WATER AND SANITATION
FOR HEALTH PROJECT

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TECHNICAL TRAINING FOR BASIC VILLAGE SERVICES PROJECT ENGINEERS

WASH FIELD REPORT NO. 141

JANUARY 1985

The WASH Project is managed by Camp Dresser & McKee International Inc. Principal cooperating institutions and subcontractors are: Associates in Rural Development, Inc.; International Science and Technology Institute, Inc.; Research Triangle Institute; Training Resources Group; University of North Carolina at Chapel Hill.

Prepared for:
USAID Mission to the
Arab Republic of Egypt
Request Memorandum No. 108

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Prepared by John Pettit

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EXECUTIVE SUMMARY

From November 5 through December 5, 1984, the Water and Sanitation for Health (WASH) Project conducted the technical component of a ten-week training program for thirteen Egyptian engineers. These engineers were responsible for activities funded by the Basic Village Services (BVS) project in Egypt. The USDA (U.S. Department of Agriculture) Graduate School was responsible for the overall course and conducted the first five weeks of training on management skills.

The WASH component focused on three major areas: water supply, groundwater and sewerage, and maintenance. Particular attention was paid to the problem of high groundwater levels and to the elements of an effective maintenance program.

The technical course was conducted by a course coordinator and by three technical specialists, each responsible for one of the three major areas. The trainers used a participant-centered learning approach, using lecture/discussions as well as small group work on specific tasks. In addition to the classroom work, the engineers took a 10-day field trip where they visited a water hyacinth plant in San Diego, a maintenance program in Phoenix, and design and construction of water supply and sewerage systems in deltaic conditions in New Orleans.

The participants' assessment of the workshop was mixed. The water supply and groundwater and sewerage aspects received average ratings while the maintenance component was rated highly. The participants felt the methodology was appropriate and the training techniques helpful. The visits to Phoenix and New Orleans were considered very useful, but some negative comments were expressed about the San Diego visit.

The trainers have several recommendations. They stress the importance of a follow-up visit to the participants to provide on-site consultation and encouragement to make use of the knowledge and skills learned. Regarding future courses, the trainers recommend integrating the technical and management aspects so as to relate the management skills directly to their everyday job situation. Another key recommendation is that a needs assessment be conducted by one of the training staff in Egypt prior to the course. The data from this needs assessment would be the basis for designing the course and ensuring its relevance to the participants.

Chapter 1

INTRODUCTION

In July of 1984 the U.S. Agency for International Development (USAID) Mission in Cairo asked the WASH Project to develop the technical component of a ten week training course for thirteen engineers involved with the Basic Village Services (BVS) project. The focus of the first five weeks of the course, prepared by the USDA (U.S. Department of Agriculture) Graduate School in Washington, D.C., was on developing and improving management skills. The WASH component concentrated on planning, constructing, and maintaining local public water supply and wastewater systems.

Initiated in 1979, the BVS project is intended to assist local government units to gain experience in choosing and implementing village-level projects. It is expected that this process will assist local units -- village councils, for example -- to become self reliant and eventually to manage their own development. The engineers who attended this course are involved in this process by helping village councils select and build useful development projects for their villages.

Order of Technical Direction No. 191 was issued under WASH I on September 17, 1984, for the planning phase of the course. After the award of the WASH II contract, Request Memorandum No. 108 was issued for the implementation phase. The planning and implementation of the workshop were done by three technical specialists and a course coordinator. James Jordan from the WASH Project conducted the maintenance portion; Joseph Haratani, a private consultant, did the groundwater and wastewater part, Jonathan French from Camp Dresser & McKee Inc. was responsible for the water supply component; and John Pettit of the Training Resources Group was responsible for the overall coordination.

This report is a summary of the activities undertaken in the planning and implementation of the technical phase of the course.

Chapter 2

PLANNING

2.1 Course Content

The scope of work which was based directly on a USAID/Cairo request, asked that the WASH team plan and conduct a course that included the following:

1. Review of water resources in Egypt, including the impact of the high groundwater table.

2. Overview of environmental problems related to, or the result of water supply and sewerage.

3. Review of water supply system design, including aspects of source selection and types of treatment.

4. Review of sewerage and groundwater systems for villages up to 1,000 and towns up to 20,000 inhabitants.

5. Focus on developing maintenance plans.

2.2 Planning Procedure Followed

2.2.1 Preliminary Meetings

Given the requirements of the scope of work and the need to integrate the various contributions of the technical team, two weeks were devoted to plan the course and develop the course materials. The workshop team (French, Haratani, Jordan, and Pettit) first met with Fred Rosensweig of the WASH Project and John Austin of USAID on September 24, 1984, to review the scope of work and reach agreement on the roles and responsibilities of each of the team members. Also scheduled during that week were separate meetings with representatives of the USDA Graduate School and USAID.

The purpose of the meeting with the Graduate School was to inform the WASH technical team about the management portion of the BVS training program, as well as the housing and other logistical arrangements being handled by USDA. Team members met with USAID officials John Grayzel and John Austin in Washington primarily to get some background information about the BVS project and the Egyptian engineers who were participating in the course. The meeting also provided a check on the initial direction and approach that the team was taking. This early contact with USAID also included a conference call to the Mission in Cairo to clarify the scope of work and confirm the subjects which the team was preparing to include in the workshop.

2.2.2 Preparation of the Trainer's Manual

By the end of the first week of planning, each of the team members had determined how much material he could realistically cover in the time

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available. Overall course objectives were agreed upon, and the consensus was to use the experiential learning methodology as much as the technical material permitted. The content of the individual sessions was decided upon. That done, team members were able to write session objectives, prepare learning activities, and identify resources the participants could use in the course and after. Figure 1 depicts the planning procedure used by the trainers.

During the second week of planning the team members prepared a Trainer Manual* which included guidelines for each of the thirty five sessions. Each guideline included:

- o Title of component and session.
- o Session objectives.
- o Instructions for conducting the training activities included in the session.
- o The amount of time each step was likely to take.
- o A list of resources and references to be used in the session.

The guidelines were grouped in tabbed sections, one for each day. Supplementary trainer notes were also included. At the beginning of each weekly sequence there was a weekly schedule that noted the order of the training sessions for a particular day. The intent was to provide the training team with some basic instructions on how to conduct sessions that would enable participants to attain the goals of the course. The manual also served as a handy means for informing the team members on the content of each other's sessions.

2.2.3 Needs Assessment

During the planning stage, a number of questions still remained about the specific needs of the participants. The training team had received recommendations from the USAID Mission on the topics to be covered in the workshop but did not have an opportunity to talk with the Egyptian engineers about the course content. What did these engineers think <u>they</u> needed to know in order to do their job better?

The workshop team was still unclear about individual needs at this point in the planning because the original needs assessment questionnaire that was cabled to the USAID Mission in Cairo and subsequently given to the participants to complete did not include a question about the participants' perception of their own skill level (see Appendix A). While the questionnaire did yield some basic biographic data and a sense that the participants were interested in covering all of the topics listed, it did not provide information on know how much of a particular topic to address and what specific problems the participants wanted to work on.

The best way to have obtained this information before the planning would have been for one of the technical training team members to have conducted an in-Egypt needs survey in the participants' offices, touring their facilities

* The Trainer Manual is available for review or to borrow from WASH.

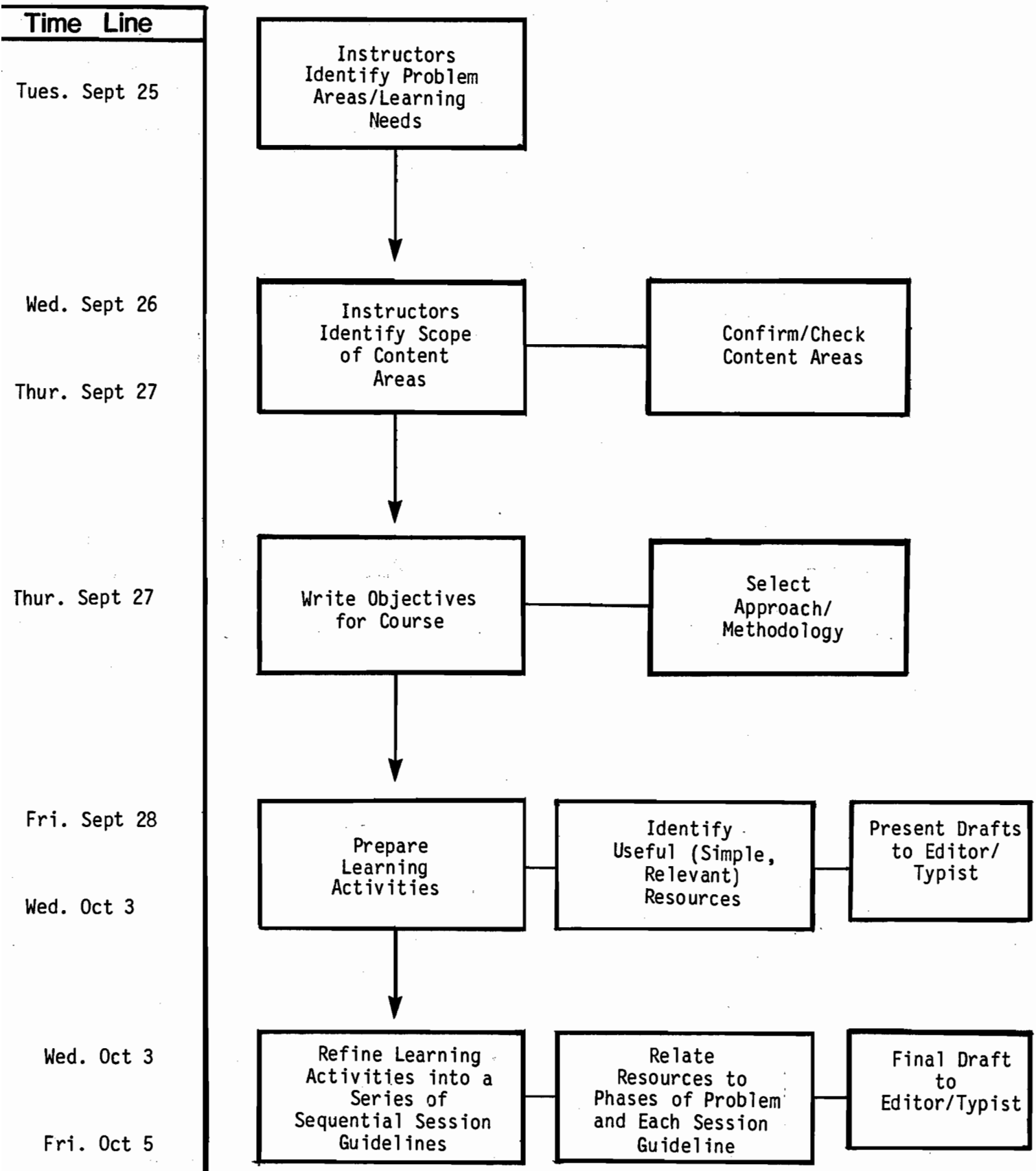

Figure 1. Task Flowchart for Planning BVS Training

and speaking with people in their area of operations. Since it was too late to do that, the next best thing was to meet with the participants while they attended the first part of their training at the USDA Graduate School. With the permission of the Graduate School training staff this was done during the second week of planning. The technical team developed a series of questions (see Appendix B) which they used to interview participants. Each member of the training team met and interviewed two participants at a time. The conversational English ability of many of the participants was limited; therefore, the joint interviews enabled them to help each other with the questions.

The two hour needs assessment meetings enabled the trainers to gain a better understanding of areas of interest that they should cover. The list of interest areas that was developed (see Table 1) varies somewhat from the ones first recommended by the USAID Mission.

Table 1

Summary Tabulation of Technical Interests

Topic	Number of People out of 13 who were Interested
High groundwater and pollution of aquifer	9
Methods for removing Iron (Fe) and Manganese (MN) from groundwater	8
Pipeline Installation and Replacement	8
Water Treatment and Compact Units	5
Storage Tanks (Design and Construction)	5
Network Analysis	5
Sanitary Engineering and Sewage Pipelines	5
Pumps	4
Maintenance of Motors	3
Groundwater well siting	2
Disinfection; modern dosing equipment	2

While the Mission requested that the technical component include a review of Egypt's water resources and an overview of environmental problems associated with pollution, none of the participants thought either of these topics important enough to mention. It is possible that they thought all of this was obvious and not necessary to cover in their course.

The mission also requested that a major block of time be spent on sewerage, yet only five people mentioned sewerage issues as important to them. The message here may be that most of these participants were involved in water supply and not sewerage. During the course it became obvious that if a participant was not responsible for handling an area he was not interested in covering that area. (In commenting on the evaluation question about whether or not the issues discussed in the course were relevant to their jobs, one person wanted to know why participants were not divided into two groups -- one for sanitation and the other for water supply. Also, during the local field visit several of the participants did not even want to bother going into a Washington Suburban Sanitation Commission (WSSC) sewerage pumping station because they did not work in this area.)

Another critical area from the Mission's perspective was maintenance, although only three out of the thirteen people interviewed mentioned it.

The Mission's and the participants' interests coincided in the area of high groundwater and the pollution of the aquifer, pipeline installation and replacement, types of water treatment, network analysis and some aspects of source selection. The three new interest areas that came out of the interviews were storage tanks, pumps, selecting well sites, and disinfection (using modern dosing equipment).

Despite the opportunity to have met with participants and to have interviewed them about their training needs team members were still not able to establish their skill levels in the interest areas. While this kind of information is difficult to obtain even under the best of conditions, the brief time with each participant and the difficulty of communicating limited the data the team was able to gather. As noted above, a pre-workshop visit to Egypt by one of the trainers would have been very useful in better defining the needs of the participants.

Chapter 3

IMPLEMENTATION

3.1 Workshop Goals

The goals of the water supply segment of the workshop were for participants to:

1. Review the nature of hydrologic flow with respect to water supply and groundwater flow in the Nile delta area.

2. Examine how water supply systems are planned, developed, operated, and maintained.

3. Determine appropriate water quality criteria, testing procedures, and treatment processes.

4. Review basic pipeline hydraulics and practice using calculations for hydraulic network analysis.

5. Review the procedures to be carried out in groundwater site selection, well installation, and prevention of contamination.

The goals for the groundwater and wastewater segment were for participants to:

6. Examine the three stages of the groundwater cycle.

7. Describe and discuss the causes of high phreatic groundwater and the problems resulting from it.

8. Develop practical methods for controlling high groundwater levels.

9. Demonstrate a methodology for designing a simple sewerage network.

10. Explore the advantages and disadvantages of the ways to dispose of excess groundwater.

11. Examine various treatment alternatives for wastewater.

The goals of the maintenance segment were for participants to:

12. Examine the effects of good and poor maintenance.

13. Establish those elements which are an essential part of a good maintenance program.

14. Determine how proper maintenance will extend the life of a facility and its equipment for many years.

15. Develop a flowchart of the steps for a preventive maintenance program that could be applied to typical BVS projects.

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16. Establish the needs of a maintenance unit in terms of manpower, equipment, support services, and budget.

17. Develop strategies for installing local preventive maintenance programs.

Finally, the goal of the simulation was:

18. To provide a series of realistic situations for participants to integrate the technical and management aspects of their training.

The workshop goals represented a balance between each of the previously mentioned technical areas. Basically the views of both the USAID Cairo Mission and the participants determined what was addressed in the course. The extent to which an area was covered depended on the amount of class time available and the trainers' assessment of the skills and knowledge of the participants.

3.2 Participants

There were thirteen participants in the workshop. All had engineering degrees. They came from various parts of Egypt, about half from the delta region.

3.3 Schedule

As can be seen from the schedule in Table 2, the classroom portion of the course was divided into thirty-five sessions that were carried out over sixteen days. There was also a one-day field visit in the Washington area and a ten-day extended field trip to sites in San Diego, Phoenix, and New Orleans (See Appendix C).

The training day was scheduled to start at 8:30 a.m. and go until 3:00 p.m., with a half hour break for lunch. In practice the training day usually went from 9:00 a.m., when the participants arrived, until 2:30 p.m. The length of sessions varied from one hour to about six, with most of them being about three hours long.

3.4 Methodology

The participant-centered approach used in this course is particularly suited for the adult learner. The theory behind this approach is based on the concept that experience and learning are closely linked. Thus, a good deal of attention was given to identifying the participants' concerns and issues and relating these to the technical content. This was usually done through a lecture/discussion format that included regular small group work on discrete tasks. As already mentioned, this classroom activity was supplemented by field visits.

3.5 Interpreter

The USDA Graduate School assigned a full-time interpreter to the WASH training

team. Fortunately, the interpreter, a native Egyptian, also had an engineering degree and was able not only to interpret but to understand the subject matter. By the end of the course he was an integral part of the training team and was virtually indispensable.

WEEK NOVEMBER 5 - 9

Table 2

WORKSHOP SCHEDULE

DAY ONE	DAY TWO	DAY THREE	DAY FOUR	DAY FIVE
SESSION 1 • Introduction to Course	SESSION 3 • Introduction to Simulation • Simulation "A": Description of BVS Program	SESSION 5 - 8 • Phreatic Aquifers • Causes/Problems of High Groundwater	SESSION 10 • Hydraulic Review No. 1	SESSION 12 • Pumps
SESSION 2 • Overview of Nile River Hydrology	SESSION 4 • Planning a Water Supply System	SESSION 9 • Simulation "B": Data Collection Strategy	SESSION 11 • Control of High Groundwater Levels	SESSION 13 • Simulation "C": Design Strategy for Water Supply and Sewage Systems

WEEK NOVEMBER 12 - 16

SCHEDULE

DAY SIX	DAY SEVEN	DAY EIGHT	DAY NINE	DAY TEN
SESSION 14 • Disposal of Excess Ground-water and Wastewater	SESSION 17 • Maintenance Management Programs	SESSION 19 • Preventive Maintenance	SESSION 21 • Simulation "D": Preparation for Local Field Trip SESSION 22 • Local Field Trip	SESSION 23 • Preparation of Maintenance Program for Two Pumping Stations
SESSION 15 • Introduction to Maintenance SESSION 16 • Effective Equipment Maintenance	SESSION 18 • Treatment of Wastewater	SESSION 20 • Design of Sewage Systems		SESSION 24 • Simulation "E": Operation and Maintenance Planning

WEEK NOVEMBER 19 - 23

SCHEDULE

DAY ELEVEN	DAY TWELVE	DAY THIRTEEN	DAY FOURTEEN	DAY FIFTEEN
SESSION 25 • Water Supply Network Workshop	SESSION 27 • Water Quality, Testing and Treatment	SESSION 29 • Maintenance Hardware Needs		
SESSION 26 • Budgeting for Equipment Maintenance Program	SESSION 28 • Maintenance Organization	SESSION 30 • Hydrology Review No. 2 SESSION 31 • Preparation for Field Trip	FIELD TRIP	FIELD TRIP

WEEK NOVEMBER 26 - 30

SCHEDULE

DAY SIXTEEN	DAY SEVENTEEN	DAY EIGHTEEN	DAY NINETEEN	DAY TWENTY
FIELD TRIP	FIELD TRIP	FIELD TRIP	FIELD TRIP	FIELD TRIP

WEEK DECEMBER 3 - 7

SCHEDULE

DAY TWENTY-ONE	DAY TWENTY-TWO	DAY TWENTY-THREE	DAY TWENTY-FOUR	DAY TWENTY-FIVE
SESSION 32 • Debrief Field Trip SESSION 33 • Simulation "F": Program and Budget Planning	SESSION 33 • Continued	SESSION 34 • Simulation "G": Meeting Between ORDEV Engineers and Senior Governorate Managers	SESSION 35 • Evaluation of Technical Component	GRADUATION CEREMONY

Chapter 4

ASSESSMENT

4.1 Goals

The participants did not believe that all of the course goals (see section 3.1) were fully achieved. On a five-point scale -- one being "not achieved" and five being "fully achieved" -- the participants' sense of achievement on goals one through eleven (these goals covered water supply, groundwater and sewerage) ranged from a mean of 1.8 through 2.8. The only exception to this result was goal number two with a mean score of 3.7 (see Table 3).

For goals twelve to eighteen (maintenance component), the mean scores were significantly higher, ranging from 3.5 to 4.3, yet when asked about their overall satisfaction with the course on a similar scale -- one being "not at all satisfied" and five being "very satisfied" -- their mean score was 3.7. The simulation, which was run in segments over a two-week period, was rated at 4.3.

While one cannot be certain about the reason for this difference in goal achievement scores, one distinct possibility is that the engineers expected to learn some new state-of-the-art technology that would enable them to solve their problems. In fact, such "miracle" technology generally does not exist. Instead success is achieved by a better application of basic theories of good management and fundamental technology. Only in the maintenance field, particularly the development of maintenance management systems, did the Egyptian engineers learn concepts that they had not been taught previously.

Table 3

Achievement of Training Objectives

Please indicate your achievement of each training objective listed below.						Mean
WATER SUPPLY	Not Achieved		Partially Achieved		Fully Achieved	
OBJECTIVE 1	1	2	3	4	5	2.8
	(1)	(2)	(7)	(2)		
To review the nature of hydrologic flow with respect to water supply & groundwater flow in the Nile delta area.						
OBJECTIVE 2	1	2	3	4	5	3.4
		(1)	(5)	(6)		
To examine how water supply systems are planned, developed, operated & maintained.						

Table 3 (Cont'd.)

	Not Achieved		Partially Achieved		Fully Achieved	Mean
OBJECTIVE 3 To determine appropriate water quality criteria, testing procedures and treatment processes.	1 (1)	2 (4)	3 (6)	4	5 (1)	2.7
OBJECTIVE 4 To review basic pipeline hydraulics and practice using calculations for hydraulic network analysis.	1 (1)	2 (5)	3 (4)	4	5 (2)	2.8
OBJECTIVE 5 To examine the procedures to be carried out in groundwater site selection, well installation, and prevention of contamination.	1 (3)	2 (6)	3 (3)	4	5	2.0
GROUNDWATER AND WASTEWATER						
OBJECTIVE 6 To examine the three stages of the groundwater cycle.	1 (5)	2 (4)	3 (3)	4	5	1.8
OBJECTIVE 7 To describe and discuss the causes of high phreatic groundwater and the problems resulting from it.	1 (4)	2 (3)	3 (3)	4 (2)	5	2.3
OBJECTIVE 8 To develop practical methods for controlling high groundwater levels.	1 (4)	2 (3)	3 (5)	4	5	2.1
OBJECTIVE 9 To demonstrate a methodology for designing a simple sewerage network.	1 (1)	2 (4)	3 (6)	4	5 (1)	2.7
OBJECTIVE 10 To explore the advantages and disadvantages of the ways to dispose of excess groundwater.	1 (1)	2 (4)	3 (6)	4 (1)	5	2.6

Table 3 (Cont'd.)

	Not Achieved		Partially Achieved		Fully Achieved	Mean
OBJECTIVE 11 To examine various treatment alternatives for wastewater.	1 (1)	2 (5)	3 (5)	4 (1)	5	2.5
MAINTENANCE						
OBJECTIVE 12 To examine the effects of good and poor maintenance.	1	2 (2)	3 (3)	4 (6)	5 (1)	3.5
OBJECTIVE 13 To establish those elements which are an essential part of a good maintenance program.	1	2	3 (4)	4 (5)	5 (3)	3.9
OBJECTIVE 14 To determine how proper maintenance will extend the life of a facility and its equipment for many years.	1	2	3 (3)	4 (6)	5 (3)	4.0
OBJECTIVE 15 To develop a flowchart of the steps for a preventive maintenance program that could be applied to typical BVS projects.	1 (1)	2 (1)	3 (4)	4 (3)	5 (3)	3.5
OBJECTIVE 16 To establish the needs of a maintenance unit in terms of manpower, equipment, support services and budget.	1	2 (2)	3 (4)	4 (3)	5 (3)	3.6
OBJECTIVE 17 To develop strategies for installing local preventive maintenance programs.	1 (1)	2 (1)	3 (4)	4 (3)	5 (3)	3.5
PROCESS SIMULATION						
OBJECTIVE 18 To provide a series of realistic situations for participants to integrate the technical and management aspects of their training.	1	2 (1)	3 (1)	4 (3)	5 (7)	4.3

4.2 Methodology

From the participants' perspective the methodology seems to have been right on target. All of them thought, for example, that the level on which the material and content were presented was about right. And almost everyone was satisfied with the degree to which they were able to share their ideas and experiences within the group.

They also saw the following activities as being quite helpful in facilitating their learning: lectures, large group discussions, small group work, field trips, and individual consultation with instructors. They felt the amount of time devoted to large group discussion and small group work was just about right, but that there should have been more time for individual consultation with instructors.

In terms of impact on the learner, this workshop did not include an opportunity for the participants to experience one of the more powerful aspects of doing participatory-based technical training, i.e., the chance to build or produce something concrete. Learners generally get far more out of an experience when they can apply what they have learned to a specific task. Access to a more "active" technical site, for example, where skills could have been tried out would have enhanced this group's overall learning. Although the classroom environment encouraged instructors to favor the lecture discussion mode, use of a personal computer on two separate occasions made it possible to be more technically active in the classroom. In general, the participants would have benefited from a more "hands-on" application or from working on an actual problem in class.

4.3 Schedule

All but one of the participants found the daily schedule about right. The training staff, on the other hand, felt that a five hour day from Monday to Thursday, and two and a half hours on Friday was not enough time to cover all of the material in the course. Time was especially critical because everything the instructors said in English had to be translated into Arabic. This was necesary because two-thirds of the participants said they could not understand lectures in English, and two-fifths said they did not know enough English to be able to participate in discussions.

Most of the participants thought that the technical portion of their training was too short and that it would have been more useful for them if the management portion has taken less time. Given the short days and the time-consuming language requirements, the training staff all agreed that the technical portion of the program should have been longer.

4.4 Field Trip

There were some negative feelings about the extended field trip. These primarily centered around the administrative arrangements including per diem and the local travel arrangements at each site.

The positive aspect of the field trip was that participants felt as if they were well prepared about what they were going to see. The site personnel, particularly in Phoenix, did an excellent job of showing them around and the participants identified a number of useful concepts they could apply in Egypt. These included:

1. Using hyacinth plants in sewerage treatment.
2. Harvesting hyacinth plants and using them as animal feed.
3. Treating sewerage for the purpose of producing potable water.
4. Separating sand from deep well water.
5. Methods of constructing pipelines in areas with high levels of groundwater.

4.5 Assessment Summary

Table 4 is a summary of the results of the more pertinent points resulting from the course assessment. The participants were asked to rate the various elements of the workshop from one to five, with one being the least and five the most favorable response. Some questions required only a yes or a no response. The assessment was conducted on the last day of the technical component.

Table 4

Course Assessment Summary

Question/Topic	Response
Yes/No Questions	
1. Were the general objectives of the course clear?	33% - yes
2. Did your previous experience or training in English adequately prepare you to	
a. Read materials?	67% - yes
b. Understand lectures?	33% - yes
c. Participate in discussions?	58% - yes
3. Was this course appropriate for your professional responsibilities?	100% - yes
4. Were you satisfied with the degree to which you were able to share your ideas and experiences with the group?	92% - yes
Topics Rated from 1 (Least Favorable) to 5 (Most Favorable)	
5. Satisfaction with George Mason Metro campus as training site.	3.7
6. Satisfaction with administrative support by training site personnel.	3.2
7. Achievement of training objectives in:	
a. Water supply component.	Range: 2.0 - 3.4
b. Groundwater and wastewater.	Range: 1.8 - 2.7
c. Maintenance.	Range: 3.5 - 4.0
d. Process simulation.	4.3
8. Helpfulness of the training techniques used:	
a. Lectures.	3.5
b. Large group discussions.	3.7
c. Small group work.	3.8
d. Field trips.	3.8
e. Individual consultations with instructors.	3.9
9. Adequacy of field trip arrangements:	
a. Preparatory information.	4.7
b. Transportation.	1.8
c. Helpfulness of professional staff accompanying participants.	1.1
d. Responsiveness of field site personnel to participants' needs:	
• San Diego	1.2
• Phoenix	4.9
• New Orleans	3.6
e. Overall coordination.	2.8
10. Adequacy of written materials.	2.8
11. Overall satisfaction with course.	3.7

Chapter 5

RECOMMENDATIONS

5.1 Fall 1984 Training Course

5.1.1 Creating an Ongoing Effect

One of the ways of assuring that the course has an ongoing effect on the participants is to notify their superiors of the topics that were covered in the course. The team prepared a letter for the Egyptian engineers to take with them describing the workshop content (Appendix D). The team hopes it will encourage the engineers, with the support of their superiors, to implement some of the ideas covered in the course.

5.1.2 Additional Books and Publications

The participants expressed an interest in acquiring additional reference books. In response, the training team prepared a list of possible texts and publications that would be useful to the engineers for their work. Appendix E contains this list, and the team recommends that the Mission consider providing some or all of this reference information to the BVS engineers. Later in 1985, someone (consultant or Mission staff) should follow up with the participants to determine which of the books/manuals are actually being used.

5.1.3 Follow-up Visit

One of the technical trainers should visit the participants approximately six months after the course. This visit would provide on-site consultation and encouragement to make use of the knowledge and skills learned in the course.

5.2 Future Training Courses

5.2.1 Combine Technical and Management

The management and technical aspects of the course should be combined. Most of the participants felt that the management component could have been shortened or that it should have come after the technical component. Clearly the participants saw it as something separate and not as important as the "more practical" technical areas. Yet the best management training occurs when training is thoroughly grounded in people's day-to-day situation.

The underlying issue here is that there really are not that many new solutions to the kinds of problems participants face daily. Technically speaking they already seem to know what to do. Many of them acknowledged in the evaluation that, while the course was relevant to their work, they did not learn anything new. It appears that one critical task for these engineers is to learn how to manage the resources they now have and to develop organizational strategies for getting their projects accomplished. Thus, future programs ought to build in opportunities which permit participants to develop the management skills that they need to carry out their everyday job responsibilities. To do this

the technical and management components have to be carefully integrated, something which did not happen in this course.

5.2.2 More Hands-On Work

Future programs should build in more time for "hands-on" site visits so participants can actually do some of the things they are expected to learn.

5.2.3 Needs Assessment

A needs assessment should be conducted in Egypt prior to the course by one of the training staff who will be doing the course. It should include interviews with the people who will be attending the course as well as their superiors and subordinates. There also should be time for visits to the offices and work sites of the future participants and ideally an opportunity to accompany one or two of them around on one of their "typical" work days. The data from such meetings should be recorded on specially prepared needs-assessment survey forms and used as the basis for designing the course. Experience has shown that the benefits of having such data during the planning stage are well worth the extra cost.

5.2.4 Pre-Course Packet of Materials

A pre-course packet of materials should be sent to the participants or given to them during the needs survey. The primary purpose of these materials would be to get the participants mentally ready for the course by asking them to identify the problem(s) they need to work on. The problem(s) could then become one of the lenses through which they might focus their course experience and view course content. Such a packet could also be used to inform participants what the course is about, what they will be expected to do, where they will be living, and what their per diem arrangements will be.

The intent here is two-fold: establish early an accurate set of expectations and enable participants to clarify what it is they want to get out of this training experience. They will then be better prepared to take advantage of the workshop.

5.2.5 Field Trip

In the future, the field trip should be treated as a study tour rather than a field trip. This would help to create a more realistic set of expectations by the participants. The more they view the field trip as an integral part of the course, the more useful the field trip will be from a learning standpoint. A study tour would imply careful preparation as well as careful debriefing after the trip to help relate the experience to the course goals.

The presence of a technically qualified group leader on the field trip would also help in maximizing its value. This leader should be one of the trainers, since he/she would be aware of the overall course and could help relate what the participants were seeing to the training program.

5.2.6 Back-Home Planning Strategy

The purpose of this recommendation is to encourage all participants taking the course to continually work toward a set of solutions they can take home. Early in the course it should be explained that, in addition to the regular content there will be time for the participants to work alone or in groups on solutions and plans for resolving their particular set of problems. Members of the training staff should monitor the progress of the participants and assist them in setting up meetings with other technical specialists, securing written or material resources, or arranging site visits.

Eventually each person should have a plan that will integrate many of the resources made available in the course. This back-home application plan should also include a strategy of steps and actions needed to put recommendations into operation. With a number of these plans documented, it would be relatively easy for WASH staff, or others, to follow up and make some determination of long-term impact.

APPENDIX A

Questionnaire for BVS Workshop

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MEMORANDUM

B-473

TO: Fred Pollack/USAID, Cairo

FROM: for Fred Rosensweig, WASH

RE: Questionnaire for BVS Workshop

DATE: August 15, 1984

Attached please find two additional copies of the BVS Workshop questionnaire which was telexed to you on 08/07/84.

DZ:rh

encls:

cc: J. Austin, ST/H/WS

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QUESTIONNAIRE
BVS WATER AND SANITATION TRAINING

1. Name:

2. Date of Birth:

3. Educational Background:

Name of School	Years Attended	Main Course of Study	Degree

4. Current Job Title:

5. Current Job Responsibilities:

6. Past Employment History:

Job Title	Duration of Time	Major Responsibilities

7. Travel Abroad:

Countries Visited	Duration of Time	Purpose of Visit

8. English Level. Circle the answer:

A. Can you read a book in your technical field?

Easily With Some Difficulty With Great Difficulty

B. Can you understand a half-hour lecture in your field?

Easily With Some Difficulty With Great Difficulty

C. Can you participate actively in a professional meeting (i.e. listening and responding)?

Easily With Some Difficulty With Great Difficulty

D. Can you write a letter to a colleague?

Easily With Some Difficulty With Great Difficulty

9. What do you expect to learn in the course that will help you in your current job?

SKILL ASSESSMENT FORM

Please fill out the following form by checking in the appropriate column whether you feel that you have no experience, some skills or knowledge, or adequate skill:

	NO SKILL	SOME SKILL	ADEQUATE SKILL
1. Environmental Problems			
A. Knowledge of environmental problems related to water supply/sewerage and other pollution.			
B. Familiarity with drainage and irrigation laws (PL 93 & 48).			
C. Understanding of impact of PL 93 and 48 on water supply/sewerage design.			
D. Knowledge of methods to deal with environmental problems given legal, economic and technical constraints.			
2. Water Supply			
A. Ability to complete hydraulic grade line (HGL).			
B. Ability to size pipes.			
C. Skill in network analysis			
D. Ability to select water sources.			
E. Knowledge of treatment methods for water sources.			

	NO SKILL	SOME SKILL	ADEQUATE SKILL
3. Sewerage and groundwater			
A. Knowledge of appropriate sewerage systems for small villages.			
B. Knowledge of conventional treatment systems for larger villages and towns.			
C. Knowledge of problems associated with effluent discharge in high groundwater areas.			
4. Periodic Maintenance			
A. Ability to define maintenance requirements of various systems.			
B. Ability to set up and implement a maintenance management system.			

APPENDIX B

Participant Interview Guide

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BVS TECHNICAL TRAINING COMPONENT

PARTICIPANT INTERVIEW GUIDE

NAME(S): _____

_____

CURRENT POSITION AND GEOGRAPHIC LOCATION:

OPENING QUESTIONS:

1. What did you tell your friends about why you are coming to the U.S.?*

2. A. What are your job responsibilities?

   B. How many systems are you responsible for?

   C. What is a typical day like for you?

   D. What are the 3 most urgent demands made of you?

*When used for more than 1 person, record both responses.

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3. What would you like to learn in this course in order to meet those job responsibilities?

ORGANIZATION: OFFICE LEVEL

4. How many people work in your office?

Engineers_____ Engineers_____

Others_____ Others_____

5. A. Whom do you report to?

B. How many people do you supervise?

BUDGET AND FUNDING

6. A. How much money did your ORDEV Office get this year and where does it come from?

B. How much of this was used for office operations?

C. How much was spent on projects?

7. How is your annual program and budget prepared?

PROJECTS AND PEOPLE SERVED

8. What kind of projects do you work on?

(Encourage them to talk in terms of physical size and cost)

9. A. What is the population of your governorate?

B. How many villages are in the governorate?

C. How many of these villages have a population of:

Below 1,000 _____

Below 1,000 - 10,000 _____

Below 10,000 - 100,000 _____

10. A. Do village people select what projects get BVS funding?

B. If yes, describe how village people participate in decisions about BVS funding for local projects?

11. A. After a project is built, who is responsible for maintenance?

B. Where does the funding for maintenance on local projects come from?

C. Do the villages get money to provide maintenance for projects like pumping stations?

WRAP-UP QUESTION:

12. If you had to choose 3 skill (knowledge) improvements to help you do your work better, what would they be?

APPENDIX C

Participants' Briefing Material for Field Trips

BVS TRAINING GROUP
VISITS TO FACILITIES IN SAN DIEGO,
PHOENIX, AND NEW ORLEANS
NOVEMBER 23 - 30, 1984

WASTEWATER BY AQUACULTURE RESEARCH STATION
SAN DIEGO

INTRODUCTION

San Diego is a city of several million people in Southern California. The climate is semi-arid (half-desert). The city is already served by large water supply and wastewater systems.

There is a research project underway in San Diego to study wastewater treatment by aquaculture. The word "aquaculture" is a combination of "aqua" (water) and "agriculture" (farming), and means "farming in water" or "cultivating water plans". The plants are water hyacinths, which grow very rapidly (2 - 5 cm/day). The plants feed on the dissolved impurities. When the plants are removed from the water (harvested), the impurities are therefore also removed. (It is necessary to harvest the hyacinth plants. If the hyacinths are not removed, they will eventually die and decay, and the impurities will return to the water).

For both research facilities the process train consists of:

1. Preliminary treatment (screening, perhaps grit removal).
2. Primary treatment, to remove solid particles.
3. Secondary treatment, to remove colloidal and dissolved impurities.
   a. Growing hyacinths
   b. Removing hyacinths
4. Discharge of the wastewater.
5. Disposing of the collected hyacinths.

The aquaculture process is found to provide treatment that is better than conventional secondary treatment. It removes P (phosporous) and N (nitrogen), and can remove metals as well.

The process is very simple. Hyacinths grow very rapidly in warm climates such as San Diego (or Egypt).

A major research question is: What shall be done with the hyacinths after they are removed from the wastewater? In the San Diego project, several uses are tried: anaerobic digestion to generate methane; conversion to animal food; and composting to make fertilizer.

There are two aquaculture plants in San Diego: Aqua 1 and Aqua 2.

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AQUA 1

This is a small facility, treating 20,000 gallons per day (75,000 L/day). At this facility, many types of treatment processes for primary treatment and for disposal of hyacinths are being studied. Because it is small, it is easy to try many different ideas for sewage treatment.

AQUA 2

This facility is newer than Aqua 1, and has 15 times the capacity: 300,000 gallons per day (1,100,000 L/day). Next year it will be expanded again, to 1 million gallons/day (3.8 Mega liters/day). The variety of processes studied at Aqua 2 is small (only two types of primary treatment are studied: conventional settling tanks, and "rotary disc filter", with a 200-micron stainless steel strainer). The main purpose of Aqua 2 is to determine the economic feasiblity of the process when operated at a size large enough to serve a city.

MAINTENANCE OF WATER SUPPLY AND TREATMENT FACILITIES PHOENIX, ARIZONA

INTRODUCTION

Phoenix is a large, rapidly growing city in the American desert, with a climate similar to that of Egypt. The water supply is at present largely from groundwater, which has a rather high iron and manganese content. In a few years' time, water will also be imported by canal from the Colorado River.

Camp Dresser & McKee International Inc., a large American consulting engineering firm specializing in water supply and wastewater engineering, has recently designed a comprehensive maintenance program for the Phoenix water supply system. The emphasis of the Phoenix visit will be on this maintenance program.

VISITS TO WELL SITES

There are over 200 wells in the Phoenix water supply system. You will visit three typical sites. At one of those sites, water is pumped to a canal to flow to a water treatment facility. At the other two sites water is pumped directly into the distribution system.

VISIT TO TYPICAL BOOSTER PUMP STATION

This station shows a layout typical of booster stations in this system, with vertical turbine pumps, a centrifugal pump, and standby generator.

VISIT TO LARGE BOOSTER PUMP STATION

This station not only has a large pumping capacity, but has as well a large storage capacity of 250 million gallons (nearly one million m^3). Chlorination facilites are here, too. Drawings of this station will be provided.

VISIT TO LARGE WATER TREATMENT FACILITY

This facility has a capacity of 120 million gallons/day (about 450 megaliters/day). The remarkable fact about your visit to this plant is that it is out of service for annual maintenance, and completely drained of water so that you will be able to see all parts normally underwater.

VISIT TO SECOND LARGE TREATMENT FACILITY

You will also visit a 140 million gallon/day (530 megaliter/day) water treatment plant, this one in operation. This plant uses the principle of declining rate filtration, whereas the first plant uses constant rate filtration, which is more traditional in the United States.

ENGINEERING CONSIDERATIONS FOR SELECTING AND DEVELOPING A WELL SITE

At the CDM office, a design engineer will discuss the engineering considerations involved in designing a well system.

CONSTRUCTION SITE VISITS
NEW ORLEANS AREA

INTRODUCTION

The New Orleans Metropolitan Area is a large, rapidly growing, urban center with a population of approximately (2) million. The area lies in the low Deltaic Plain of the Mississippi River and consists pimarily of reclaimed swamps and marshes at elevations 10 ft above sea level to 5 ft below sea level. The developed areas are surrounded by man-made flood protection levees. Near surface soils in the area are typified by four to fifteen ft of very soft, highly organic clays or fibrous peats underlain with soft, grey, inorganic clays. Severe soil settlement is a major problem and many residential areas have experienced 2 to 3 ft of subsidence in a few years causing failure of streets, building foundations, and sewers as well as sheared gas and water lines.

The area has a humid, semi-tropical climate with an average annual rainfall of 58 inches, an average annual temperature of 70^{0} F, and an average mid-day relative humidity of 63 percent. All rainfall runoff is collected by systems of ditches and canals and pumped into Lake Pontchartrain. Ground water elevations range in depth from several inches to 6 ft below the ground surface.

The unique geologic, hydrologic, and climatic conditions of the area pose constraints for public works projects. The following construction projects are selected to demonstrate interesting aspects of design and construction in the New Orleans area.

JEFFERSON PARISH MAJOR FORCE MAIN PROJECT

This 66 inch diameter, prestressed concrete force main sewer is now being constructed in a ten to twelve ft deep trench, down the middle of a major traffic thoroughfare. Unique aspects of this project include highly congested existing utilities which must be relocated, special bedding construction, continuous trench dewatering, and stringent backfill compaction specifications.

JEFFERSON PARISH MAJOR LIFT STATION PROJECT

This 60 million gallon per day (peak flow) sewage lift station is being constructed of reinforced concrete on a mat foundation. The excavation is continously dewatered and groundwater elevation is controlled during construction to maintain a balance between settling and buoyant forces.

JEFFERSON PARISH CASED HIGHWAY CROSSING PROJECT

A 14 inch diameter, steel casing is being jacked and bored beneath a 6 lane, major interstate highway to provide for a force main sewer crossing. This construction is critical in that the casing will be bored 300 ft through saturated sand and clay.

JEFFERSON PARISH LIFT STATION REHABILITATION PROJECT

Nine existing sewage lift stations are being rehabilitated and upgraded by the addition of wet well capacity and the replacement of pumps, piping, controls, and electrical systems. Wet well additions will be reinforced concrete on mat foundations and will be connected by piping to existing wet wells. Construction will be in heavily congested residential areas and temporary bypass pumping of sewage flows will be practiced to maintain sewer service during construction.

KELVIN LANDFILL PROJECT

This general purpose landfill was sized to service the entire population and some industry within Jefferson Parish. It is designed for landfilling of refuse and sludge. This landfill is constructed of 20 ft deep cells excavated to only 6 ft below grade to accommodate poor soil conditions. The cells are lined with in-place, scarified, recompacted clay of low permeability to prevent migration of leachate. Leachate collection is provided by perforated plastic pipe in shell-filled trenches.

APPENDIX D

Letter of Achievement

WATER AND SANITATION FOR HEALTH PROJECT

WASH

COORDINATION AND INFORMATION CENTER

Operated by The CDM Associates
Sponsored by the U. S. Agency for International Development

1611 N. Kent Street, Room 1002
Arlington, Virginia 22209 USA

Telephone: (703) 243-8200
Telex No. WUI 64552
Cable Address WASHAID

The WASH Project is managed by Camp Dresser & McKee International Inc. Principal cooperating institutions and subcontractors are: Associates in Rural Development, Inc.; International Science and Technology Institute, Inc.; Research Triangle Institute; Training Resources Group, Inc.; University of North Carolina at Chapel Hill.

LETTER OF ACHIEVEMENT

Mr. _____ (name) has successfully completed a five-week workshop from November 5 - December 5, 1984 which covered the design, construction, operations and maintenance of water supply and sanitation systems. The workshop was sponsored by the USAID Mission in Egypt through the Basic Village Services Project and was conducted in Washington, D.C. by instructions provided by the AID-funded Water and Sanitation for Health (WASH) Project. The workshop, part of a ten-week course organized by the USDA Graduate School, was divided into three components: Water Supply, Groundwater and Wastewater, and Operations and Maintenance.

The specific topics covered were:

Water Supply

- Review of hydrologic flow in Nile River area.
- Design and construction of water systems.
- How to determine water quality criteria.
- Review of pipeline hydraulics.
- Review of pipeline hydraulics.
- Correct procedures for drilling wells.

Groundwater and Wastewater

- Three stages of groundwater cycle.
- Causes of high phreatic groundwater.
- Practical methods for controlling high groundwater levels.
- Design of sewage network.
- Wastewater treatment techniques

Operations and Maintenance

- Elements of a good maintenance program.
- Preventive maintenance programs.
- Development of strategies for implementing a maintenance program.
- Monitoring maintenance systems.

The workshop was a participatory one, and Mr. _____ (name) contributed to the success of the workshop by his willingness to share his ideas and experiences with the other engineers taking the course. I am pleased to acknowledge his successful participation in this workshop.

Sincerely,

Fred Rosensweig
Associate Director/Human Resource Development

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APPENDIX E

Recommended Reference Books and Manuals

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I. First Priority List (Inexpensive materials; suggested for immediate procurement)

1. American Water Works Association. Basic Level Water Treatment Operator's Practices: AWWA Manual M18. Denver, CO: AWWA, 1971.

2. _____. Simplified Procedures for Water Examination, Including Supplement on Instrumental Methods: AWWA Manual M12. Denver, CO: AWWA, 1977.

3. _____. Water Chlorination Principles and Practices: AWWA Manual M20. Denver, CO: AWWA, 1973.

4. _____. Water Distribution Operator Training Handbook. Denver, CO: AWWA, 1976.

5. _____. Water Distribution Training Course: AWWA Manual M8. Denver, CO: AWWA, 1962.

6. _____. Water Treatment Plant Design. Denver, CO: AWWA, 1969.

7. Wagner, E.G., and J.N. Lanoix. Water Supply for Rural Areas and Small Communities. Geneva: WHO, 1969.

II. Basic Reference List (More expensive but very useful sources)

1. Al-Layla, M. Arris. Water Supply Engineering Design. Ann Arbor, MI: Ann Arbor Science, 1977.

2. American Water Works Association. Standard Methods for the Examination of Water and Wastewater. Denver, CO: AWWA, 1975.

3. Babbitt, Harold E. Water Supply Engineering. New York: McGraw Hill, 1962.

4. Clark, John W., et al. Water Supply and Pollution Control. New York: Harper and Row, 1977.

5. Degremont Company Editors. Water Treatment Handbook. New York: Taylor-Carlisle, 1973.

6. Dixon, Wilfrid J., and F.J. Massey, Jr. Introduction to Statistical Analysis. New York: McGraw Hill, 1969.

7. Johnson Division. Groundwater and Wells. St. Paul, MN: Johnson Division, UOP Inc., 1975.

8. Metcalf & Eddy, Inc. Wastewater Engineering: Treatment, Disposal, Reuse. New York: McGraw Hill, 1979.

9. Parmakian, John. Waterhammer Analysis. New York: Dover, 1955.

10. Uhlig, Herbert H. Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering. New York: John Wiley, 1971.

11. Ven-Te, Chow. Handbook of Applied Hydrology: A Compendium of Water Resources Knowledge. New York: McGraw Hill, 1964.