class, adding details on alternative construction procedures.

3.6.4 Session 10: Suspended Cable Crossing Design and Field Trip to Observe Pipe Crossings of a Stream and Landslide

The morning session featured a lecture on the theory of designing a suspended crossing using wire rope cables available in Nepal. A design procedure was demonstrated, and a sample problem was solved with the participation of the class. The training emphasized:

- identification of all loads to be supported by the cable
- calculation of cable tension and selection of the correct cable size
- design and construction of cable anchors using a combination of stone masonry and locally available dry stone.

The class divided into teams to solve practice problems.

In the afternoon, two water projects were visited having examples of landslide crossings. In the first, Bhairapani, a previously constructed crossing with a center pillar supported by sliding earth is in need of repair; and the class discussed alternatives for building a suspended crossing without a center support. In the second, Kumaltari, the water project has been built with the pipe lying on the ground surface of the landslide. Each year, the pipe breaks, and a suspended cable crossing is required. The participants did a preliminary Abney Level survey of the crossing location and identified natural rock

anchors spanning the 52 meter slide from which to attach the suspended cable crossing.

3.6.5 Session 11: Spring Intake Repairs and Sedimentation Tanks and Demonstration of Model Water System

This session was added as a result of feedback from the mid-point evaluation (see Chapter 4). The morning session included instruction in methods of designing a spring repair (also called "well repairs") and the decision criteria for when a reservoir tank is needed at a spring repair.

The training in sedimentation tank design covered the theory of sedimentation, applicable settling rates for sediments found in Nepal, and the sizing of sedimentation tanks for water projects supplied by a stream intake.

The afternoon session included another demonstration of the model water system, as well as an open period for individual questions. The demonstration and question period were added as a result of the mid-point evaluation. During the demonstration, the trainer asked the overseers and sub-overseers to set up the model and show its different capabilities to the construction supervisors who had missed the earlier demonstrations. The question period provided time for participants to bring their questions on suspended crossing and sedimentation tank design and to practice solving design problems on these subjects. There were also questions on trigonometry and pipe and reservoir sizing. Also, another design problem involving a complex water system was assigned.

3.6.6 Session 12: Retaining Wall Design and Survey of Village Water System Maintenance Practices

The session on retaining wall design was added to the training as a result of the participants' learning goals identified in the first session. The morning class on retaining wall design included:

- applicability of retaining walls in water supply, general construction, and irrigation work by SCF
- theory of retaining wall design using dry stone walls
- design criteria for retaining walls in rural Nepal
- sample problems.

In the afternoon session, the participants formed teams to conduct a survey of maintenance practices in four water systems in Takukot. Each team was assigned to one of the following systems: Ritepani, Banspani, Bahakot, and Mohariya. The teams used questionnaires which included questions such as:

1. Is there a maintenance committee?
2. Who is a member of the committee?
3. Is there a special plumber?
4. Does the plumber have tools?
5. Does the plumber get paid? how frequently?
6. What does the committee perceive to be the major maintenance needs?
7. Ask six water users, "What are the major maintenance needs?"

Each team prepared a report, and these reports were presented to the class in sessions 14 and 15.

3.7 Village Water Supply Design, Construction, and Maintenance: Third Week Sessions

The third week of the workshop generally dealt with maintenance, plumbers' training, and village maintenance committee training. At the request of the participants, two sessions on the fundamentals of irrigation engineering were added at the end of the week.

3.7.1 Session 13: Estimating Quantities

The session started with some questions and answers about retaining walls. Following this, the training in estimating emphasized procedures to assure that estimates were complete and accurate. A five-step process was outlined:

1. design: assembling all survey data; making a general plan; collecting flow measurement data; calculating water demand; calculating pipe size; and designing drawings of structures, including a district location plant

2. key plan: preparing a simplified plan that identifies and numbers all structures (tanks and tapstands) and individual sections of pipe

3. detailed estimate: developing a detailed quantity and cost estimate for each discrete part of the water system identified in the key plan

4. summary: developing a single page cost summary by part of the water system

5. checking: checking the estimate by another overseer.

Also during this session, the participants were asked to pool their experience in estimating the productivity of labor for water projects. The estimates shown below on Table 3-1 are the result of the participants' discussion.

3.7.2 Session 14: Training of Village Maintenance Workers and Training of Special Plumbers in Pipe Joining

This session began three days of training of trainers, including training village maintenance workers and village maintenance committees. The session was opened with two of the teams presenting the reports of their survey of maintenance practices in Takukot.

New teams were formed, each team headed by a construction supervisor and three overseers and sub-overseers. The teams were instructed to develop their own training problem for special plumbers, and names of four plumbers were

TABLE 3-1. LABOR ESTIMATES FOR TYPICAL WATER SUPPLY WORK

Excavation (Unskilled Labor)

Typical Soil.....0.9 person-day/cubic meter
Soil and Stone.....1.1 person-day/cubic meter
Soft/Medium Rock.....2.0 person-day/cubic meter
Hard Rock.....4.0 person-day/cubic meter

Making Stone Aggregate (Unskilled Labor)

Medium Size 2-3 cm.....14.0 to 17 person-days/cubic meter
Large Size 4-5 cm..... 7.0 to 10 person-days/cubic meter

Rock Breaking (Quarrying) (Semi-skilled Labor)

Hard Rock.....1.5 person-days/cubic meter
Medium Rock.....1.0 person-days/cubic meter

Stone Soiling 20 to 30 cm deep

Skilled Labor.....0.5 person-days/cubic meter
Semi-skilled Labor.....2.0 person-days/cubic meter

Stone Carrying (Unskilled Labor)

Hot Weather.....0.5 person-days per 25 kg/kilometer
Cool Weather.....0.3 person-days per 25 kg/kilometer

Stone Masonry

	Person-days/cubic meter	
	Skilled Labor	Semi-skilled Labor
Rubble Stone	1.5 to 1.7	2.5 to 3.0
Hammer-Dressed Stone	6	4
Chisel-Dressed Stone	8	2.5

Plastering (Estimates include mixing the cement mortar)

Skilled Labor.....0.3 person-day/square meter
Semi-skilled Labor.....1.5 person-day/square meter

Note: plastering ceilings requires substantially longer time

RCC Slabs (8 to 12 cm thick)

Skilled Labor.....0.1 person-day/square meter
Semi-skilled Labor.....0.5 person-day/square meter
Blacksmith.....0.25 person-day/square meter
Carpenter.....0.5 person-day/square meter

assigned to each team for the next three days. The trainer presented the following guidelines to the teams for organizing the training:

- days 1 and 2--plastic and iron pipe joining
- day 3--preventive maintenance procedures
- the teams' plans for each day to include:

  -methods
  -planning
  -implementation responsibilities
  -evaluation

- scope of training to include care of tools, use of tools, and pipe joining techniques.

Each team was given an hour to plan the first two days' training. The groups reported on their detailed schedules, activities, responsibilities, required materials, and evaluation procedures. The four teams' plans were compared on flipcharts and discussed. Based on the discussion, two teams were devoted solely to plastic pipe and two teams to iron pipe on day one. On the second day, the teams would switch. This arrangement made for a convenient sharing of the available tools.

In the afternoon session, the teams worked with their assigned plumbers from 1 pm to 5 pm completing a checklist of pipe joining, cutting, threading, and fabricating tasks. The trainers monitored the work of each team and performed independent evaluations of the quality of the plumbers' work.

3.7.3 Session 15: Training of Village Maintenance Workers in Preventive Maintenance, and Training of Village Maintenance Committees and Training of Special Plumbers in Pipe Joining

This session opened with a presentation of the two remaining reports on the survey of maintenance practices in Takukot. The trainer then conducted a guided discussion of the activities involved in preventive maintenance and the respective responsibilities and duties of the village maintenance workers and village maintenance committees. With respect to the frequency of preventive maintenance work, the discussion with the participants concluded with the following:

	Frequency of Inspection or Other Work by the Special Plumber	
Part of the Water System	Monsoon	Dry Season
Inspect Source and Intake	Weekly	Weekly
Clean Intake Tank	1-2 per week	1-2 per month
Clean Reservoir Tank	Weekly	1 per 2 months
Fix Tapstands	When reported broken	
Inspect and Adjust Valve Boxes	Weekly	Weekly
Inspect Break Pressure Tanks	1 per week	2 per month
Clean Washout Points in Pipe	Same frequency as reservoir tank	
Inspect Air Release Valves	When water flow is low	

One participant suggested that the plumber's routine work be supplemented with voluntary effort by the village maintenance committee, proposing that every other day one member of the committee inspect the entire system. The committee members could take turns in doing these inspections, and their efforts could reduce the cost of the plumber's work.

The scope of training for a village maintenance committee was discussed by the participants and would include:

- knowledge of how the water system works
- the importance of source protection
- the committee's role in maintenance
  -collecting funds
  -paying the special plumber
  -purchasing spare parts
  -keeping monthly maintenance reports
  -hiring and evaluating a special plumber

- organization of the committee.

Similar to the previous day, the four teams were given time to independently plan a training for village maintenance committees that would span two days. The teams reported back to the class, and their respective plans were compared on flipcharts and discussed among the participants.

All participants thought that a slide show would be an important addition to the village maintenance committee training. The design of the slide show was discussed, and SCF is developing a project to prepare such a slide show.

In the afternoon session, the training teams again worked with the special plumbers from 1 pm to 5 pm. The teams that had worked with plastic pipe on the previous day worked with iron pipe on this day and vice versa.

3.7.4 Session 16: Irrigation Water Requirements and Training of Special Plumbers in Preventive Maintenance Procedures

After concluding the basic instruction on the theme of maintenance, this session was added in response to the participants' learning goals presented in the first session of the workshop. This class featured methods to calculate the volume and flow rate of irrigation water. Theory was presented along with design criteria applicable to rural hill areas in Nepal.

In the afternoon, the training teams for the training of the special plumbers each visited a designated water system to instruct the plumbers in appropriate inspection, cleaning,and flow adjustment techniques. The WASH consultant joined one of the teams, and the following work was performed at Bairapani:

- flow adjusted at source to deliver flow to the overflow pipe in a way that created a small tapstand
- cleaning of the intake tank
- adjusting of the flow at all tapstands

3.7.5 Session 17: Irrigation Structures

This session continued the instruction from the preceding morning and covered the design of economical canal cross-sections, consideration of scouring and siltation velocities, structures for crossing streams (trestles, arches, bridges), and inverted siphons.

The afternoon session was reserved for individual questions. The questions covered suspended pipe design, retaining walls, siphons, and complex water system design. About one half of the participants attended this session, which extended until the questions were all answered--a period of about three hours.

3.7.6 Session 18: Final Evaluation and Closing Ceremony

The morning was reserved for completing the final evaluation form for the training. See Chapter 4 for the description and results of the evaluation.

The afternoon was a free period, and a closing ceremony was held in the evening. The ceremony included the presentation of certificates, speeches by trainers and participants, beverages and banquet, and traditional Nepali entertainment and merriment.

Chapter 4

EVALUATION

4.1 General

The training was evaluated by the participants and the trainers. A mid-point evaluation by the participants was conducted for the purpose of identifying the need for any mid-course corrections in the training work plan. Final evaluations by both the participants and trainers were made for two purposes:

- to measure the effectiveness of the training
- to develop suggestions for follow-through actions stemming from this training.

4.2 Participant Evaluations

Participants evaluated the training at the midpoint and at the conclusion of the training. The mid-point evaluation was conducted on June 2 at the close of the eighth session. Participants were asked to complete the evaluation form and bring it to the class on the next day. The mid-point evaluation form and a summary of the results are presented in Appendix B.

The results of the mid-point evaluation were very positive with respect to the content of the training, the format, and the methods. Several excellent suggestions were offered by the participants, and these were adopted in future sessions:

- offer more sessions dedicated to individual questions
- summarize previous session at beginning of class and ask for questions from the previous session
- use more English where Nepali technical terms are lacking.

Certain requests by the participants for training in additional topics could not be accommodated in the scope of this training workshop, and these are included in Chapter 5 as recommendations for SCF to consider for future training. These topics include:

- deep tubewells and shallow tubewells
- use of theodolite and level (surveying instruments)
- design of reinforced concrete slabs.

Also, a number of participants asked that the training be extended to run for one month. The aspect of a longer training is discussed further in section 4.3.

A final evaluation was conducted on the last day of the training, June 13, 1986. The participants completed the evaluation forms during the morning, and the completed forms and summaries of the responses are presented in Appendix C.

Similar to the mid-point evaluation, the participants' final evaluation was positive and enthusiastic. Several participants requested that there be follow-up training in water supply and that there be a similar training in building construction. In the requests for a follow-up training, a number of participants offered very constructive suggestions for implementing the training, and these are presented in Appendix C and discussed further in the Trainers' Evaluation that follows.

4.3 Trainers' Evaluation

All three trainers were impressed by the effort and achievement of the participants in both workshops. All participants were very eager to learn creating a powerful force in making the workshops successful and in making the trainers' work relatively easy.

The participant evaluations in Appendices B and C raise five issues which are discussed in the trainers' evaluation below:

- training site
- participants' training needs and curriculum
- class size
- training format
- duration of training.

4.3.1 Training Site

The choice of a training site in the field close to completed water projects and water projects under construction proved to be a good decision on the part of SCF. While some participants suggested that a central training site in a larger city would have been more convenient, the trainers and most participants (in their evaluations of the afternoon field trips) believed that the advantages of having many examples of water projects close by outweighed any considerations of participant inconvenience. Also, by having the training in the field, the participants had to confront real problems as they must confront in their jobs, forcing them to analyze, improvise, and make do with limited resources.

4.3.2 Participants' Training Needs and Curriculum

The curriculum was designed based on the training needs assessment conducted for SCF in September 1985. The assessment and resulting curriculum for training proved appropriate for SCF's needs in water supply training, and it proved appropriate for most of the invited participants from other agencies. Also, open sessions had been built into the training schedule to accommodate other topics sought by the SCF and non-SCF participants. As a result of the learning goals expressed by the participants in session 1, and other subsequent feedback, the following new topics were added to the training beyond those envisioned in the earlier training needs assessment:

- retaining walls
- irrigation fundamentals

- more detail on suspended pipe crossings of rivers and landslides
- sedimentation tank
- estimating costs and quantities.

While the curriculum that resulted from the added topics was suitable to most participants, some invited participants stated that a training needs assessment of their project areas would have added some new material or different emphasis to the training in some sessions. The trainers recognize the slight shortcoming in the training design on this issue but also recognize that there is much in common among all agencies building water projects in rural Nepal and that the amount of commonality greatly outweighs the modest differences in such things as:

- standard design for masonry tapstands
- approach to the village contribution of labor and materials
- format for design calculations and estimates.

Perhaps the greatest difference between the SCF participant training needs and those of the non-SCF participants was in the area of maintenance of water systems. SCF showed itself to be far ahead of other organizations in implementing maintenance programs, and it is believed that the non-SCF participants found some of the maintenance training advanced beyond a stage which they could implement in the context of their own projects.

A second factor in the participants' training needs and the curriculum deals with the respective needs of the overseers and sub-overseers of SCF, as opposed to the needs of the construction supervisors. One participant suggested that a future training offer separate classes for the construction supervisors to address their specific training needs and the differences in their education level. In designing the training, the trainers scheduled the participation of the construction supervisors for only the second two weeks, thus bypassing the first week's emphasis on design calculations. In the trainers' viewpoint, there were advantages in having the construction supervisors, overseers, and sub-overseers together, because each group learned from the other; and the construction supervisors took a lead role in the plumbers' training in a way that could not have been filled by the overseers and sub-overseers alone.

In planning future training, the trainers would try to schedule design classes separately for overseers and sub-overseers, and for construction supervisors who want to attend, but would keep all these participants together for training in construction and maintenance topics.

4.3.3 Class Size

In total, there were 50 trainees in three basic training groups:

Workshop #1: Planning and Management	17
Workshop #2: Design, Construction, and Maintenance	17
Plumbers' Training	16
	50

These class sizes are considered to be maximum limits in order to assure effective training and individual attention to participants' questions. When class sizes exceed these numbers, the difference in learning speed becomes an important consideration. Differences among the participants' learning speeds were handled in the workshops through scheduled sessions for individual questions, practice in problem-solving for slower learners, and the addition of other topics to the training curriculum at the request of faster learners. The trainers recognize that the opportunity for training is limited in Nepal, and the training sponsor must weigh the limited opportunities against the factor of the number of participants.

4.3.4 Training Format

The training format was basically a three-hour morning classroom session followed by a three- or four-hour afternoon practical session involving field trips, plumbers' training, or practice surveys. The trainers and most participants found this to be an effective format, adding variety and linking classroom design questions with actual construction situations.

4.3.5 Duration of Training

From the trainers' perspective, the three-week duration of the training was appropriate; and it allowed the goals of the training to be met. Five participants believed that the three-weeks duration would better have been four weeks, and the four weeks would include more topics and more time on certain topics. The WASH consultant believes that some of the interest in a longer training stems from the learning technique of many of the participants which involved memorization. The Nepali educational system stresses memorization as a learning technique; consequently more time devoted to individual subjects would assist the participants in memorizing. The WASH consultant's thought in designing the training manual and using the available technical references in Nepal was to avoid the need for excessive memorization and to focus on analytical approaches to solving design problems. In setting up a similar future training, a three-week duration should be considered a minimum and a four-week duration a maximum. A benefit of a four-week training would be the ability to devote more sessions specifically to the needs of the construction supervisors.

Chapter 5

RECOMMENDATIONS

5.1 General

This chapter summarizes recommendations made throughout the report by the training participants and the WASH consultant. The rationale for the various recommendations is given in the report and not repeated in detail here. Recommendations are of two types:

- follow-up actions by SCF as a result of this training
- future trainings

5.2 Follow-up Actions by SCF

There are four general follow-up actions recommended in the Executive Summary of this report; they include:

1. Start handing over completed water projects to the village maintenance committees where the projects are small in scale and the committees active; start the two-year maintenance guidance period for these projects; and use these as models for completing other, more complex water projects later.

2. Initiate the construction of new water projects in accordance with a schedule for the completion of projects that are now functioning but are not finalized with respect to source protection or other work.

3. Include in new cost estimates for water projects a line item for source protection, the cost of which would be shared by SCF with a village contribution.

4. Fabricate additional demonstration models of water systems for use with beneficiary committees in all impact areas.

In addition to these four general recommendations, there are the following project specific recommendations:

5. Discuss the training participants' recommendations for improvement to the projects in Takukot with the field coordinator and respective village maintenance committees and implement these recommendations considering the comments that arose from these discussions. The recommendations for Banspani are given in section 3.5.6, for Bahakot in section 3.6.1., and for Ritepani in section 3.6.2.

6. Given the frequent disputes over water rights at water sources, SCF should consider making a standard policy of building a tapstand at each source, unless the overseer can justify not constructing a tapstand. The Bairapani project at Takukot is an

example of a location where water users who traditionally had taken water from the source (and those who are normally served by the Banspani system in the wet season) have tampered with the source intake (the tank at Bairapani) in an effort to create a tapstand there. SCF should consider adding a tapstand at the Bairapani intake tank to avoid future problems with the flow distribution at the intake tank.

7. The SCF water program advisor should review the designs of the overseers and sub-overseers to assure that the designs provide for easy maintenance of water system structures, i.e., light, lockable valve box covers, washout valves, perimeter drains around intake tanks, etc.

8. Consider the recommendations of the participants outlined in section 3.4.5 with respect to new water supply project policy. Respond formally to each point recommended by the participants.

9. Purchase an Indian civil engineers standard handbook for each impact area office.

10. Consider the bulk purchase of good quality valves for tapstands as recommended by the participants in section 3.6.2.

11. Consult closely with the overseers and sub-overseers who will be responsible for delivering training to village maintenance committees regarding the design of the proposed photographic slide show of water project maintenance as discussed in section 3.7.3.

5.3 Recommendations for Future Training

Future training is recommended in two areas: first for a follow-up on this water supply training, and second for training in other subjects identified by the participants.

With respect to follow-up training in water supply, SCF should reassess training needs after one year. The reassessment should consider the number of new overseers and sub-overseers who have not been previously exposed to water supply training, and it should consider the need for more advanced training for staff who have previously been trained. Based on the experience in the training described in this report, it is recommended that SCF again consider inviting other organizations to send participants, as there was important idea-sharing among the different agencies. The specific training needs of the other invited agencies should be assessed in advance by SCF overseers or by the SCF water program coordinator through site visits to the invited agencies' water projects.

During the water supply training, a number of participants asked for similar training in other topics. These topics are listed below, and SCF should examine specific needs for training in each:

- school construction
- surveying with theodolite and level
- shallow and deep tubewells
- more extensive use of local materials.

APPENDIX A

List of Participants

SCF VILLAGE WATER SUPPLY TRAINING PROGRAM

Week One: Village Water Supply Planning and Management - May 25-29, 1986

Name	Affiliation
Dilli Ram Adhikari	SCF/Nepal
Ganech Prasad Adhikari	SCF/Nepal
Jayashwor Devkota	SCF/Nepal
Arjun Bahadur Gurung	SCF/Nepal
Hom Bahadur Gurung	SCF/Nepal
Tulsi Gurung	SCF/Nepal
Ishor Bahadur Khatri	SCF/Nepal
Kirshna Bahadur Kumal	SCF/Nepal
Kiran Lamsal	SCF/Nepal
Hem Raj Moktan	SCF/Bhutan
Jai Sing Pal*	SCF/Nepal
Lila Mani Sharma	SCF/Nepal
Sharad Babu Shrestha	SCF/Nepal
Hari Bahadur Thapa	Redd Barna
Norbu Tshering	SCF/Bhutan
Thakur Krishna Uprety	SCF/Nepal
Tashi Yezer	SCF/Bhutan

Week One: Village Water Supply Design, Construction, and Maintenance - May 25-30, 1986

Name	Affiliation
Indra Kumar Dhital	USAID/Rapti Project
Shiva Shanker Dongal	SCF/Nepal
Mahendra Bahadur Magar	United Mission to Nepal
Ranjan Singh Maskey	Lutheran World Service
Padam Prasad Regmi	SCF/Nepal
Gyanendra Rai	SCF/Nepal
Deepak Shrestha	Lutheran World Service
Hari Bahadur Thapa	Redd Barna
Ram Babu Upreti	USAID/Rapti Project
Rishi Ram Wagli	SCF/Nepal
Ramji Yadav	USAID/Rapti Project
Tashi Yezer	SCF/Bhutan

* Attended the first session.

Week Two: Village Water Supply Design, Construction, and Maintenance - June 1-6, 1986

Name	Affiliation
Indra Kumar Dhital	USAID/Rapti Project
Shiva Shanker Dongal	SCF/Nepal
Karna Bahadur Gurung	SCF/Nepal
Yam Bahadur Gurung	SCF/Nepal
Mahendra Bahadur Magar	United Mission to Nepal
Ranjan Singh Maskey	Lutheran World Service
Padam Prasad Regmi	SCF/Nepal
Gyanendra Rai*	SCF/Nepal
Deepak Shrestha	Lutheran World Service
Hare Ram Shrestha	SCF/Nepal
Indra Bahadur Thapa	SCF/Nepal
Ram Babu Upreti	USAID/Rapti Project
Rishi Ram Wagli	SCF/Nepal
Ramji Yadav	USAID/Rapti Project
Tashi Yezer	SCF/Bhutan
Til Bahadur Gurung	CARE
Kabindra Bikram Karki	UNICEF

Week Three: Village Water Supply Design, Construction, and Maintenance - June 8-13, 1986

Name	Affiliation
Overseers, Sub-overseers, and Construction Supervisors: Same as Week Two	
Village Maintenance Workers	
Indra Bahadur Khatri	Takukot
Jit Bahadur Baram	Takukot
Chandra Bahadur Khatri	Majlakuribot
Mangal Prasad Gurung	Takukot
Top Bahadur Thapa	Takukot
Arjun Bahadur Thapa	Takukot
Toran Bahadur Thapa	Majlakuribot
Nanda Bahadur Magar	Dhuwakot
Shiva Prasad Ghimire	Takukot
Man Bahadur Shrestha	Takukot
Hasta Bahadur Basnet	Majlakuribot
Amrit Bahadur Nagarkoti	Dhuwakot
Uttam Bahadur Magar	Takukot
Kep Bahadur Magar	Takukot
Krishna Khatri	Deurali
Chakra Bahadur Baram	Takukot

* Attended through June 3. Later participated in private tutoring in Kathmandu on June 17, 18, and 19 to complete the training.

APPENDIX B

Mid-point Evaluation

This appendix presents a summary of the mid-point evaluation conducted on Monday, June 2, 1986, at the end of the eighth session. Each participant was given an evaluation form with ten questions written in English which were translated to Nepali during the class period. Each participant was asked to return the completed evaluation form on the next day. The questions are listed below along with a summary of the answers received. Fifteen participants took part in the mid-point evaluation.

1. WHAT HAVE YOU LIKED ABOUT THE TRAINING?

   Sample responses:

   "I like this training because in this training I am learning other methods of designing reservoir tanks, stream intakes, checking Abney level and will get the chance to study retaining walls, landslide and river crossings and ferrocement tanks."

   "All the training activities including the course materials. I like being able to exchange technical ideas, problems and improved techniques with participants from other agencies."

   "All the sessions so far are very useful."

   "I liked the trainers teaching technique and time table."

   "I have liked all the teaching lectures and sessions of the training so far, because all of these were of practical importance."

   NOTE: There were no negative responses to this question.

2. WHAT HAVE YOU NOT LIKED ABOUT THE TRAINING?

   Sample responses:

   "The only thing I did not like is that the training is too far from the roadhead. Some trouble was felt during the 6-8 hour walk. I think a better place would have been Deurali Panchayat."

   "I think it would be easier for both the trainer and myself if he used English while explaining very technical problems."

   "You should check everyone's work."

   NOTE: All other responses indicated that the participants "liked everything so far."

3. WHAT WOULD YOU DO TO IMPROVE THE TRAINING?

   Sample responses:

   "The training should be one month long."

   "Trainer should give a short summary about the past session and should outline the next session before each session."

"I feel that some additional topics on sedimentation tanks, retaining walls and stream crossings should be included in the schedule."

"I would like to see practical class (field trip) in the morning and class sessions in the afternoon, because it is difficult to walk in the afternoon heat."

"If possible, kindly give more detail and calculations necessary for water system design."

"As there are supervisors and plumbers also involved in training, mostly uneducated, training for them should be designed in such a way that would be able to understand the technical knowledge from a very basic level."

NOTE: All others said that they would change nothing in the training.

4. HAVE THE SESSIONS BEEN:

TOO FAST 0 TOO SLOW 0 OKAY 15

5. DO YOU UNDERSTAND THE DESIGN PROCEDURES?

NOTE: All participants, except two, said that they understood the design procedures. Those two said they were not completely clear and would like some additional help.

6. ARE THE CLASS SESSIONS:

TOO FAST 0 TOO SLOW 0 OKAY 15

7. DO YOU HAVE ENOUGH TIME TO ASK QUESTIONS?

NOTE: All participants stated that they had enough time to ask questions, if not during the class itself, then during the time between classes or in the evening.

8. ARE THE AFTERNOON SESSIONS USEFUL?

NOTE: Again, all participants responded positively, and some reasons were:

"have gotten a chance to solve practical problems"

"the field procedures and problems were found to be common for everyone"

"useful because of the practical demonstrations"

"I can observe different situations regarding the improvement of source and system."

9. CAN YOU UNDERSTAND THE INSTRUCTOR?

VERY WELL 15 OKAY 0 POORLY 0

10. WHAT OTHER SUBJECTS WOULD YOU LIKE TO ADD TO THE TRAINING?

- shallow tubewalls
- deep tubewalls
- use of local materials other than cement
- compass, leveling instrument, and theodolite surveying
- stream intake and sedimentation tank design
- retaining wall design

APPENDIX C

Final Evaluation

This appendix presents a summary of the final evaluation conducted on Friday, June 13, 1986, at the last day of the training. Each participant was given an evaluation form with ten questions written in English; translations to Nepali were made before starting. Each participant was asked to complete the evaluation form and return it at the end of the session. The questions are listed below along with a summary of the responses. Sixteen participants took part in the final evaluation.

1. WHICH TOPICS WERE MOST USEFUL TO YOU?

   NOTE: Pipeline design and reservoir tank sizing were mentioned by almost everyone. Retaining walls, river and landslide crossings, and ferrocement water tanks were the second most useful topics mentioned.

2. WHICH TOPICS WERE LEAST USEFUL TO YOU?

   NOTE: Two people stated that irrigation canals were least useful to them. Two people stated that pipeline design and reservoir sizing were least useful. One person stated, "the water supply design chapter (was least useful), because too much time was spent on it." Everyone else stated that there was nothing least useful in the training.

3. IF YOU WERE ASKED TO ARRANGE A SIMILAR TRAINING, WHAT WOULD YOU DO DIFFERENTLY?

   Sample responses:

   "At first, I would categorize all participants according to their ability (based on technical knowledge and language) and make the training schedule accordingly."

   "First I would arrange to know the existing problems of completed water systems. Second, I would want to know about possible problems which may happen in future projects."

   "I would give more time to field trips."

   "I would have the village development committee and a village maintenance committee attend a one-day session."

   "I would invite only overseers and supervisors in rural water supply projects. I would provide a separate lecture class for overseers and supervisors."

   "I would make a drinking water system step-by-step including survey, profile, design and estimate."

   NOTE: Other comments suggested that they would do the training the same way.

4. WERE THE TOPICS OF MOST INTEREST TO YOU COVERED ADEQUATELY?

NOTE: Almost all participants responded yes to this question, and other answers are as follows:

"Different types of surveying techniques were not covered in this training."

"No, only slightly covered."

"...building construction and design was not covered."

5. WHAT WERE THE GOOD POINTS OF THE TRAINING?

Sample responses:

"Design and maintenance of water supply projects."

"to have a chance to meet friends and exchange ideas"

"the trainer repeated the problems until everyone understood"

"It was well organized."

"a. lecture in Nepali language
b. practical work
c. problem solving in class"

"1. effective method of training/lecture
2. group discussion with common problems
3. training in project based area."

NOTE: All other responses referred to Question #1.

6. WHAT WERE THE BAD POINTS OF THE TRAINING?

Sample responses:

"The training goals were mainly based on SCF problems."

"1. Too much discussion on unnecessary points or subjects
2. Not enough discipline in trainees"

"I was scared in the tent that somebody might step on my face at night, weren't you?"

NOTE: All others answered that there were no bad points.

7. COMPARED TO BEFORE THE TRAINING, DO YOU FEEL YOU NOW UNDERSTAND

__3__ SLIGHTLY BETTER __12__ MUCH BETTER _____ NO DIFFERENT

NOTE: One participant had no response to this question.

8. HOW WAS THE TRAINING USEFUL TO YOU?

Sample responses:

"Without this training, it would be very difficult to work in my project."

"clarified the confusions"

"I had no basic training before this, so very useful."

"Above mentioned points were major problems in my job."

"We got to express our experience to others and also learn from others."

"I can utilize the training in my job."

9. IF THE TRAINING WAS NOT USEFUL, WHY NOT?

NOTE: There were no negative answers to Question #9.

10. WHAT WOULD YOU SUGGEST FOR FOLLOW-UP TRAINING?

Sample responses:

"All the topics in this session to be covered again."

"I would like to get training in surveying with theodolite, leveling instrument and compass."

"A follow-up training should be arranged to observe the improvement after one year from this training."

"I would like a follow-up training on building construction, also."

"I would like to suggest a follow-up training, but it should have more difficult problems and more topics."

"Follow-up training should be just before the national festival of Dasain, because at that time, it won't interrupt our construction work."

"I think the follow-up training should be more than 3 weeks."

"Better facilities for accommodation and good diet."

APPENDIX D

Certificates

Certificate of Attendance

This is to certify that

has successfully completed a Save the Children-

WASH Training Course in

Village Maintenance Committees and Special Plumbers held in Nepal from

_____ through _____

_____ _____

Carl R. Johnson Mark Williams

Save the Children®

Certificate of Attendance

This is to certify that

has successfully completed a Save the Children WASH Training of Trainers Course in Village Water Supply Management held in Nepal from _____ through _____

_____ Carl R. Johnson

_____ Mark Williams

Save the Children®

Certificate of Attendance

This is to certify that

has successfully completed a Save the Children-

WASH Training Course in Village

Water Supply Management, Design and Maintenance

held in Nepal from

_____ through _____

_____ _____

Carl R. Johnson Mark Williams

Save the Children®

Certificate of Attendance

This is to certify that

_____

has successfully completed a Save the Children-

WASH Training Course in Village

Water Supply Construction and Maintenance

held in Nepal from

_____ **through** _____

_____ _____

Carl R. Johnson Mark Williams

Save the Children®

APPENDIX E

WASH Consultant Itinerary

May 16	Flight from Boston to Los Angeles
May 16 to 17	Flight from Los Angeles to Tokyo
May 17	Overnight at Tokyo
May 18	Flight from Tokyo to Bangkok; overnight at Bangkok
May 19	Flight from Bangkok to Kathmandu in morning; began final planning with SCF in afternoon
May 20 to 22	Final planning with SCF and USAID in Kathmandu
May 23	Travel by Land Rover from Kathmandu to Gorkha
May 24	Travel by foot from Gorkha to Takukot training site
May 25 to June 13	Training workshops at Takukot
June 14	Travel by foot from Takukot to Gorkha, then by Land Rover from Gorkha to Kathmandu
June 15 to 20	Preparation of draft report and briefings with SCF staff on June 17 to 19 and 20; briefing with USAID on June 18
June 20	Travel from Kathmandu to New Delhi in evening
June 21	Travel from New Delhi to Boston, Massachusetts