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REPORT OF THE

EGYPTIAN IRRIGATION MANAGEMENT SYSTEMS

BY THE

USAID DESIGN TEAM

MANPOWER DEVELOPMENT AND TRAINING

CH2M HILL INTERNATIONAL
engineers
planners
economists
scientists

Requirements Contract No. AID/OTR-C-1618

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Ministry of Irrigation
and
USAID/Egypt
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The ccoperation in obtaining information has made working in Egypt with the Ministry and AID a distinct pleasure. The team members: M. J. Morgan, Richard V. Haapala, and Robert B. Conklin wish to express their appreciation for the assistance received and in the solving of logistical problems for traveling through the irrigated areas of Egypt. The open door policy of officials when we needed to see someone on short notice certainly expedited our task.

It is our sincere hope that the training program briefly outlined in this report will assist the MOI in achieving their goal of a viable training program for their staff.

Sincerely,

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EXECUTIVE SUMMARY

The purpose of the Irrigation Management Systems project is to strengthen the capabilities of the Ministry of Irrigation (MOI) in operating, maintaining and planning for the irrigation network. The objective of the Manpower Development and Training Program is to create a Manpower Development and Training program to provide adequate numbers of personnel with the technical skills required by the MOI to carry out efficiently its current and anticipated future programs.

The immediate or short term goal is to provide the training required for the design, planning, and replacement of those structures that no longer provide adequate control of the irrigation system.

The MOI engineer has good basic engineering training and general exposure to irrigation practices and facilities in Egypt but is lacking in practical experience and training. There is a shortage of adequately trained irrigation technicians to support the engineer in his day to day activities. With training provided by this project and with continued recruitment success, the Irrigation Department feels that it can better carry out the proposed structural replacement program and implement an adequate operation and maintenance program.

There is some indication that there is an imbalance of workload with respect to staff levels. MOI management may need to take a close look at staffing patterns in the Irrigation Department.

In order for the MOI to meet the short-term engineering staff requirements for the immediate future, the following should be done:

1) Institute a training program,
2) Launch a concentrated recruiting drive to attract the newly graduated engineers,
3) Initiate an incentive program to reward above average performance of all staff.

The MOI needs to decrease the attrition of students between the end of the first and second years at the two Survey Institutes.

The MOI needs a Manpower and Development Committee. This committee should function as a policy committee on training activities reporting directly to the Minister.

The responsibility for the training proposed in this project should be placed with the WRC.

In country training proposed by the Manpower Development

and Training program is divided into three categories. These are short courses, seminars, and on-the-job training (OJT). Short course training will be offered initially in the following:

1) Irrigation Design and Construction
2) Construction Methods, Materials and Quality Control
3) Operation and Maintenance
4) On-Farm Water Management
5) Administration and Management

Short course training priorities have been established as follows:

First Priority: Courses in "Irrigation Design and Construction" and "Construction Methods, Materials and Quality Control" will be initially directed to design and construction engineers involved in the structure replacement program. Technicians will be given training in the same basic fields as the construction engineers. However the topics will be oriented more toward construction management, surveying and drafting.

Second Priority: Since training engineers in "Operation and Maintenance of Irrigation Systems" and "On-Farm Water Management" will take a certain amount of time to implement, these topics will be presented later in the program. Engineers

in specific geographic areas should be trained prior to the completion of the rehabilitation work in their areas.

Lowest Priority: Lowest priority will be given to courses in "Administration and Management."

MOI staff will be recruited, sent to the U.S. for 6 months training. The training will start within 8 months of the signing of the Project Agreement.

From 120 to 360 engineers can take the short course training in a year. The number trained will depend on the adequacy of the facilities used and the number of instructors recruited and trained.

Two years of long term Technical Assistance (TA) and 21 months of short term TA is recommended. A training site still has to be chosen. The Sakha and Mariout Training Centers are suggested as possible suitable sites.

Senior Management Seminars are recommended for senior level MOI staff. These will be conducted by Egyptian management firms as much as possible.

On-the-job training is recommended for all MOI departments.

Twenty two person years of participant training is planned in engineering and construction over the life of the project.

The proposed training program is extensive but training is only a minor part of effective Irrigation Management in Egypt. The key to increased efficiency and productivity is motivation of adequately qualified staff.

INTRODUCTION

In order to carry out its responsibilities for the management, operation and maintenance of the irrigation, drainage and related systems in Egypt, the Ministry of Irrigation (MOI) needs a pool of manpower suited to its purposes. This pool must have the proper levels and mix of a broad range of management, administrative, engineering and technical skills. The MOI must be able to meet its obligation to the irrigation system with adequately trained personnel. To meet this obligation the MOI must have a positive recruitment and training program.

The growing population will continue to place heavy demands on the agriculture community in the foreseeable future. The MOI must make every effort possible to meet these demands by providing a functional system with adequate water management.

Approached in these terms, manpower development and training becomes one of the highest priorities of the Ministry. It requires the attention of an interdisciplinary group of the most knowlegeable people within the Ministry. This manpower and training advisory group or committee would present recommendations to the Minister for policy development. They would engage in a continuous assessment of current and future manpower needs based upon a comprehensive evaluation

of the nation's requirements. The proper management of the waters of the Nile is for Egypt the very essence of the capacity to sustain life. The manpower that will manage the system must be the best and most efficient that Egypt can provide. To enter the 21st century with less, would be to flirt with disaster when each drop of water must by then serve two persons for every one now in this land.

Objective of Training

The objective of this project is to create a Manpower Development and Training program to provide adequate numbers of personnel with the technical skills required by the MOI to carry out its current and anticipated future programs efficiently.

The immediate or short term goal is to provide the training required for the design, planning, and construction supervision necessary for the replacement of those structures that no longer provide adequate control of the irrigation system.

Specific Targets

The specific targets of the training program are:

1) Develop a cadre of senior and middle managers with a comprehensive knowledge of how to plan, manage and direct the technical, financial, and manpower resources of the MOI.

2) Provide needed training to engineering personnel, in appropriate numbers, to staff the MOI to execute present and future targets.

3) Provide management and resources for continuing professional self-development of engineers and other professional staff.

4) Create training programs for sub-professional personnel to develop their needed range of practical skills.

5) Create a close and continuing linkage between a process for assessment of MOI management and skills requirement and field operational needs.

ASSESSMENT OF MOI MANPOWER CAPACITY

Qualitative Evaluation

It is evident that the MOI engineer has good basic engineering training and general exposure to irrigation practices and facilities in Egypt. A lack of practical experience and training results in engineers who are unable to develop the most innovative designs. Shortage of funds, staff, and certain construction materials and techniques in Egypt limit implementation of new, more efficient designs. However, practical training is the area in which most are deficient.

Interviews with engineers have revealed a need for training in the areas of management of construction activities, use of water measurement data, irrigation system management, crop-water use requirements, on-farm water management, administration, personnel, and budget management. Another area in which a significant weakness was observed, was in the economic evaluation of alternative designs.

The sub-professional irrigation technician is purported to be adequately trained for the job for which he is intended to fill at the district and Project Directorate levels. Most of the technicians currently employed by the Irrigation Department, are not graduates of technical institutes nor are they fully qualified irrigation technicians. They are

predominantly graduates of technical high schools which offer a 3 year technical course after preparatory school. The MOI is extremely short of qualified irrigation technicians. Only about 10% of the technicians are considered to be qualified to fill the positions they are now occupying.

Quantitative Evaluation

The Irrigation Department has 1392 approved, currently budgeted engineering positions. With only 707 of these positions filled, there are presently vacancies for 685 additional engineers. The largest number of the vacancies occur in the lower ranks. This should be expected since the rate of new hires has been relatively lower in the past 5 years than previously. The mid-level and senior positions are filled by engineers who do not have the option to retire. By increasing the staff level to the authorized level (1392 engineers) and with additional training to be provided by this project, the Irrigation Department feels that it can carry out the proposed structural replacement program and implement an adequate operation and maintenance program. This increased level of staffing is considered to be sufficient for the next 5 years.

Currently Authorized Manpower Levels

Tables I and II show the authorized budgeted positions for the Irrigation Department. Not all of the authorized positions are currently filled.

TABLE I PROFESSIONAL STAFF Budgeted Positions

Position	No.	Civil Service Rank	Training	Age
Senior Undersecretary of State	4	Special	Engineering	
Undersecretary of State	10	Special	Engineering	
Director General for Engineering	39	Special	Engineering	
Director General for Administration	2	Special	Non-Engineering but University trained	
Inspector of Irrigation	38	1st Degree	Engineering	49-52
Assistant Inspector	116	1st & 2nd Degree	Engineering	44-50
Director of Works	133	2nd Degree	Engineering	43-47
Assistant Director of Works	346	2nd & 3rd Degree	Engineering	35-43
Engineers	706	3rd Degree	Engineering	24-35
Administrative Positions	377	7-1st Degree; 89-2nd Degree; 281-3rd Degree	University Non-Engineering -	
Total Administrative	379			
Total Engineering	1392			

TABLE II NON-PROFESSIONAL STAFF Budgeted Positions

Position	No.	Civil Service Rank	Remarks
Clerks	1351	1st through 6th Degree	Majority of ranks are 3rd & 4th Degree
Technicians	3027	1st through 6th Degree	Majority of ranks are 3rd & 4th Degree
Artisans or Craftsmen	5472	2nd through 6th Degree	Majority of ranks are 3rd & 4th Degree
Helpers	15663	2nd through 6th Degree	Majority of ranks are 3rd & 4th Degree
Total	25,513		

Current Engineering Staff

The present number of staff in 1981 and the short term future needs are shown in Table III.

It is interesting to note that of all the engineers shown on Table III, there are 382 in the age group 24 to 35. This is an indication that there has been some degree of success in recruiting engineers in the past few years. Since the average student is approximately 24 years old when he graduates, it appears that more than half of the currently employed engineers have been hired within the past ten years.

The engineering organization is heavily staffed at higher levels as can be seen upon close examination of the data in Table III.

Table III shows the staff as of 1981 and the projected requirements through 1986 for the subordinate units of the Irrigation Department. The Undersecretaries' (U/S) offices and the offices under his jurisdiction are responsible for design and construction of small structures. The Project Directorate offices are responsible for the design and construction of large structures and Horizontal Expansion. Therefore, qualified design and project management engineers are needed at all levels.

TABLE III IRRIGATION DEPARTMENT STAFFING

Position	Current Number of Employees 1981	Future Needs (next 5 years)
10 Undersecretary Offices		
Undersecretaries	10	20
Director of Works	10	20
Assistant Director of Works	10	20
Engineer	10	20
Sub-Total (Engr.)	40	80
20 Directorates		
Director General	20	20
Inspector (Assistant to Director General)	20	20
Director of Works	20	40
Assistant Director of Works	30	40
Engineers	70	160
Sub-Total (Engr.)	160	280
45 Inspectorates		
Inspectors	45	45
Assistant Inspector	45	45
Assistant Director of Works	45	90
Engineers	65	225
Sub-Total (Engr.)	200	405
167 Districts		
Irrigation Engineers	167	167
Drainage Engineers	-	167
Irrigation Technicians	314*	1002
Sub-Total (Engr.)	167	334
14 Project Directorates		
Director Generals	14	14
Inspectors	14	14
Director of Works	14	42
Assistant Director of Works	28	56
Engineers	70	167
Technicians	140	280
Sub-Total (Engr.)	140	293
Total Technicians	454	1282
Total Engineers	707	1392

* Not all have certificates from formal training institutes as irrigation technicians.

For Operation and Maintenance (O/M) of the irrigation system there are 167 District engineers with a requirement for 167 additional engineers. The offices above the level of the district offices are responsible for O/M and design support and have 400 engineers with a requirement for 365 additional engineers. At the district level, where the most work is implemented, there are 167 engineers or 29% of the total O/M engineering force. Seventy one percent of the Irrigation Department engineering staff are in engineering design, administrative and managerial positions above the district level.

The Project Directorate offices have responsibilities which include new lands development. These offices design structures; prepare plans and specifications; and prepare bid tender documents as well as providing support to the Undersecretaries. The 14 Project Directorate offices have 140 engineers with an additional requirement of 154 engineers.

Due to the nature of the irrigation system large amounts of the work must of necessity be accomplished at the lower levels. Consequently, the apparent imbalance of workload with respect to staff levels contributes to the fact that the district engineers are often overworked.

The load on the district engineers can be reduced by proper utilization of trained technicians to assist the

engineer in his duties.

Current Technician Staff

The majority of the people who work for the MOI in positions classified as technicians as shown in Table II are not fully qualified as irrigation technicians. The MOI classifies all sub-professional technical staff as technicians. These technicians may be contruction foremen or agriculturalists with little or no engineering or irrigation training. Of the 3027 positions shown in Table II, 2878 are occupied. Two hundred nineteen, in fact, have no technical qualification but can read and write; 216 have finished preparatory school; 1989 have finished a technical secondary school either in agriculture or construction; 304 finished a 2 year technical school beyond secondary school but not the Survey Institute; and only 150 are graduates from the Irrigation and Drainage curriculum at one of the Survey Institutes and are qualified as irrigation technicians.

Current Administrative Requirements

MOI officials have determined that no shortages of adequately trained administrative personnel exist. The administrative staff need only on-the-job training after finishing their formal prerequisite training.

MANPOWER DEVELOPMENT AND TRAINING

Background

Prior to 1965, the MOI had no problem in recruiting and keeping engineers. Gradually, with increasing inflation and without a corresponding increase in civil service salaries, more lucrative opportunities became available with private companies in Egypt and the OPEC countries.

In the past, engineers were trained in an informal on-the-job training basis by their superiors. They were moved from section to section during the early years of employment. This allowed them to obtain an overall working knowledge of the functions of the various sections of the MOI in various parts of Egypt. In later years, due to the shortage of engineers and the immediate demand for engineering services at the district level, this informal method of training was curtailed considerably.

Staff Recruitment

Recruitment of engineering staff in the MOI has suffered considerably since 1976 when the GOE rescinded the requirement that those Civil Engineering students who had taken the irrigation option in Civil Engineering were required to work for the MOI. From 1976 to 1978, the MOI did not hire any new engineers. In 1978, the MOI reinstituted the current incentive program. ne hundred forty five engineers left

the MOI and 215 new entry level engineers at the 3rd degree were employed for a net gain of 70 during the period from 1976 to 1980. Engineers are only hired at the entry level of 3rd degree. Those leaving MOI employment included retirements, a few resignations and some suspensions. Once an engineer is employed by the MOI, resignations are difficult to obtain.

The small net gain that resulted after the incentive program was reinstituted, is an indication that similar methods may be useful in future staff recruitment.

Objective

The objective of the Manpower Development and Training program is to provide training for the MOI engineers involved in the implementation of the operation and maintenance and structure replacement program. Training will be given to upgrade the capability of the present engineering staff, to increase the technical skill of the irrigation technicians, and to train the senior staff with special courses in management.

In order for the MOI to meet the short-term engineering requirements for the immediate future, the following should be done:

1) Institute a training program
2) Launch a concentrated recruiting drive to attract new engineers
3) Initiate an incentive program to reward above average performance of all staff

Current Training Programs

Egypt has a well established educational system that has the capability of training personnel to fill many of the technical staff needs of the MOI. However, certain short comings must be filled by instituting a supplemental training program under the control of the MOI.

In addition to the university system, there are many training institutes in Egypt. These provide technical training opportunities to secondary school graduates that failed to achieve a test level of 75 percentile or greater which would permit them to enter the University Faculty of Engineering. Those students who do not meet university level entrance requirements may choose to pursue a two year GOE financed technical training course in irrigation and drainage, land reclamation or surveying at either of two Survey Institutes. The graduate of the two year Survey Institute is obligated to work for the MOI for a period of five years after graduation. However, the student may , at his option, pay the LE 250 cost of the training and eliminate the mandatory MOI employment obligation. Private companies gladly pay the cost to get the technical institute graduate to come to work for them.

The currently operating technical institutes are located in Giza and Assiut. They are administered by the Ministry of Higher Education but sponsored financially by

the General Survey Authority which is part of the Ministry of Irrigation. The training institute in Giza is temporarily located in limited physical facilities. The two year course content is designed to train irrigation and drainage technicians for the MOI. A typical first year enrollment for the two institutes is 750 students. Approximately 170 to 180 students graduate each year. The usual distribution of the fields studied is as follows: 50% of the students graduate in surveying, 33% in irrigation and drainage, and 17% in land reclamation. Thirty to forty students with exceptionally high scores normally choose to continue on to a university for further study.

Each year there are approximately 35 irrigation technicians graduating from the institutes. Some of these move to private industry as surveyors, perhaps as much as 15 percent, with the balance going to the MOI.

As an initial step in MOI staff improvement, there is a recently initiated MOI funded English language training program. This is by the nature of the funding a temporary program for which the future is doubtful. All engineers have been ordered to take the English training during non-work hours. The policy of mandatory after hours training is highly unpopular.

The two institutes for technical training and the English language program are the only organized, structured training conducted by the MOI. There are a few organized seminars and courses sponsored by the MOI. MOI staff occasionally participate in training courses offered by universities but not on a regular basis. Overseas academic training is provided only through foreign donor assistance programs. The MOI does not have a program for overseas academic or non-academic training. However, a MOI employee may apply for a paid leave of absence to pursue an advanced degree program in an Egyptian University. There are limited opportunities for a MOI engineering employee to keep up to date on the state of the art of modern irrigation technology. There is a definite need for more internal training within the MOI.

Manpower Development and Training Committee

A committee to coordinate the manpower development and training programs is proposed. This committee would function to set manpower development and training goals, identify areas of deficiencies, and maintain an inventory of current and future needs in manpower and training with respect to the MOI needs in Egypt. This committee would have a policy and advisory role for the proposed training for this project.

The suggested committee composition is as follows:

Committee Chairman	Undersecretary for Planning
Executive Secretary	Chairman Water Research Center (WRC)
Committee members	6-Senior Undersecretaries of State for Irrigation 1 member from the Drainage Authority 1 member from the Survey Authority

The Undersecretary for Planning is suggested as Committee chairman since he has financial and planning responsibility for projects and O/M. He, also, is aware of staff vacancies and the technical training needs. The Chairman of the WRC is suggested as executive secretary since he has been designated to have the responsibility of administering any training programs for the MOI. Members from the Drainage and Survey Authorities give representation from those disciplines. The Manpower Development and Training Committee would be directly responsible to the Minister.

The committee would set policy and serve as the close and continued linkage between MOI Management and the field operational needs referred to as the 5th Specific Target referred to in the Introduction.

Proposed Training

The Ministry has a training program in the planning stage that will be administered by the WRC. The program is intended to provide coordinated training for the MOI staff at the national level.

The MOI eventually intends to move the WRC headquarters to the Delta Barrage. Present facilities there include a large office building, two large hydraulic testing laboratories, a modern test facility for testing and calibrating current meters, a soil mechanics laboratory, and a modern telemetering system. The above training program will have access to the use of the above functional laboratories and telemetering system for instructional purposes.

Senior Ministry officials have indicated their desire to establish a formal training program for MOI staff under the supervision of the WRC. All training will be supervised by this organization.

It is recommended that USAID/Egypt support the WRC as the administrating agency for the training component of this project. AID financed technical assistance and classes will remain separate from the proposed International Training Center.

The coordination of the training for the various activities of this project will be the responsibility of the training

organization that will be established by the MOI. The nucleus organization will have a headmaster or officer in charge. He will be of the rank of Director General. To support him there will be the instructional, administrative and specialist staff. The functions of the training organization will be as follows:

1. Coordinate training for all activities of this project
2. Supply logistical support for all training activities
3. Act as a clearing house for all nominations for training overseas
4. Conduct organized classroom instruction
5. Coordinate and supply technical support for on-the-job training throughout the MOI
6. Serve as a liaison office between the MOI and donor agencies for training overseas
7. Serve as a liaison office between the MOI and the Universities to organize efforts to get more irrigation relevant courses in the curriculum for irrigation engineers

The MOI basis for establishing this organization will be the Minister's decree which established a training program for the MOI under the auspices of the WRC.

The training organization will also, as a special project, work toward the establishment of a professional engineering curriculum in Agricultural Engineering. This will involve investigation to determine which university in Egypt would have the best facilities and faculties for establishing the curriculum and granting the degree. For further details see Annex B.

The training organization will also serve as a repository or library for video tape courses in all irrigation related fields. There will be a communications media specialist on the staff who will have responsibility for developing short courses for the MOI. In addition to the media specialist, a short term technical advisor in communications media and video course development is provided as part of the Manpower Development and Training Program.

In Country Training

Three categories of courses are to be taught in Egypt. The specific categories of the courses are short courses, seminars, and on-the-job training. They are intended to be developed into a self perpetuating program that will assure that engineers and technicians within the MOI are offered appropriate courses to develop and maintain their proficiency.

Short Courses

After many interviews and discussions with MOI officials,

from district engineers to the Senior Undersecretary of State for Irrigation, five distinct areas of short course training were identified. The titles of these courses are:

1. Irrigation Design and Construction
2. Administration and Management
3. Operation and Maintenance
4. On-farm Water Management
5. Construction Management, Methods and Quality Control.

The short courses of one to three weeks duration are designed to present practical, detailed technical material to all levels of working engineers and technicians. The details and duration of the specific courses will be adjusted to suit the particular needs of each group of students. As soon as the first "push" for meeting construction related training requirements have been initiated, the remaining short courses should be prepared. The training will be available to custom tailor courses aimed at relieving cadre other staff problems. One of the possible courses that was discussed briefly with MOI staff is a curriculum in the fundamentals of surveying to be presented to technicians now working for the MOI. Such courses could help relieve the district engineer of some of his surveying burden. Other courses could help streamline the MOI engineering efficiency.

It will be one of the functions of the training staff to develop courses for relieving staff constraints to increased MOI productivity. A few suggested additional topics are:

1. Sprinkler irrigation sytsem design
2. Center pivot irrigation system design
3. The design of underground pipe irrigation system
4. Utilization of effluent from urban sewerage system for agricultural production

Short Course Training Priorities

The first priority of this training program is to provide specific training in irrigation structure design and quality control of construction to those design and construction engineers who are involved in the initial phases of the structure replacement program. This will eliminate as much as possible any bottlenecks in the progress of the program. The training will concentrate on courses in "Irrigation Design and Construction" and "Construction Management Methods and Quality Control". To give assistance to the design and construction engineers, technicians will be given specialized training in the practical aspects of same fields as the construction engineers. Topics that are applicable to the technician level courses are construction management, surveying and drafting.

Training engineers in "Operation and Maintenance of Irrigation Systems" and "On Farm Water Management" will be assigned a second priority since the structure replacement will be implemented first and demands immediate attention by qualified staff. Engineers in specific geographic areas should be trained in O&M topics prior to the completion of the rehabilitation work in their area.

The lowest priority will be given to the "Administration and Management" course which will be taught as soon as feasible without interfering with other more essential training.

Initiation of the short course training will be done in accordance with the Implementation Plan as specified in Annex F of the Egyptian Irrigation Systems Operation, Maintenance and Structure Replacement Main Report, dated May 1981.

Staff Requirements

Staff to teach the short courses will be recruited as much as possible from the MOI. This does not preclude selection of staff from university faculties of engineering and from project expatriate staff. Project staff will not be utilized until they have received an adequate indoctrination to Egyptian culture and problems. As soon as an Egyptian cadre can be trained, they will take over the full teaching load.

The selection of Egyptian staff members is a crucial factor in the success of an on-going, functional training program. The need for furthering the education of the Egyptian irrigation or civil engineer who works for the MOI is for more practical rather than academic training. He needs to be shown new ideas or concepts for design, new construction material, and construction methods. The MOI engineer has not had an opportunity to observe, first hand, new ways of doing things. He has not had an opportunity to become well-trained in high quality construction work. His areas of practical experience are limited. He needs an opportunity to study and delve into all the ramifications of new ways of design and construction. Therefore, when selecting Egyptian staff for teaching at the training institute the academician should be by-passed. The staff should be selected from those who have been known to be innovators. The pioneer in the field of design or the man who accepts a challenge and who dares to try the new or the innovative, the man who demands perfection of contractors, those are the potential teaching staff of the training center.

Technical Assistance

It is anticipated that technical assistance (water resources engineers) will be provided to help administer the short courses as follows:

One long term technical advisor for two years;

1st project year - 3 technical advisors for 3 months each

2nd project year - 2 technical advisors for 3 months each

3rd project year - 2 technical advisors for 3 months each

The one person for two years will advise and assist the Egyptian in charge of the training of MOI staff in organizing class schedules; in recruitment and training of Egyptian teaching staff for the national program; in ordering supplies and equipment; in identifying areas in which training is needed; and in administration of the national training effort. A MOI staff member is to be assigned director of the national training program as soon as reasonably possible after approval of the project paper. He will act as counterpart to the long term advisor.

The short term technical advisors are needed to advise, assist and observe the newly trained Egyptian teacher early in the development of the training staff. The timing should be such that each year one advisor follows the other.

The Egyptian staff will gain by having exposure to more than one person experienced in teaching the courses each year. The long term technical advisor will be able to

assist in this training effort.

One task for the long term advisor will be to assist the MOI in identifying course material that can be presented through video tapes. Once the material has been identified, a short term technical advisor in communication media will spend a period of approximately three months advising the MOI in the production of the video tapes. The MOI has the cameras and other equipment for making the tapes. The communications media advisor will also instruct the staff in the best utilization of video tapes as a means of teaching.

A long term technical advisor is recommended to provide continuity to the efforts of the short term advisors as well as to advise the director of the National Training Program. In the event that USAID/Egypt and the MOI should decide against the one long term advisor, they should keep in mind the following:

1) The likelihood of obtaining the same short term advisor each year is remote
2) Project management runs the risk of having short term advisors being utilized as replacements for Egyptian staff instead of as advisors to Egyptian staff
3) A long term advisor could provide a great deal of continuity to the efforts of the short term technical assistance staff.

Location for Instruction

The training for this project should be conducted in a location that will be near the irrigated lands in the Delta. The irrigation system can then be used as a practical laboratory for instruction. It should also be near on-going construction. The construction does not necessarily need to be that of irrigation structures but there do need to be examples of good as well as poor quality construction in order to show the trainees both. The best location to find construction examples is in Cairo and the vicinity. Separate construction of training facilities are not contemplated by this project.

Possible locations for the training that should be considered are the Sakha Agricultural Training Center in Kafr El Sheikh, and the Mariout Training Center near Alexandria. The Training Centers in Sakha or Mariout each have classrooms and dormitory facilities.

Other suggested locations for conducting limited classes are: the library of the Water Research Center and a large conference room at the new facilities of the MOI Planning Unit.

All classes could be conducted at either Sakha or Mariout. The library at the WRC or the conference room at the Planning Unit would be suitable for course No. 1 (Irrigation Design and Construction). Course No. 2 (Administration and Management) and Course No. 5 (Construction Management,

Methods and Quality Control). Course No. 3 (Operation and Maintenance of Irrigation Systems) and No. 4 (On-Farm Water Management) should be conducted in the Delta. The MOI and USAID/Egypt need to agree on the facilities to use. Before the project paper is finalized, it will be necessary to make a decision on the location of facilities to be used for the short course training. It is strongly recommended that all short courses be taught at the same location over a long period of time. This will permit more efficient administration of the program with fewer logistical problems.

Senior Management Seminars

Senior level MOI officials have expressed a desire and need for top level Management Development courses or seminars. The younger engineers who occupy senior positions indicate that they would welcome an opportunity to participate in a series of Management Development seminars. These courses should be linked together with a chain of continuity that would gradually build upon the areas of management responsibility pertinent to those involved. The person responsible for leading the seminar should be carefully selected to maximize benefits to the participants. Those who receive the training should be carefully selected so a maximum amount of interaction and exchange of ideas will result.

The seminar lecturer should be someone of considerable practical experience and technical expertise. He should be recognized as a capable manager, preferably with Middle East or Arabic experience. Egyptian management experts should be

utilized as lecturers for the seminars whenever possible. The lecturer would be selected far enough in advance to allow time for proper preparation. The lecturer should spend at least two weeks in advance of the seminar to become familiar with the participants' needs and specific details of the topics to be covered. The goal of the seminar would be to plant seeds for thought with the fervent hope that they germinate as the name seminar implies.

Possible seminar titles for a Management Development series are as follows:

a. Management Systems

b. Management Objectives

c. Attainment of Higher Performance Standards

d. Building Group and Organizational "espirit de corps".

e. Use of "Productivity" Circles

f. Techniques for Increasing Productivity

g. The Art of Employee Motivation

h. Communications Skills

i. Development of Employee Resources

Continuity of participants and lecturers throughout the series will increase the benefits derived from the program. The seminars would be scheduled approximately 4 months apart. Periodically the participants should be required to analyze the impacts upon the performance of their regular jobs.

The seminar series offers the opportunity for participants to gain insight into problems common to all managers. Through diligent work, measureable progress can be made toward solution of a myriad of management problems existing within the MOI.

A large resource of Egyptian management firms exists in country. They should be utilized to conduct the seminars as much as possible.

On-the-job Training

As a supplement to the proposed training, the MOI will develop an on-the-job training (OJT) program. A new employee will have an initial indoctrination period of OJT of no less than 3 months in his new assignment before being sent for the short courses in the practical, technical training proposed by this project. During the three months indoctrination period, the new engineer will learn the organizational structure of the MOI; and the duties and responsibilities of the individual engineering employee in the MOI.

Upon his return to the job, following the short courses, OJT will be closely supervised by an experienced employee of the MOI. An informal monthly conference or seminar will be held at the irrigation directorate to inform all employees of new developments in the Ministry, new construction methods or designs being considered, and to discuss any problems of design, construction, and O/M.

OJT should be adopted as a routine procedure for all departments of the MOI and for all staff. Once the training organization is established, it can then act as the catalyst to initiate interest and action to get such a program started.

Participant Training

A program of participant (overseas) training is proposed for two groups of trainees. The largest group will be gineers regulary working for the MOI who will be sent to the U.S. for an intensive course in specialized technical subjects. It is referred to as the "Participant Technical Training Program". The other aspect of participant training will involve a small very select senior group of engineers who will be sent to the U.S. for a top level management overview program, referred to as the "Participant Senior Management Training Program".

Participant Technical Training

The Participant Technical Training Program will be offered to mid-level engineers who have exhibited exceptional levels of performance and maturity. The program and the courses listed below are more fully described in Annex G:

- Operation and Maintenance of Irrigation Systems
- On-Farm Irrigation Practices
- Design of Irrigation and Drainage Facilities
- Construction Management

Two mid-level engineers in each of the above subject areas will be assigned duties as instructors in the short course training upon their return to Egypt. These eight potential instructors will be selected and sent for training prior to the initiation of this project. The balance of the participant trainees will be selected from key positions in the design and construction group in the structural replacement program, and from the operation and maintenance staff of the Irrigation Department.

Participant Senior Management Training

It is recommended that the Manpower Development and Training Committee select a small group of engineers in senior administrative positions from the MOI to receive special training in management. Those selected will participate in an individually tailored non-academic introduction to top level management concepts of industry, education and public organizations in the U.S.

The one to two month long tour will provide exposure to management concepts that can be adapted to Egyptian irrigation problems. Sufficient time should be spent with each group to pursue the rationale for making significant management decisions. It is through these observations of the decision making processes in action that the Egyptian engineers can understand and adopt the methods used. Personnel management,

financial control, and motivation of employees are particular areas that should be observed.

Implementation Plan

The training portion of the Manpower Development and Training program involves implementation of the following:

a. Short courses

b. Senior Management Seminars

c. On-the-job training

d. Participant technical training

e. Participant Senior Management training

In addition to an implementation schedule for initiating training, a schedule is needed for the arrival of the technical assistance team.

A discussion of the number of students per class, the length of each course, priority for selection of students for each class, and implementation of the proposed training it given below.

A realistic goal of the number of personnel to take all the short courses in a given year is no more than 120 unless a permanent arrangement can be made with the Sakha or Mariout Training Centers as a place to conduct the classes. If a permanent arrangement can be made with the Sakha or Mariout Training Center, then 2 or possibly 3 sections of 30 students

each could be trained simultaneously.

The number of hours per class for each course was determined by the number of topics to be covered and complexity of these topics. The length of each course was also related to a similar university course. A class taught on the semester system basis meets 3 to 4 hours per week for 18 weeks. A three hour course then meets 54 times in one semester. An engineering student in a university will spend a minimum of 2 hours on course work outside of class to each hour of lecture or 162 hours to total effort for a 3 semester hour course. In a teaching situtation similar to that projected for this project, a student will not spend as much time outside of class as he would at a university. Therefore, the number of class hours is double what it would be for a university course for the more difficult complex courses and increased by 50% for the less complex one. The total combined time for all courses amounts to 11 weeks of class time. If the classes are all held at the same location, this will allow for 4 sessions of 11 weeks each with one week between sessions for a total of 48 weeks. This allows one month for vacation for the teaching staff. If it is found that either too much or not enough time has been programmed for a particular course, then hours of class will be adjusted to fit the need.

Within the training program, it is proposed that the courses be taught to engineers as well as technicians and managers of many different levels of seniority. Since the training that senior engineers and irrigation technicians receive varies according to levels of responsibility, it is necessary that those attending the classes be divided into groups associated with common training objectives.

The emphasis of the instruction given to the higher level engineers will be on issues related to administration, planning and progress control. Very little instructional time will be spent upon topics such as structure design, hydraulics, or construction inspection. Topics such as water management are applicable to all levels of instruction. However, the emphasis of each particular class level must be adjusted to the area in which the participants are working. As an example, a water management class taught to senior engineers should be targeted toward policies and procedures that will improve the efficiency of Egypt's water resource utilization. Irrigation Technicians attending the course of the same title would receive instruction in water management and data collection taught in very basic non-technical terms. Mid-level engineers would receive material that is structured for their needs.

It will be the responsibility of the training organization and more specifically the individual instructor to tailor

the courses to the student's needs. This will place a great deal of responsibility upon the instructors and institutional staff. Therefore, it is important that only the most competent instructors and staff are used in the training program. They must understand the needs of the students as well as the technical content of the curriculum.

Each class should be composed of staff of the same general peer group. In discussions with high level Ministry officials, it was decided that class groups should be as follows with each of the three degrees and the special ranks in separate classes:

Civil Service

Rank	Title	
3rd degree	Muhandis	Engineer
	Mosad Modeir El Amal	Asst. Director of Works
2nd degree	Modeir Al Amal	Director of Works
	Wakil Al Taftish	Asst. Inspector of Irri.
1st degree	Mufatish Al Rai	Inspector of Irrigation
Special Rank	Modier Al Am	Director General
" "	Wakil Wizarat	U/S of State for Irri.
" "	Wakil Awal	Senior U/S of State for Irri.

The length of individual courses will be shorter for those of higher rank and longer for those of lower rank. A discussion of the length of courses for each class is in Annex A.

A schedule for the implementation of each of the short courses is given in Annex F. The scheduling of the Senior Management Seminars will be fixed by the Egyptian Project Manager and the long term technical assistance advisor. On-the-job training will be initiated after the project agreement (pro-ag) is signed with the first group of newly hired engineers. Annex G describes the technical training for participants. This annex shows one year and a lesser period of time for each type of training for which participants are to be sent. It is planned to send the first group of participants for the shorter period of time shown in the course description for each type of training to be given. They would be instructors for the short course training. The schedule is as follows:

1) Operation and Maintenance of Irrigation Systems:

Length of course	6 months
Date of departure	1 month after pro-ag signed

2) On-Farm Irrigation Practices:

Length of course	6 months
Date of departure	1 month after pro-ag signed

3) Design of Irrigation and Drainage Facilities:

Length of course	6 months
Date of departure	1 month after pro-ag signed

4) Construction Management:

Length of course	6 months
Date of departure	1 month after pro-ag signed

The long term technical assistance (TA) advisor is scheduled to arrive 8 months after project paper approved as shown in Annex F. One of his first tasks upon arrival will be to assist in organizing the short course training. As part of this task, he will determine in conjunction with his Egyptian counterpart the schedule for the arrival of the short term technical advisors for that year's training program. Each year, the schedule for the arrival of the short term advisors will be developed.

Another task requiring the early attention of the TA advisor will be to identify subject areas in which there are the greatest need for improving the skills of the technicians employed by the MOI. He will outline courses and prepare course material for them. Two courses have already been tentatively identified for training those technicians who have completed technical secondary school. These are surveying and drafting.

All of the TA team advisors will be irrigation engineers with practical experience in irrigation system design and construction. Every effort should be made to find qualified advisors with teaching experience.

The communication media specialist should have experience in directing the production of video tapes in technical or engineering courses. He will work with the Egyptian and TA team teaching staff in developing appropriate video tapes.

Support of Current Programs

A limited amount of support for currently existing training programs could possibly be considered by AID. These programs are of quite limited nature and therefore, have very little impact on the proposed project. Under certain conditions the Survey Institutes may be considered for more financial support.

Survey Institutes

The programs administered by the Ministry of Higher Education at the two Survey Institutes (Giza and Assiut) are not currently producing a significant number of trained irrigation technicians for the MOI each year. The curriculum has the potential of producing technicians that will be beneficial to the MOI. At this time the output of the Institutes is materially affected by the high attrition rate between the first and second years of the program. If the number of students that successfully complete the program can be increased, it may be reasonable for AID to provide more support to the programs. A possible incentive that would encourage more students to participate in the program would be the opportunity to obtain a relatively highly paid

job with the MOI upon graduation. The trained technicians could be included in the current and proposed incentive pay programs for engineers in the MOI.

Additional support to the Survey Institutes through equipment donations, instructor staff, and added funding would enhance the programs. The limited benefits received from these investments and the potential administrative entanglements with the Ministry of Higher Education should be carefully evaluated before any commitment is made.

English Language Program

The current English language training program is undoubtedly beneficial to the staff of the MOI. This program must be properly funded and be administered properly. To be successful there must be an incentive for the students to participate willingly. Under the current policies, mandatory attendance during non-working hours is not popular and does not create a favorable learning environment. Unless popular support can be developed for the program, commitment of funds is not recommended.

ANNEX A

RECOMMENDED SHORT COURSES

Course No. 1

Irrigation Design and Construction

The purpose of this course is to provide the engineering staff members with sufficient training to design irrigation system structures that utilize alternative materials and construction methods that are new to the MOI.

The use and method of evaluating alternative designs, construction materials, and construction methods will be stressed.

This course is to be taught to all levels of engineering staff within the Ministry of Irrigation (MOI) but any given class should be made up entirely of the same peer group, i.e., either beginning, mid-level, or senior engineers. The topics to be covered will be the same for all levels differing only in the depth of coverage for each topic and the duration (number of weeks) of the course. This course is intended as a review of the design of irrigation structures with primary emphasis on alternative methods of design and new construction materials and techniques.

The staff utilized will be knowledgeable and appreciative of Egyptian conditions, that is, logistical problems, quality

and availability of materials, availability of qualified construction workers, etc. Therefore, project expatriate staff, who are newly arrived in country, will not be used as lecturers until they have had an opportunity to become acquainted with the irrigation systems, the experience and competence of the Egyptian contractors and MOI engineers, and the Egyptian culture. As soon as reasonably possible, an all Egyptian staff will be selected and trained to conduct this as well as all other classes.

On-going construction in Cairo will be used for observing quality controlled construction until such time as construction of suitable quality can be seen in the Delta. Field trips will be used extensively to carry out the practical part of the training. The course will be as practically oriented as it is humanly possible to make it.

The primary language of instruction will be English. The major topecs to be covered in the course are listed below.

A. Types of Construction:

1. Reinforced concrete and other conrete products,
2. Prefabricated and prestressed concrete construction,
3. Steel products and their application, i.e., ductile iron pipe, corrugated piping, etc.,
4. Masonry construction,

5. Compacted earth fills, and

6. Mechanical and electrical equipment.

B. Project Design:

1. Alternative analysis,

2. Economic evaluation, and

3. Adaptation and evaluation of standard plans to a particular site.

C. Raw material selection (sand, gravel, etc.):

1. Gradation and hardness of gravel,

2. Gradation of sand,

3. Foreign material in sand and gravel, i.e., trash, calcium deposits, soil, salts,

4. Minimum specification for cement,

5. Re-bar; kinds, sizes, and strength, and

6. New shuttering (forming) techniques.

D. Concrete mix design and its control on construction site.

E. Placement of re-bar in concrete form.

F. Project construction management:

1. New construction,

2. Rehabilitation, and

3. Maintenance.

G. Pre-design requirements:

1. Site survey,

2. Foundation requirements and investigation,

3. Design requirements of structure,

4. Selection of design and method of construction, and

5. Environmental impact analysis.

H. Design procedure.

I. Selection and design of mechanical and electrical equipment.

J. Specifications on quality of materials..

K. Specifications on quality of workmanship.

L. General specifications including environmental considerations.

M. Design techniques:

1. Steel culverts,

2. Box culverts,

3. Corrugated pipe culverts,

4. Underground piped irrigation systems, and

5. Mechanical and electrical equipment design.

N. Project evaluation and economics of design alternatives:

1. Estimating costs of construction,

2. Alternative design including environmental consideration,

3. Comparison of useful life for each design,

4. Comparison of maintenance cost for each design,

5. Comparison of alternative design, and

6. Computer programs for project evaluation.

O. Drainage system design:

1. General introduction,

2. Basic principles of drainage including environmental consideration,

3. New drainage theories and application,

4. Methods of drainage investigations,

5. Drainage design and the use of new techniques,

6. Drainage construction techniques,

7. Drainage system maintenance,

8. Planning of drainage projects,

9. Evaluation of drainage projects including environmental considerations,

10. Field training, and

11. Re-use of drainage water.

P. Design of shore protection devices.

Q. Design project: Individual projects for student participation.

Course No. 2

Administration and Management

The Faculty of Engineering curriculum for civil engineers does not allow for training in administration and management. The purpose of this course is to provide the training required for the engineer in administrative management.

There is a general consensus at all levels within the Ministry of Irrigation that a general course in administration and personnel management is needed. The course can be slanted to the particular needs that are peculiar to the organizational structure of the MOI. This course will be primarily for junior and mid-level MOI staff but would not preclude senior staff if they are desirous of taking the course or are selected by their superiors to do so.

The teaching staff will be selected from the various GOE administrative institutes as well as the MOI and project expatriate staff.

The primary language for the course will be Arabic but English speaking instructors may also be utilized.

This course is designed to assist the junior to mid-level employee to become familiar with the administrative requirements of the MOI. General topics to be covered follow.

A. Responsibilities of the engineer.

B. Water rights:

1. Egyptian legislation on the rights of the landowner in the division of irrigation water,

2. Responsibilities of the MOI in supplying water to the Egyptian farmer,

3. Legal procedure to be used in the protection of the farmer's water rights,

4. Legal procedure to be used by the MOI and other, ministries in preventing illegal use of water and illegal construction on the canal system, and

5. Responsibilities of other ministries, such as Agriculture, Housing and Land Reclamation, Health, etc.

C. Employee rights:

1. Promotion,

2. Training,

3. Vacation,

4. Cost of living allowances,

5. Family allowances,

6. Housing, and

7. Employer-employee relations.

D. Financial and records management:

1. Budget,
2. Water data,
3. Utilization of data,
4. Preparation of budgets, and
5. Budget management.

E. Design, construction, and bid tenders:

1. Evaluation of engineering problems,
2. Preliminary design,
3. Design approval,
4. Final design,
5. Preparation of tender documents,
6. Advertising for bid tenders,
7. Awarding of bids, and
8. Supervision of construction.

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Course No. 3

Operation and Maintenance of Irrigation Systems

The purpose of this course is to train the new engineering employee to a better understanding of the interrelationship of the complex problems involved in the management of an irrigation system.

This course is to be taught to irrigation technicians and to all levels of engineering staff within the MOI that the course will benefit, but any given class should be made up entirely of either technicians or of beginning, mid-level, or senior level engineers. There should not be a mixture of personnel levels in any class.

The topics to be covered will be the same for all classes differing only in the depth of coverage for each.

The staff will be experienced, well qualified, mid, and senior level MOI staff and project expatriate staff. The teaching staff from the MOI will be selected on the basis of their field experience and reputation as good managers of the irrigated areas under their control.

The primary language of instruction will be English for the engineers and Arabic for the irrigation technicians. A brief outline of topics to be covered follows.

A. Operation of Irrigation systems:

1. Water measurement and record management,
2. Data utilization and feedback,
3. Command area and crop water use requirement,
4. Conveyance losses and irrigation efficiencies,
5. Water scheduleing and control,
6. Operation of open canal systems,
7. Operation of pipeline systems,
8. Communications and transportation,
9. Water user relations and settlement of disputes,
10. Legislation (regulations) and legal problems,
11. Environmental impact, and
12. Water quality.

B. Maintenance of irrigation systems:

1. Importance of prompt and efficient maintenance,
2. Weed control methods in irrigation and drainage canals,
3. Use and maintenance of measurement equipment and control structures,
4. Use, and efficient management of maintenance equipment and labor,
5. Importance of maintaining equipment,
6. Maintenance of records and data feedback, and
7. Maintenance procedures for underground drains.

C. Rehabilitation of systems.

D. Human and staff relations.

Course No. 4

On-Farm Water Management

The purpose of the water management course is to train the civil engineering graduate of the university in the management of water for the most efficient utilization of the Nile waters for maximum crop production. The B.Sc. graduate in civil engineering receives minimal training in irrigated agricultural crop production. This course is designed to give him an understanding of the soil-water-plant relationship and its importance to agricultural production.

This course will be offered to all levels of MOI staff including engineers and agriculturalists; junior, mid-level and senior irrigation and agricultural engineers and irrigation technicians. Again, each class should be composed of only those of the same peer group.

The staff will be drawn from university faculties of agriculture and engineering; senior level MOI staff members; and project expatriate staff. There will be a strong emphasis given to the agricultural relationship of soil, water, and plants, crop consumptive use, quality of irrigation water, etc. The primary language of instruction will be English. A brief outline of topics to be covered follows.

A. Soils and water:

1. Agricultural classification of soils,

   a. Texture and water holding capacity

   b. Fertility and fertilizer requirements

   c. Salt content of soils and its effect on production

2. Soil moisture and relationship to crop production,

   a. Field capacity of soils

   b. Saturation point

   c. Wilting point

3. Soil-water-plant relationship,

   a. Consumptive use

   b. Evapotranspiration

   c. Crop water use requirement

4. Tolerance of crops to water quality,

5. Ecological effects of water quality, deterioration/change, and

6. Farm irrigation efficiency and its relation to irrigation methods.

B. Irrigated service area and water requirement:

1. Importance of feddanage determination,

2. Crop water use requirement, and

3. Available irrigation water supply.

C. Quality of water:

1. Salt content limitations,

2. Re-use of drainage,

3. Limits of contaminants in industrial effluents,

4. Use of urban (sewerage) effluents,

5. Salt water intrusion,

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6. Leaching requirements, and

7. Environmental impact of water quality.

D. Water measurement, data management and utilization:

1. Types of measuring devices and structures,

2. Computational methods and their accuracy limitations,

3. Selection of measuring methods for existing situations,

4. Record keeping, and

5. Data interpretation.

E. Land leveling:

1. Importance,

2. Methods of leveling,

3. Economics of leveling,

4. Surveying for leveling, and

5. Alternative methods of irrigation.

F. Irrigation system efficiency and methods of improvement.

G. Groundwater as a source of irrigation water:

1. Beneficial effects of its use in the Delta, and

2. Quality of groundwater.

H. Night storage and its deleterious effects.

Course No. 5

Construction Management; Methods and Quality Control

The purpose of this course is to provide training in modern construction methods for engineers and irrigation technicians. Training will be given in sufficient depth so that they will be able to adequately supervise and inspect contractor performance for acceptable workmanship. Irrigation technicians will be trained in a separate course to serve as the engineering assistant and observer for the engineer on the job site.

The course will be taught to all junior level engineers and irrigation and drainage technicians. The topics for each group will be modified to fit their responsibilities. Each class will be made up of individuals in the same peer group.

Initially the teaching staff utilized will be primarily project expatriate staffs, therefore, English will be the language of instruction. The major topics to be covered are listed below.

A. Purpose and components of contract documents.

B. Responsibilities in contract execution:

   1. Resident engineer's responsibility,

   2. Contractor's responsibility, and

   3. Defects of performance.

C. Construction inspection:

1. Site clearing,
2. Construction site layout and elevations,
3. Preparation for foundation, and
4. General inspections, site and shop.

D. Construction components:

1. Earthwork,
2. Concrete work: in place, prefabricated, prestressed,
3. Pipe systems,
4. Mechanical and electrical installation, and
5. Prefabricated steel work.

E. Safety.

G. Preparation of pay estimates.

H. Penalty clauses and purpose.

I. Quality control:

1. Testing of materials,
2. Concrete mixes,
3. Re-bar placement,
4. Construction and placement of shuttering,
5. Compaction of fill, and
6. Protective coatings.

ANNEX B

NEED FOR DEVELOPMENT OF AGRICULTURAL ENGINEERING CURRICULUM

A degree program leading to a Bachelor of Science in agricultural engineering is not offered in any Egyptian University. In the United States, Canada and many other countries of the world this field of study is a recognized profession in engineering.

One of the subject areas in which agricultural engineers may specialize is in the field of soil and water engineering, or irrigation and drainage engineering. The other areas of specialization in agricultural engineering are electric power and processing of crops; farm power and machinery; and farm building design. Of these the field of soil and water engineering or, in the case of Egypt, irrigation and drainage engineering is the most important.

The agricultural engineer, who has specialized in irrigation and drainage engineering, is more qualified than any other field of engineering in the design of farm irrigation systems and in on-farm water management. In order to be qualified to do this, he has to have a thorough understanding of crop water use requirements; water losses in crop production; evapotranspiration; farm irrigation system efficiencies; and the essentials of crop cultural patterns. Knowledge of the

above should play an important part in the management of the irrigation system of Egypt.

Curriculums in civil engineering in Egyptian universities do not offer an opportunity for the student to take any of the courses that would be necessary to acquire that knowlege. There is a definite need for trained agricultural engineers on the staff of MOI. Agricultural engineering should be included as a department in at least one faculty of engineering in an Egyptian University in order to meet the need. If an Egyptian university should become interested in establishing a department of agricultural engineering, perhaps they would be interested in visiting the University of Khartoum and seeing what has been developed in this University. The University of Khartoum has a department of agricultural engineering in the faculty of engineering. There are required courses in agriculture to meet the peculiar needs of this profession. The Dean of Agriculture advises in the requirements for the major fields of study but the degree is granted in engineering and the department is in the faculty of engineering.

It is not meant that the University of Khartoum would have the answer to fit the needs of Egypt. Probably they would not, as it is understood that major emphasis is placed on farm power and machinery. The example of a close sister University could be followed as an example of how to overcome the problem that needs immediate attention in Egypt.

ANNEX C

INSTITUTE FOR SURVEY, LAND RECLAMATION,

IRRIGATION AND DRAINAGE

GIZA AND ASSIUT

EQUIPMENT BUDGET

	$000
Vehicles	
Buses (4), 30 passengers	120
Vans (3), 10 passengers	39
Pick-up trucks (9)	99
Sub-Total	258
Survey Equipment, Photogrammetric and Cartographic Labs	
EDM (6), medium range, with theodolites (1 sec.)	90
Theodolites (10), 10 sec.	40
Precise levels (6), with rods	12
Engineering levels (10), with rods	12
Plane tables (15), with alidades	75
Miscellaneous small equipment	50
Stereo plotter (1)	50
Mirror stereoscopes (15)	45
Scribing tools and light tables	50
Sub-Total	424

	$000
Irrigation and Drainage Equipment	
Water meters, current meters, recorders, soil and water analysis equipment	150
Sub-Total	150
Teaching Aids	
Closed circuit TV Systems (2) with 10 monitors	40
Training Video Tapes on surveying	4
Text Books	10
Sub-Total	54
Staff Training (short term 3 months ea. participant - non-academic - 12 mos. total)	41
Sub-Total	41
GRAND TOTAL	927

Comment:

The vehicles and equipment would be divided between Giza and Assiut with approximately two thirds going to Giza because of the higher enrollment. The vehicles are needed to transport students and equipment to and from survey camps that are to be established with GOE funding.

CURRICULUM FOR SURVEY INSTITUTES

Study Plan of First Year

Subject	Hours Per Week			
	Lect.	Section	Pract.	Total
Cadastral surveying	2	3	6	11
Topographic surveying	2	-	4	6
Mathematics	1	1	-	2
Optics	1	-	2	3
Engineering drawing	-	3	-	3
Geology	1	-	-	1
Agriculture	1	-	-	1
Descriptive geometry	2	2	-	4
English language	-	2	-	2
Social studies	1	-	-	1
Land laws	1	-	-	1
TOTAL	12	11	12	35

Study Plan of Second Year Surveying

Subject	Hours Per Week			
	Lect.	Section	Pract.	Total
Cadastral surveying	2	4	10	16
Topographic surveying	1	1	5	7
Map drawing	-	3	-	3
Geodetic surveying	1	-	-	1
Aerial surveying	1	2	-	3
Building	1	-	-	1
Spherical astronomy	1	-	-	1
Mining surveying	1	1	-	2
Social studies	1	-	-	1
TOTAL	9	11	15	35

Study Plan of Second Year Irrigation & Drainage Section

Subject	Hours Per Week			
	Lect.	Section	Pract.	Total
Social studies	1	-	-	1
Project planning	1	-	2	3
Resurvey	1	-	3	4
Levelling	1	-	3	4
Building	1	1	-	2
Irrigation & Drainage	2	1	-	3
Irrigation project	1	2	-	3
Drainage project	2	1	-	3
Eng. drawing	-	3	-	3
Specifications & Quantities	2	1	-	3
Obs. measurements	-	3	-	3
Drainage measurements	2	1	-	3
TOTAL	14	13	8	35

Study Plan of Second Year Land Reclamation Section

Subject	Hours Per Week			
	Lect.	Section	Pract.	Total
Social studies	1	-	-	1
Project planning	1	-	2	3
Resurvey	1	-	3	4
Levelling	1	-	3	4
Building	1	1	-	2
Land reclamation	3	1	-	4
Machinery	1	4	-	5
Specifications & Quantities	2	1	-	3
Irrigation & Drainage	3	3	-	6
Eng. drawing	-	3	-	3
TOTAL	14	13	8	35

ANNEX D

MANPOWER DEVELOPMENT AND TRAINING

BUDGET

	$000
Vehicles	
Buses, 20 passengers (2)	60
Vans, 10 passengers (2)	26
Pick-ups, 2 WD (6)	66
Suburbans (2)	22
Sub-Total	174
Laboratory Equipment and Teaching Aids	
Portable, trailer mounted, water quality laboratory	25
Soils equipment, soil augers, core sampling equipment	15
Survey equipment (optical), transit, engineers level, and auxiliary equipment	30
Audio-visual equipment, screens, movie, slide and overhead projects; closed circuit TV and TV-monitors	65
Water measuring equipment: current meters, parshal flumes, portable weirs , etc.	20

	$000
Soil mechanics testing equipment, Atterberg liquid limit tester, consolidometer, standard proctor tester	25
Concrete testing equipment: slump test, compresssion and tension testing equipment, aggragate seives	50
Sub-Total	230
Technical Assistance	
21 person months @ 13,000/month	273
2 person years @150,000/year	300
Sub-Total	573
Operation of Short Courses Per Year	
Senior management course per year: Meeting room, lecturer fees, per diem, International travel, incidentals	120
Short courses per year: Student per diem, Egyptian university lecturers, teaching staff per diem (American and Egyptian)	200
Sub-Total	320

Participant Training Budget	FY81	FY82	FY83	FY84	FY85
			($000)		
Long term academic training					
Total Cost (Mos.) 1/	268.8(168)	22.2(12)	25.8(12)	30 (12)	34.5(12)
Sub-Total					381.3
Short term non-academic					
Total Cost (Mos.) 2/	20.5	23.4	27.0	31.2	36.0
Sub-Total					138.1
				Sub-Total	519.4
				GRAND TOTAL	1817.0
				20% Contingency	364.0
				15% Inflation	327.0
				ADJUSTED GRAND TOTAL	2508

1/ Cost per month: FY81 - $1600; FY82 -$1850; FY83 -$2150; FY84 -$2500; FY85 -$2875

2/ Cost per month: FY81 -$3400; FY82 -$3900; FY83 -$4500; FY84 -$5200; FY85 -$6000

ANNEX E

LOGICAL FRAMEWORK

GOAL : To improve efficiency of operation of the irrigation system

PURPOSE : To establish MOI staff development program

INPUTS : Funds, technical assistance, staff, trainees

OUTPUTS : Trainers trained; trained MOI engineering and techniccian staff; quality construction; adaptation of alternative design concept by MOI, timely replacement of structures

ASSUMPTIONS:

1) That MOI will assign training staff,
2) That trainees will be provided,
3) That trainees will apply principles learned to daily activities,
4) That MOI will make optimal use of training and of trained personnel
5) That MOI will adopt policy of requirement of quality control of construction,
6) That MOI will continue with the training program.

E.O.P.S. :

1) Sizeable cadre of MOI personnel have been trained,

2) Courses provided on an annual basis,

3) Additional funding provided for seminars and conferences on irrigation technology,

4) Additional funding provided for minimum technical library at irrigation directorate,

VERIFIABLE: INDICATORS

1) Training staff report for duty,

2) Trainees report for training,

3) Quality of construction improves,

4) Productivity increases

5) MOI requires specifications that will produce quality construction,

6) MOI adopts quality construction as requirement,

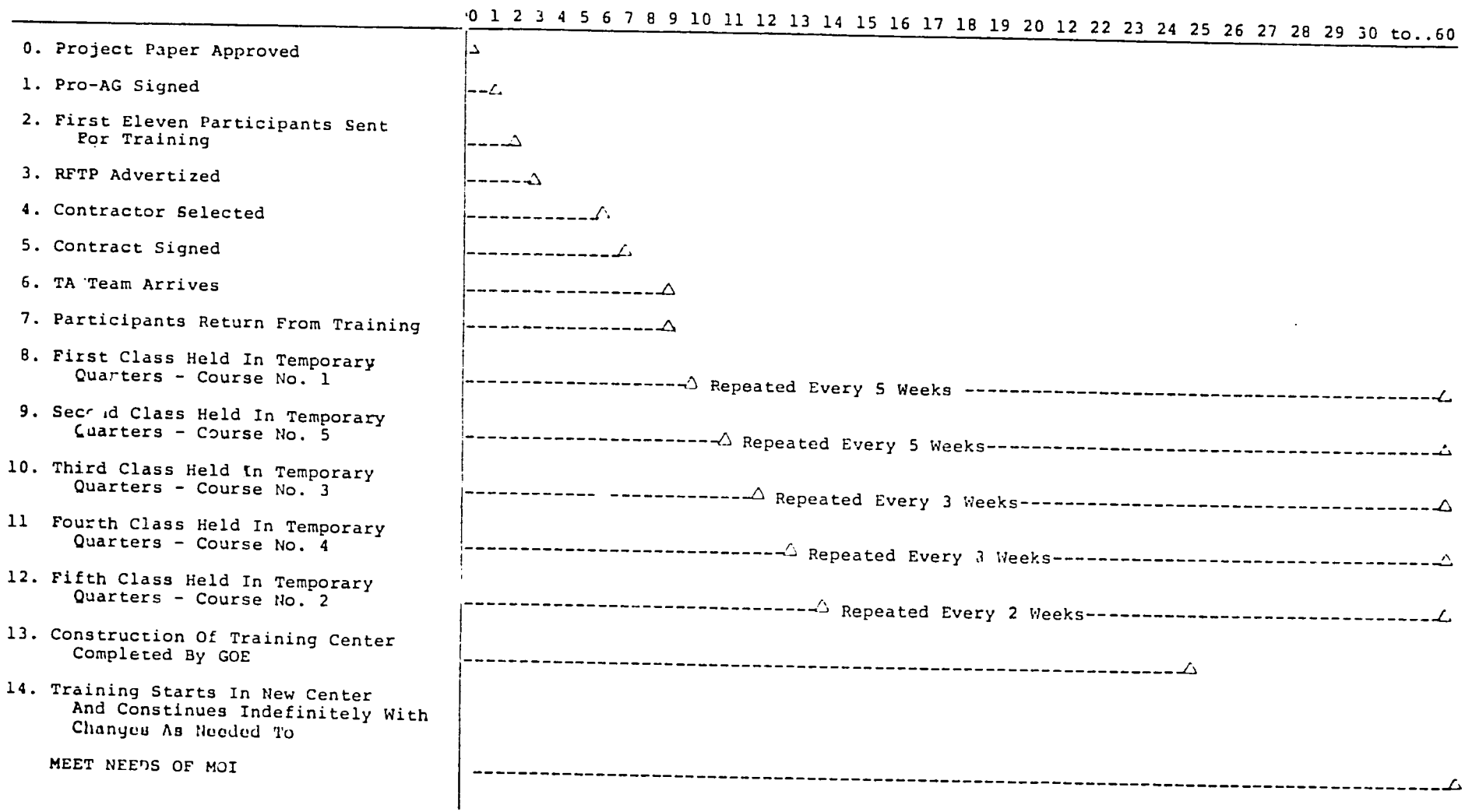
7) Training organization is formed by MOI.

ANNEX F

TRAINING IMPLEMENTATION SCHEDULE

IN MONTHS FROM

PROJECT APPROVAL DATE



ANNEX G

PARTICIPANT TECHNICAL TRAINING

Purpose: To provide a nucleus of highly skilled specialists within the departments of the MOI.

Personnel to be trained: Mid-career level people who have demonstrated leadership, advancement potential, and long-term commitment to the MOI.

Timing of training: Should be given shortly after, approximately 6 months, a person has been moved into a position requiring the higher skill level. The six months work experience in the new position is valuable so that the employer has a clear picture of job demands and responsibilities of his new position.

Specific disciplines in which training is needed:

A. Operation and Maintenance of Irrigation Systems

1) Course sketch-

a) Water measurement techniques

b) Scheduling of water movement through irrigation system

c) Communications and records management

d) Establishment of maintenance standards

e) Maintenance techniques

f) Weeds and debris management

2) Location and length of training-

Both a one year and a six month course can be scheduled. The course should be scheduled and supervised by a Western U.S.

University with visits to operating irrigation and drainage systems as well as visits to the Water and Power Resources Service (WPRS), Engineering and Research Service (ENR), in Denver, Colorado. Colorado State University, Fort Collins, Colorado would be an ideal University to coordinate this training.

3) Goal-

During the project three specialists will be trained for one year each or six specialists will be trained for six months each depending on the needs of the project and the MOI. The training will be directed toward the participants assuming management roles within the planning and design sections of the MOI.

4) Utilization after training-

The participants would work in regularly assigned positions within the implementation group for this project full time but with a two months temporary assignment per year at the irrigation training program assisting in instruction and/or teaching specialized classes.

5) Frequency of training-

Three people should be sent for one year

(or 6 people for 6 months each) initially and with at least one additional person every two years (or one person every year for 6 months).

6) Total person years of training during life of project -- 5 person years.

B. On-farm Irrigation Practices

1) Course sketch-

a) Soil-plant-water relationship,

b) Traditional and new irrigation techniques

c) Evaluation of irrigation efficiencies,

d) Drainage requirements and techniques,

e) Water and soil quality related to crop production.

2) Location and length of training-

A one year (or six months) course should be scheduled with a U.S. University which has a practical training in this field with climate and crop patterns similar to Egypts. Arizona State University, Tempe, Arizona or the University of California, Davis, California would be a suitable location.

3) Goal-

During the life of the project two participants should be trained for one year each or four participants for six months each so that they can assume management

roles within the planning or operational sections of the MOI.

4) Utilization after training-

Participants should return to work full time for the MOI Planning unit but with two months per year at the irrigation training center assisting in the instruction and/or teaching special classes.

5) Frequency of training-

Two participants for one year or four participants for six months go initially with at east one for one year every other year or two for six months every year during the life of the project.

6) Total person years of training during life of project -- 4 person years.

C. Design of Irrigation and Drainage Facilities

1) Course sketch-

a) Alternative structure selection;

b) Conventional and new material applications;

c) Selection of materials and designs for economic durability, evaluation of designs;

d) Earthwork for canals and canal lining;

e) Soil stability, erosion, and subsidence;

f) Plans, specifications and bid tender documents.

2) Location and length of training-

A one year course taught at a U.S. university which can offer practical application and examples of design alternatives and construction should be selected. A visit of at least one month to the design branch of USBR at ENR Center in Denver, Colorado and to at least one branch office should be arranged.

3) Goal-

During the life of the project initially three participants for one year each are to be trained for posts within the Special Projects Design Section and Planning Unit.

4) Utilization after training-

Participants should return to work full time in Special Projects Design Section or the Planning Unit with two months per year temporary assignment with the Irrigation Training Center assisting in instruction and/or teaching special classes.

5) Frequency of training-

During the first year, two participants will be trained for one year each. During the remainder of the project two participants will each receive 6 months of training each year.

6) Total person years of training during life of project -- 7 person years.

D. Construction Management

1) Course sketch-

a) Interpretation of plans and specifications,

b) Contract administration,

c) Role of contractor and resident engineer,

d) Quality control,

e) Estimating construction costs,

f) Management of payments and claims,

g) Progress control and scheduling,

h) Plans, specifications and bid tender documents

2) Location and length of training-

A one year course should be scheduled with a U.S. university with experience in teaching a course of this nature to engineers. Visits to construction sites to observe construction and its management will be mandatory. The civil engineering department of Oregon State University, Corvallis, Oregon offers an ideal course in construction management at the Bachelor's and Master's degree levels.

3) Goal-

During the first year of the program five participants will be trained for one year each for posts with the Project Directorates and two persons for six months each for the short course instruction.

4) Utilization after training-

Participants will return to be assigned to project implementation of this project with two months temporary assignment per year with the Irrigation Training Center assisting in instruction and/or teaching special classes.

5) Frequency of training-

Initially two participants for 6 months each and five participants for one year each with a short course for two people for 6 months each year during the life of the project.

6) Total person years of training during the of the project -- 8 person years.