QUARTERLY REPORT

July 1, 1982 to September 30, 1982

EGYPT WATER USE AND MANAGEMENT PROJECT

Submitted By

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Cairo, Egypt

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I. PROJECT STATUS IN EGYPT

A "plan book", developed by the staff, was distributed to all EWUP personnel this quarter. It includes detail plans for nine task groups and six pilot program groups for the period July 1, 1982 to June 30, 1983. This will be the final year of EWUP field work under the existing USAID contract.

Major field work the past quarter consisted of consolidating and refining farmer organizations, land leveling, mesqa and open drain cleaning,, construction of improved canals and mesqas, construction of a buried pipeline system and experimentation with alternative systems of marwa and mesqa lining. A considerable effort was also devoted to planning the irrigation management of the buried pipeline system and raised mesqas which are now under construction. Routine work continued regarding evaluation of on-farm irrigation systems, collection and analysis of farm record data, collection and analysis of water budget data and collection of sociological data through visits to farmers. Agronomists continued to work on development of crop calendars and the use of crop calendars in analyzing water requirements for specified areas in EWUP field sites. A study of groundwater characteristics was conducted at Beni Magdul. The pumping test data are being analyzed at Colorado State University.

A major Project effort during the third quarter, 1982 consisted of staff training at Kafr el-Sheikh. Twenty one junior employees of the Ministry of Irrigation (MOI) were provided extensive training in on-farm water management by an all Egyptian training team. This is a culmination of five years of training in which a major objective was to develop an Egyptian training staff. According to evaluations made by the trainees, the work of the Egyptian trainers is judged to be superior.

The construction of the buried pipeline has been delayed. Negotiations between the Ministry of Irrigation and the Petro Jet Company are underway to determine if the contract should be terminated. At the present time, Petro Jet Company has let a subcontract to Arab Contractors Company to dewater the areas where pump houses are to be constructed. The dewatering equipment has been installed but Petro Jet has not moved to begin the construction of the pump houses.

The construction work to straighten, establish the design cross section and raise the banks of Abyuba Canal is on schedule and completion is expected

to be in January 1983. The Project is moving ahead with the modification of mesqas at that site so that the entire area of nearly 1,200 feddans can benefit from the increased head available from the new system.

A joint meeting of the Egyptian based Project Advisory Committee and campus based Policy and Coordinating Committee was held in Fort Collins, September 13 - 17. The joint committee recommended giving strong emphasis to economic feasibility studies of proposed irrigation management interventions. Other recommendations included assigning a high priority to mesqa and marwa lining research, a soil fertility testing facility for Egypt, a national workshop on irrigation water management and an international conference on irrigation water management. The joint committee meeting agenda, attendees, pilot program accomplishments and report "Irrigation Water Management Improvement in Egypt" by Thomas W. Ley and E. V. Richardson are included in the appendix.

An evaluation of the Salt River Project (SRP)- Ministry of Irrigation (MOI) exchange program was conducted at Phoenix, Arizona just preceeding the joint meeting in Fort Collins. Both sides have been pleased with the exchange and feel that the benefits are substantial. At the present time, two SRP engineers are in Egypt and two MOI engineers are in Phoenix.

In general, task groups and pilot program groups are progressing according to plans. The only major exception is the El Hammami Pilot Program which is delayed due to poor performance by the contractor.

Meetings and field visit exchanges were held with the Egypt Major Cereals Improvement Project (EMCIP) and the Agricultural Mechanization Project (AMP) during the quarter. These projects, in the Ministry of Agriculture, have both used EWUP findings to facilitate their work with Egyptian farmers. Both projects have also expressed interest in working on EWUP sites for mutual promotion of each project's objectives.

Arbitrary application of regulations by the Egyptian Customs Department have caused continued problems. An air freight shipment containing desk calculators, paper for water level recording instruments and other equipment and supplies has been detained at the airport since March. Release of recent shipments of other equipment vitally needed to complete Project research reports, has also been held up. Meanwhile, the Customs Department charges storage for these shipments. Continued efforts are being made through USAID and the Government of Egypt to resolve this problem.

Project work is now organized among six pilot program groups and nine active task groups.

Pilot Programs

Kafr el-Sheikh Site:	Manshiya Mesqa
	Hammad Mesqa
El-Mansuriya Site:	El-Hammami Pipeline
	Mesqa 10 Raised Channel
El Minya Site:	Abu Ma Canal Raised Channel
	Mesqa 26 Raised Channel

Task Groups

TG 1	On-Farm Irrigation
TG 2	Water Distribution Systems
TG 3	Farmer Organization
TG 4	Farm Management and Planning
TG 5	Water Budget
TG 6	Land Leveling
TG 8	Soil Characterization
TG 10	Conjunctive Use of Water
TG 11	Irrigation Advisory Service

Task groups 7 and 9, Soil Fertility and Pest Control respectively, have completed their objectives and have been terminated.

A detailed report of each pilot program and task group follows.

EL-MANSURIYA

The pilot programs of Mansuriya include the elevation of mesqa 10, forming a lined concrete structure and construction of a buried pipeline replacing the El-Hammami Canal.

The objectives of installing these structures are basically to:

1. Deliver proper quantities of water to all farmers served by the system.
2. Reduce the conveyance losses which now occur.
3. Deliver water to farmers with sufficient head to allow for faster irrigations by gravity.
4. Eliminate the need for lifting water.

I. Accomplishments and Future Plans for the El-Hammami Pipeline Pilot Program are as follows:

1. Although construction has been slow, the following work has been accomplished as of October 12th:

	Unit	Total number to be installed	Total number actually installed	
		No.	No.	Percent
Pipes with diameter, 60 cm	meter	3084	2296	75
Pipe with diameter, 50 cm	meter	1667	1224	73
Horizontal pipes, 25 cm	Unit	768	176	2P
Vertical Pipes, 25 cm	Unit	-	-	-
Elbow pipes	Unit	54	8	12.5
T connection pipes	Unit	64	37	58

All past concrete work on the gate stands was rejected. New work is not started on these stands yet. By mid October it is planned that new work will begin. A contract was let to Osman Ahmed Osman Company by Petro Jet Company to do the dewatering of the soil for both of the pump stands. See I & IV on map (Fig. 1. It will be the responsibility of Petro Jet to be ready and construct the pump house as the area is dewatered.

According to the work schedule for the pipeline, the contractor is behind schedule on all counts. It is impossible that the completion date will be November 1982.

Problems have occurred in water delivery to farmers during construction. This has had deliterious effects on relationships

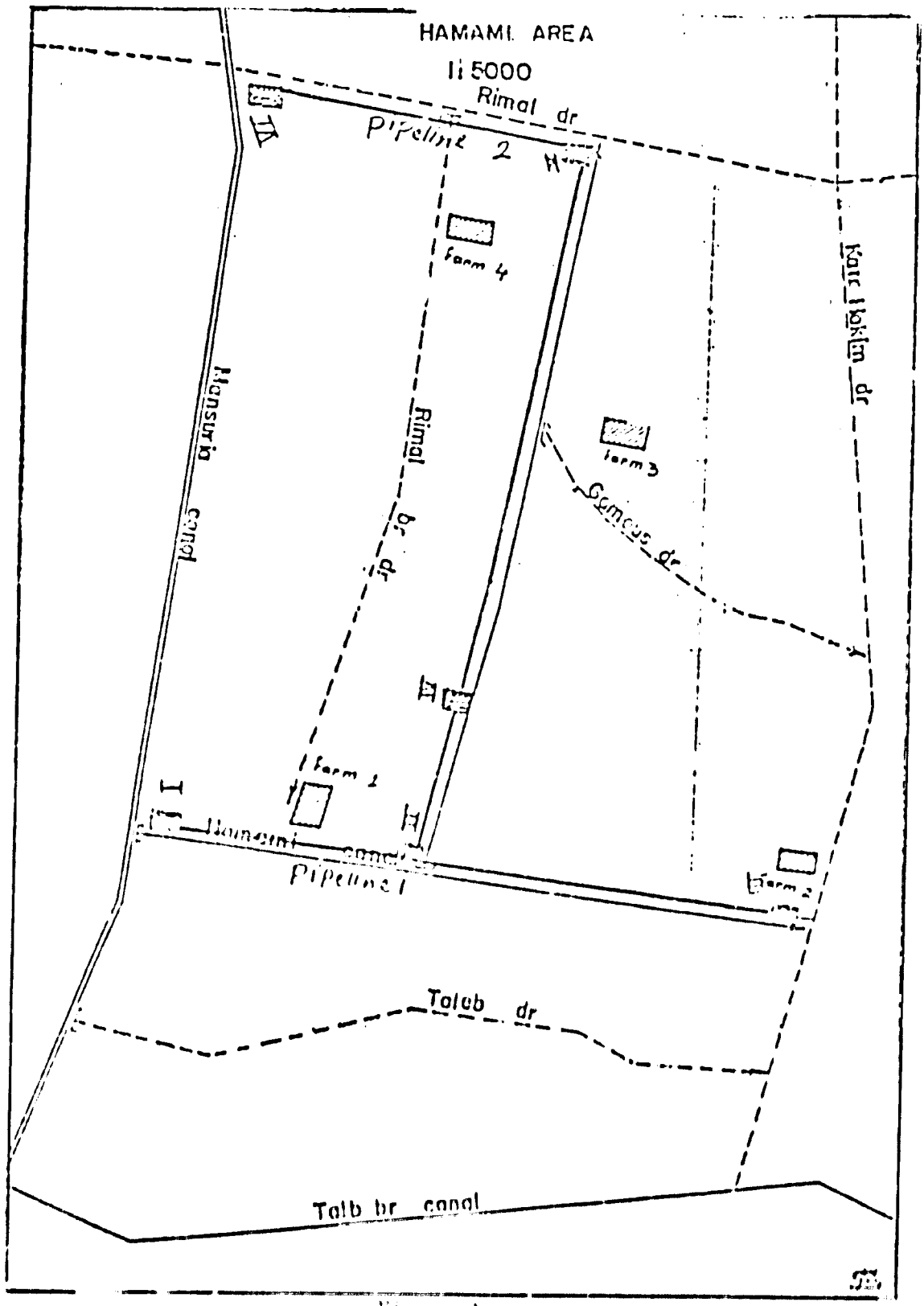
HAMAMI AREA
1:5000
Rimal dr
Pipeline 2
Farm 4
Kaic Hakim dr
Mansuria canal
Rimal dr
Farm 3
Samous dr
Farm 1
Mansuria canal
Pipeline 1
Farm 2
Taleb dr
Talb br canal

Figure 1

Figure 2. Work Schedule for El Hammami Pipeline

REVISION :
DATE :
SHEET : OF

between EWUP and the farmers. Weekly meetings are being held with the contractor to push the work. Attendance at these meetings by the contractor has been less than satisfactory.

2. On-farm water management data are being collected on several sites. This will continue in the next quarter.
3. The farm record data are being collected on thirteen sites in the area and will continue. Several new crop interprise cost studies have been completed with others following the next quarter.
4. Selected water budget data are being collected and will continue, as well as water quality data.
5. Various plans of operation for the pipeline are being developed and discussed. A complete plan of operation will be finalized in the next quarter.

II. Accomplishments and Future Plans for Beni Magdul, Mesqa 10, Pilot Programs are as follows:

1. OFWM data continues to be collected.
2. During the past quarter the Beni Magdul canal was cleaned by EWUP. This has greatly helped alleviate the problem of water shortages at the pump site of mesqa 10.

   Arrangements have been made to use the well at the end of mesqa 10 to supplement water supply during critical times. In addition, the old mesqa has been converted into a field drain with a depth of 1.10 meters. A head gate was installed on the old mesqa at Beni Magdul canal. This will be opened only in case of emergency if the pump system fails to provide water in the raised mesqa.

III. Special Studies:

1. The water budget is being continued in the Beni Magdul area. Full details are reported by the water budget task group.
2. The cropping sequence studies are continuing in both areas.
3. OFWM reports on birsim and corn will be completed next quarter.

IV. Two papers released this quarter are:

1. Sociological survey and Engineering experiences on mesqa 6 Beni Magdul Canal, Mansuriya District, Egypt. OWP #29
2. Summary of the Farmer Organization and On-Farm Water Management Data for mesqa 10, Beni Magdul Canal. OWP #28

V. We anticipate the following reports to be released in the next quarter:

1. Birsim irrigation and production on mesqa 6, Beni Magdul 1981-82.
2. Basic engineering data for raised mesqas and lined canals and pipeline construction concepts.

MANSURIYA FIELD STAFF

PROFESSIONAL

Dr. Mona El Kady	Team Leader	Bill Braunworth	Assistant Team Leader
Eng. Eldon Hanson	(one half time)	Moheb Semaika (one third time)	Agronomist
Wadie Fahim	Engineer	Farouk Abdel Al	Sociologist
Shinnawy A. Atty	Economist	Mohamed Naguib	Sociologist
Ahmed Tahoon	Agronomist	Sabah Mahmoud	Agronomist
Gamal Fawzy*	Economist	Mahmoud Khedr	Agronomist
Tarik Abdel Rahman	Agronomist	Tarif Zeiton	Engineer

NON-PROFESSIONAL

Badry Mahoud	S. Tech.	Hamdy El Said	S. Tech.
Ibrahim Hussein	S. Tech.	Gamal Ahmed	S. Tech.
Rokaya Abdel Mowla	Secretary	Ibrahim Abdou	S. Tech.
El Said Kamal	S. Tech.	Ibrahim Zakaria	S. Tech.
Moustafa Mahmoud	S. Tech.	Said Rezk	S. Tech.
Mohamed Abdel Hamid	S. Tech.	Abdalla Abdel Moniem	S. Tech.
El Said Hamed	S. Tech.	Ibrahim Abdel Fattah	S. Tech.
Mohamed Farrag	S. Tech.	Mohamed El Dash	S. Tech.
Mohamed Shaaban	J. Tech.	Esmail El Shimi	J. Tech.
Abdel Rahman Eid	J. Tech.	Abdel Renim Mohamed	J. Tech.
Shawky El Awad	J. Tech. Lab.	Abdel Maaboud Ibrahim	J. Tech
Selim El Tantawy	J. Tech.	Farahat El Ashkar	J. Tech. Lab.
Fathy Abdel Nasr	J. Tech. Lab.	Hamed Aly Tahoon	J. Tech. Lab.
Ahmed Ragab	J. Tech. Lab.	El Shimi Ismail	J. Tech. Lab.

DRIVERS

Yehya Abdel Sallam	Mohamed Rezk
Rashad Abou Bakr	Mohamed Khalil
Salah Sadek	

*on training leave for nine months at Colorado State University

KAFR EL-SHEIKH

I. Summary of Progress

During the third quarter of 1982, work at the Kafr el-Sheikh EWUP site focused on activities as described below.

1. Summary Report for Winter 1981-1982 on Farm Pilot Work

A report was prepared covering engineering, agronomic, economic, and sociological impact of on-farm pilot work during the 1981-1982 winter cropping season. Included in the program were a total of four saqia units on the Hammad and Manshia mesqas. High irrigation efficiencies were obtained by use of improved marwas and long level borders and furrows. Average yield values for the main winter crops of wheat and sugar beets were higher than on non-pilot farms. Farmers were generally pleased with the pilot program.

2. Marwa Lining Report

During the winter season, marwas were improved by lining by plastic sheets at two sites and by use of flatted plastic pipe at one site. Results were summarized into a marwa lining report which was attached as an appendix to the winter report.

Marwa improvement by the plastic lining and by the flatted plastic pipe virtually eliminated conveyance losses at the sites. Secondary benefits included time saving, increased yield near the marwa, lowering of the water table by the marwa, and increased cropped area. Disadvantages included high cost, susceptibility to damage, and in the case of the flatted pipe, need for high management skills.

3. Summer Season 1982 Pilot Program Implementation

The Kafr el-Sheikh EWUP team implemented the pilot program on 37 feddans of cotton, rice, and corn during the summer season 1982. Land was leveled during the second quarter 1982. Routine data collection during the third quarter included surface water measurement of water lifted and applied and soil-water measurement of water stored and depleted. Cylinder infiltration tests were conducted during first border irrigation for rice and blocked furrow infiltration tests were carried out before furrow

irrigation for cotton and corn. A few furrow advance-recession tests were conducted in conjunction with the blocked furrow infiltration tests. Soil salinity samples were taken at mid-season for the three crops and weekly water table salinity samples were taken from observation wells. The economists continued their farm records work.

4. Manshia Lake

The Manshia mesqa near Manshia village has deteriorated until its cross section resembles a lake. This long standing situation was identified as a problem requiring solution during the 1978-79 EWUP Problem Identification work. During the past quarter the Manshia team's sociologist and engineer worked with the farmers to attempt to improve the cross section of the Manshia mesqa. The 6 farmers who own the land now occupied by the lake showed interested in the work. An agreement was reached that Ministry of Irrigation would provide the soil and EWUP would provide the tractor, the driver, and an engineer. In return the farmers agreed to provide a trailer and the labor for the earth moving.

Since these discussions we have been waiting for the farmers to bring the money for renting a trailer. Further work concerning Manshia lake has been postponed until our sociologist returns from the training tour in the United States.

5. Water Budget Activities

The routine work of the water budget including water stage recorder charts on canals and drains, water table depth monitoring, and salinity of canals and drains continued during the quarter. In addition, the study of times that farmers prefer to irrigate was continued. On the Om Sen mesqa, observations were made of how many saqias were turning at each hour of the day and night in both on and off periods of the canal.

The results of the saqia study along with other data are to be used in making recommendations concerning the water delivery system of the Dagalt Canal. During September the water budget group met with the District Engineer Abd El Alim Gasha to discuss control of water on Omsen mesqa and Dagalt Canal as a whole. It was agreed to put a gate on the flume and pipe at

Omsen and that the EWUP team would give recommendations to the District Engineer concerning how to match water supply with water demand on the entire Dagalt Canal.

6. Winter 1982-1983 Site Selection

The team made several field tours to select sites for the coming winter season. Selection criteria include accessibility for land leveling and farmers willingness to accept the entire pilot program package. Also we will not do land leveling after rice so that sites will follow cotton or corn. A number of site possibilities were identified and discussions are continuing with farmers.

II. Work Plans For the Next Two Quarters

1. Final selection for winter 1982-1983 pilot sites will take place and the pilot program will be implemented on these sites.
2. A comprehensive summary report for the summer 1982 on-farm pilot work will be written.
3. Efforts will continue for solving the Manshia lake problem.
4. Routine data collection will continue for the water budget. A plan for control of water entering Omsen mesqa will be completed and implemented.
5. Work will continue with marwa improvement alternatives. Better quality plastic sheets will be tested. Other possibilities for marwa improvement such as metal gated pipe will be considered.
6. Preparations for the summer season 1983 pilot program work will be carried out including site selection and initiation of land leveling.

III. Personnel Activities

Professional Staff

1.	Eng. Kamal Ezz El Din	Team Leader
2.	Eng. Kenneth E. Litwiller	Assistant Team Leader
3.	Eng. Abdel Fattah Metawie	Water Budget/Team Leader
4.	Eng. Safwat Fahmy	Hamrad Group
5.	Agr. Mamdy Awad[illegible]	Hamrad Group
6.	Eng. Ahmed El Attar	Hamrad Group
7.	Eng. Mamdy Badawi	Hamrad Group

Professional Staff (Continued)

8.	Agr. Ahmed Ismail	Hammad Group
9.	Agr. Hoda Hussein Abdel Latif	Hammad Group
10.	Eco. Ragy Darwish	Hammad Group
11.	Eng. Saad Hussein Zaki	El Manshia Group
12.	Agr. Mahmoud Mohamed Said[3/]	El Manshia Group
13.	Agr. Mohamed Ibrahim Meleha	El Manshia Group
14.	Eco. Sochi Ahmed Elewa[2/]	El Manshia Group
15.	Soc. Sohair Kamal Yousef	El Manshia Group
16.	Eng. Amany El Kayal[4/]	El Manshia Group

Technicians

1.	Mohamed Ahmed Badr	Hammad Group
2.	Mohamed Omer Abdel Maqeed	Hammad Group
3.	Kamal Mohamed Abo Omer	Hammad Group
4.	Helal Mohamed Hussein	Hammad Group
5.	Abdel Aziz Osman El Yamany	Hammad Group
6.	Ragab Mohamed Shanab	Hammad Group
7.	Abdou Mostafa Kamel	Hammad Group
8.	Mohed Abdel Samad E. Sawey	El Manshia Group
9.	El Said Abdel Holy Abdel Hamid	El Manshia Group
10.	Ahmed Abdel Hamid Ali	El Manshia Group
11.	Magdy Abdel Hamid	El Manshia Group
12.	El Said Al Sayyid Helal	El Manshia Group
13.	Salah El Sayed Abdel Hafeez	El Manshia Group
14.	Abdel Hamid Attia Saif	El Manshia Group
15.	Ramadan Gazal	Water Budget
16.	El Said Abdel Salam El Barbari	Water Budget
17.	Sabri Mostafa Tawa	Water Budget

1/ Farm Machinery

2/ Sociologist

3/ Laboratory

4/ On Training Leave for Entire Period

Technicians (Continued)

18.	Atef Hamed Sayed Ahmed	Laboratory
19.	Hanaa Ali Said	Laboratory
20.	Alaa Fatoh Ibrahim	Equipment & Cars
21.	Abdel Hamid Said	Equipment & Cars

Secretaries and Administrative

1.	Mohamed Abo Omer	Administrative Assistant
2.	Nadia Mahmoud Arafa	Secretary

Drivers

1.	Asel Ahmed Abdel Aziz	
2.	Mohasen Abdel Razek Saad	(July only)
3.	Attia Mostafa Abdo	(Tractor)
4.	Abdel Ghafar El Sanafawy	(July only)
5.	Osama Mohamed Sobh	(August & September only)
6.	Kamal Saleh Talha	(September only)

Laborers

1.	Saber Ahmed Ismail	Water Budget
2.	Abrahim Gaid Ahmed	Hammad Group
3.	Abdel Raouf Mazal	Manshia Group
4.	Mohamed Mostafa Omar	Laboratory
5.	Osman Abdel RAsool	Training Center
6.	Ahmed Mostafa Barka	Office
7.	Ibrahim Mohamed El Besawy	Office

Guards

1.	El Sayed Ahmed El Felawi	Training Center
2.	Mohamed Mahmoud El Mashaly	Training Center
3.	Mostafa Bassulal El Gamal	K.S. Office Stores

IV. Training Status and Changes

1. Engineer Amany El Kayal is continuing a Master's degree progra at Utah State University under the peace fellowship program.
2. Agronomist Ahmed Ismail returned from long term academic trainin at Colorado State University in July.
3. Economist Ragy Darwish received his master's degree from th International Center for Mediterranean Advanced Agronomic Studie at the Institute of Bari, Italy, and returned to Kafr el-Sheik in mid August.
4. Engineer Kamal Ezz El Din, Agronomist Magdy Mohamed Awad, an Sociologist Ahmed El Said El Attar left to Colorado Stat University in August for two semesters of training.
5. Engineer Safaa Fahmy, Engineer Saad Hussein Zaki, Sociologist Sohair Kamal Yousef, and Economist Magdy Badawi participated i the EWUP summer training program in Kafr el-Sheikh from August 1 until September 15. After the training they left for a fiel trip in the southwestern part of the United States fro September 22 until October 16.
6. Engineer Abd El Fattah Metawie and Agronomist Mahmoud Mohamed Said participated in the EWUP summer training program as trainers from August 1 until September 25. After the training Engineer Metawie took over responsibilities as Kafr El-Sheikh EWUP Team Leader.
7. Agronomist Hoda Hussein Abdel Latif joined the Kafr el-Sheikh team on 15 September.

EL MINYA

I. Summary of Accomplishments

During the third quarter of 1982 work at El Minya continued to emphasize canal and mesqa improvement.

A. Abucha Canal Pilot Program

1. In July the contractor brought white stones and placed them along the canal in locations which require pitching. He transferred soil from Mohelt Drain to the left bank of the

canal, cleaned the lower reach of the canal and delivered reinforced concrete pipe to the site for use in constructing vents.

2. Soil placed on the left bank was sprayed with water and compacted with a sheeps foot packer.
3. Pitching was placed along the banks at the inlets of mesqas 22 and 28, at the bend, location kilo 2, and along the first reach of the canal from the inlet at Ibrahimiya Canal to location kilo .42.
4. The inlet to mesqa 1 was constructed.
5. The Vice Minister of Irrigation Engineer Ismail Badawy and the Directors visited the field site on August 19 and observed the construction. The Vice Minister talked to farmers at mesqas 7 and 26 regarding the management of the new irrigation system. He discussed water measurement with Project Technicians.
6. Dr. Hassan Wanby discussed the plans for a new regulator at kilo 2 on the Abyuha Canal with the Undersecretary of State for Irrigation at Minya. He also discussed modification of the tail escape.
7. Surveys of all mesqas were completed in preparation for making designs for mesqa modification.
8. Engineer Bayoumi assisted us with final modifications of the iron gates being manufactured for installation at the head of each mesqa.
9. Arrangements were made with the Irrigation Department to install a main gate at the Abyuha Canal inlet during the winter closure.
10. Improvement of mesqas progressed as follows:
    a. Unit 4 includes an area served by mesqas 7, 9 and 11. The land between these mesqas was plowed and leveled so that the farmers can irrigate from mesqas 7 and 11 without any need for mesqa 9. A road was constructed in place of mesqa 9. A meeting was held with farmers of mesqa 11 to discuss plans for its improvement.

b. Mesqa leaders have been selected for each of 30 mesqas. Meetings of these leaders have been held under the direction of Dr. Layton, main office sociologist, to discuss the plans for improving Abyuha Canal and each of its mesqas. The responsibility of farmers in managing the new system was also discussed.

c. Mesqa 7 was cleaned by the farmers. They have started to use canvas dams to help establish necessary head and adequate flow for gravity irrigation. Arrangements were discussed with authorities regarding how to install the vent without disturbing an existing domestic water line. Discussions are continuing.

B. Mesqa 26 Pilot Program

The farmers worked together through their organization very well during the past quarter. Irrigation scheduling is improving and the farmers are pleased to be relieved from lifting water from the mesqa to their fields. Careful measurements of water entering the mesqa were continued. Three farmers producing corn and soybeans were selected for intensive study. On each farm soil moisture was measured before and after irrigation. Water application was measured and crop yields were measured at harvest time.

C. Routine Work

1. Water budget measurements of observation wells and drainage were continued according to plans.
2. Precision land leveling was accomplished on 120 feddans for farmers interested in establishing improved irrigation systems.
3. The EWUP Technical Director and members of the Egypt Major Cereals Improvement Project visited the field site to observe our work in land leveling and irrigation improvement. Cooperation between the two projects was discussed.

II. Plans for Next Quarter

A. Abyuha Canal Pilot Program

1. Complete construction of Abyuha Canal banks.
2. Install main inlet, check structure and spillway.
3. Complete unit 4 as a demonstration area.
4. Continue mesqa improvement planning.

5. Continue land leveling with cooperation of EMCIP if possible.
6. Meet with farmers to continue the development of cooperation, assistance and communications.

B. Mesqa 26 Pilot Program

Continue assistance with mesqa management.

III. PERSONNEL

Professionals

1. Abd El Raouf Hassan (Eng.) Team Leader
2. Dr. Erwin Nielsen (Agr. Eng.) Assistant Team Leader
3. Tim Gates (Eng.) One Half Time
4. Soc. Abd Alla Saber
5. Soc. Farouk Hassanin
6. Agr. Mohamed Awad
7. Eng. Ahmed Abd El Naim
8. Eco. Nabil Farag
9. Eng. Esmat Wafik
10. Econ. Elia Soriel

Technicians

1. Eman Ebid
2. Nashat Youssis
3. Mahmoud Nenan
4. Bekit Nazer
5. Mohy Yehya
6. Mohamed Alla

Drivers

1. Kalaf Mohamed Kalaf
2. Farouk Hassan
3. Mohamed Esawy

Laborers

1. Kalat Saad
2. Kamel Ahmed
3. Hamid Said
4. Said Abd El Fatah

Training Status

Engineer Esmat Wafik and Economist Elia Soriel finished two semesters of training at Colorado State University and returned to the Project late in August.

Economist Nabil Farag and Sociologist Farouk Hassanien completed the summer training in Kafr el-Sheikh and went to the U.S. for a field trip. They returned October 16th.

TASK GROUP 1 ON-FARM WATER MANAGEMENT

Objectives

1. The development of criteria for the proper frequency and amount of irrigation and the development of an acceptable procedure for implementing the criteria in the pilot areas.
2. The impact of various on-farm water management practices on soil properties, water table, and crop production.
3. The cost and benefits associated with the changes in delivery system for selected sites.
4. The sociological changes brought about by the various changes in marwa delivery systems and on-farm water management practices.
5. The on-farm water management practice of long-furrows and/or borders as compared to conventional basins.

Work Completed During the Quarter

1. A report on the "Design of Level Furrows and Border by Programmable Calculator" (Draft Working Paper No. 95) was completed by Kamal Ezz El-Din and Kenneth Litwiller. This report presents the design procedure and calculator programs for level furrow and/or border irrigation system design.

   The advantages of using calculator programs in irrigation system design include time saving, minimization of calculation errors, and facilitation of field computations. Alternative designs can also be evaluated in a reasonable time period.

   Level furrow and/or border irrigation systems, designed and constructed by the EWUP Kafr el-Sheikh team using the proposed procedures have yielded favorable results despite variations in available discharge, intake families, and retardance coefficients.
2. A report on "Summary of the Farmers Organization and On-Farm Water Management Data for Mesqa 10, Beni Magdul Canal, Manouiya District, Egypt" (Draft Working Paper No. 98) was completed by A. Lahoon, Farouk Abdel Al, W. S. Braunworth. The report includes information on the farmer organization, irrigation scheduling, crop survey, crop

calendars, and on-farm water management. Surveys of plots for land leveling and bulk density measurement are also included for a few selected field sites.

In Summary, the report concludes (1) that EWUP has succeeded in developing a functioning farmer organization unit; (2) the complexity of the farming system illustrated in the crop calendars and crop surveys, requires intensive management; (3) the two study cases of on-farm water management indicate that farmers control the water well.

3. A report on "Sociological Survey & Engineering Experiences on Mesqa 6, Beni Magdul Canal, Mansuriya District, Egypt" (Draft Working Paper No. 99) was completed by Mona El-Kady, Farouk Abdel Al, Wadie Fahim, W. S. Braunworth.

   This report presents the results of the sociological survey conducted on Mesqa 6 along with a discussion of proposed changes. Based on the proposed changes, irrigation schedules were developed for several winter and summer months.

4. A report on "Kafr el-Sheikh, Farm Management Survey, Crops Enterprise Budgets and Profitability Analysis" (Project Technical Report No. 11) was completed by Mohamed Haider and Farouk Abdel Al. This report presents the results of the farm management survey conducted at Kafr el-Sheikh. Crop enterprise budgets and a preliminary profitability analysis for crops produced in the area were developed from the survey data.

   Based on the net income analysis, sugarbeets are the most profitable winter crop and maize the most profitable summer crop, however, only 3 percent of the farm area was planted to sugarbeets and 11 percent of the farm area was planted to maize.

Work In Process

1. A draft of a report on "The Influence of Land Leveling on Irrigation Efficiency and Management of Irrigation" has been completed by Elton Hanson, et. al. The report delineates the aspects of long border and/or furrow systems, focusing on the impacts to improved irrigation water management, irrigation efficiencies and crop yields.

2. A draft of a report on "Mesqa 10, Farm Management Survey" by Martelli, et. al. is being revised. This report presents the results of the farm management survey on Mesqa 10.

Plans for Next Quarter

1. Water use efficiencies and water table positions will continue to be evaluated.
2. Continue the evaluation of long-furrow and/or basin irrigation data. Maher, Hanson, and Martella.
3. The report on the influence of land leveling on irrigation efficiency and management of irrigation will be completed by Hanson, et.al.
4. The report on the criteria for determining irrigation frequency requirements will be completed by Hanson, Saleh and Nadia.
5. Work on data base books for pilot areas will focus on completing the farm record summary and analysis reports for each site which will fulfill the data base requirements are being drafted by the site economists supported by main office staff.
6. A cost study on the Abyuda system will be completed by Farouk and Martella on completion of construction.
7. A report on the impact of on-farm water management on soil properties, water table level and crop production will be completed by Taher, Assia and Saleh.
8. Plans for the 2nd phase of the farm management surveys will be developed by Farouk and Martella.

Future Work Involving TDY Personnel

1. Evaluation of criteria for determining irrigation frequency and requirements - John Wolfe (January 15 to March 31, 1983).
2. Evaluation of long-furrow and/or basins as compared to small basins irrigation - Tom Ley (December 27, 1982 to February 3, 1983).

Personnel Presently Assigned to the Task Group

Maher, Martella, Hanson, Taher, Assia, Saleh, Farouk, Sallam, Nadia.

TASK GROUP 2 - WATER DISTRIBUTION SYSTEMS

Objectives

1. Prepare and evaluate procedures for designing gravity distribution systems through canals and mesqas. Along with hydraulic principles consider aspects of minimum and maximum stream sizes required at the field inlet, and delivery by continuous flow, rotation, and demand schedules for peak demands and period of reduced demands.
2. Organize and evaluate operation and scheduling procedures for the El Hammami pipeline.
3. Describe how farmers are organized around their present distribution systems and analyze how different types of farmer organizations may be established in response to changes in these distribution systems.
4. Measure and evaluate seepage losses in the El Hammami Canal and in improved mesqas (lined and/or elevated) and other selected mesqas. Evaluate the effect of the improvements on seepage losses.
5. Using data obtained in seepage tests, evaluate the aspects of mesqa maintenance with respect to the efficiency of water delivery.

Work Completed During the Quarter

1. Continuous vs. rotational flow: no additional comment -
2. Lift vs. gravity: no additional information -
3. Recommendations on rotation modifications
   a. Contained in technical report on rice, currently being completed.
   b. Additional recommendation upon completion of irrigation gap analysis.
4. Information about lining of canals and mesqas is contained in a draft of conceptual ideas for design and operation of irrigation systems. It is the initial base for one of the task group final reports.
5. El Hammami Pipelines: Four different procedures for operating and scheduling the pipelines have been developed to be considered as alternatives to the initial plan of operations prepared last quarter.
   a. Valve control. Valves are opened to deliver a predetermined flow rate, usually 60 liters per second per valve for a total of 360 liters per second which equals the design capacity of each set of pumps.

b. Time control. A sufficient number of valves are fully opened to delivery 360 liters per second through a pipeline. Each valve will remain open until the required volume of water has been delivered for the area to be served.

c. Orifice control. Risers to alfalfa valve are fitted with orifices which will permit adjacent valves serving successive one-fourths of the area to flow 12 hours to deliver the amount of water required for a four-days frequency.

d. Random operation. Any six valves are opened at one time. Flow continues through a valve until a sufficient volume of water has been delivered.

6. Abyuha Canal: Construction work is continuing and progressing well despite requirements of having to work during off periods with dammed sections from which water has been removed by pumping.

Plans have been completed for installation of pipe vents and construction of headwalls. Final design for headwalls has been prepared. Several headgates that have been made had minor deficiencies which have been corrected.

7. Computer Method: A comprehensive computer program has been organized by W. O. Ree and T. K. Cates for analyzing the hydraulics of flow in pipeline with alfalfa valves. This program was used by them to develop and evaluate the alternative methods for operating the El-Hammami system.

8. Future Plans: Canal construction will continue with completion estimated to be in early 1983. The installation of all vents is expected to be completed next quarter.

Mesqa 9 will be replaced by a road during next quarter.

Mesqa 11 improvements for gravity irrigation will commence next quarter.

Personnel Presently Assigned to Task Group 2

Gamal Ayad, Eldon Hanson, Ahmed Maher, Tim Cates, Dick Tinsley, and Jim Layton.

TASK GROUP 3 - FARMER ORGANIZATION

Objectives

1. To define the purpose and nature of a farmer organization.
2. To examine the existing organizational capabilities of the farmers.
3. To develop and analyze strategies for the implementation of specific farmers organizations.
4. To analyze the procedures and administrative structure encompassing the farmer organizations at the specific field sites.

Work Completed During the Quarter

The tasks of Task Group 3 involve three major forms of activity:

1. The actual development and sustaining of various farmer organizations,
2. the documentation of this process, and
3. the documentation of the existing situation of which the organization is part.

Activity 1 is designed to accomplish objective 3 while activity 2 is designed to complete objective 4. Activity 3 is matched with objectives 1 and 2.

Developing and Sustaining Farmer Organization

1. Minya - Mesqa 26:

   During this quarter the administration of the scheduling, and the cleaning and maintenance of the mesqa was performed by the farmers themselves. Project personnel informed the mesqa leadership of the on-period times, and the scheduling format was set up by the mesqa leadership. The routine for scheduling irrigation and the cleaning and maintenance program have become routinized in the farmers schedule.

2. Minya-Abyuna Canal:

   Further discussions with the farmers leadership of the various mesqas concerning the work on the canal will proceed in coordination with the physical work schedule.

3. Minya - Unit Area 4:

   A farmer organization has been established on mesqa 7, but there has been no scheduling pattern set up by EMUP. An informal scheduling system has been established by the farmers through the leadership group.

The leadership for mesqa 11 has been selected and has had discussions with EWUP concerning the work in the Unit Area. The leadership for both of the mesqas has been involved in the work for establishing a road in place of mesqa 9.

4. Mansuriya - Mesqa 10:

   The farmers have had an organizational framework established and periodic meetings with the leadership, and others, have been held. The organization has been contacted concerning the number of problems associated with the new mesqa. Scheduling along the mesqa has been a focus of activity for the farmers.

5. Mansuriya - El-Hammami:

   The work with the farmers is commensurate with the status of the pipeline itself.

6. Kafr El-Sheikh:

   The farmer organizations set up along the Om Sen, Manshia, and Hamad mesqas were developed for the specific job of cleaning their respective mesqas. Contacts are being made with the Manshia farmers concerning the Manshia "Lake" problem.

Documentation of Farmer Organization Work

The documentation of the organizational work will follow the six major procedural steps in organization farmers:

1. identifying the local leadership,
2. contacting that leadership,
3. contacting the farmer,
4. establishing the organization,
5. sustaining the organization,
6. evaluating the organization.

All documentation will result from interviews and observation studies.

1. Accumulated leadership studies (complete for mesqa 10, Mansuriya; 28 of the 30 mesqas in Minya; Om Sen Canal, Hamed Canal, Manshia Canal (KFS).
2. Contacting leadership [illegible] as 1. Also a special contact with the general [illegible] Canal leadership)
3. Contacting farmers [illegible] as 1 except for Minya it is only with mesqa 26 and Unit Area 4A).

4. Establishing the organization:
   - Creating the structure of the organization (complete Mesqa 26 Unit Area 4A, Om Sen, Hamed, Manshia, Mesqa 10).
   - Naming the personnel for the organization (complete Mesqa 26 Unit Area 4A, Om Sen, Hamed, Manshia, Mesqa 10).
   - Establishing working procedures for the organization (complete Mesqa 26, Mesqa 10, Om Sen, Hamed, Manshia).
5. Sustaining the organization:
   - EWUP interaction (in process for all areas). Documenting how EWUP works with the farmers in the particular organization.
6. Evaluating the organization (to be accomplished in future).
   - Achieving its stated goals. (Initial evaluation of Mesqa 26 completed and Kafr El-Sheikh).
   - Performance under the existing structure, (Initial evaluation of Mesqa 26 completed and Kafr El-Sheikh).
   - Performance under the existing procedures. (Initial evaluation of Mesqa 26 completed and Kafr El-Sheikh).

Documentation of the Existing Situation

Efforts for this topic are focused on looking at how the farmers presently work together for particular practices and how other organizations (i.e., the Cooperative and [illegible]) affect the farmers' activities.

The major source of this documentation as of now is the system of farmers contact records which [illegible] how the farmers are reacting to various project activities. Included in these records is information about activities of the organizations.

Future Tasks

The tasks being worked on now and for the next quarter will follow the past quarter's work. Present organizations established will be studied as to how they are sustained and evaluated, while other organizations which need to be established will be created. Again, documentation of these organizational efforts [illegible] previously presented will be of top priority.

Developing [illegible] Organization

1. Mesqa
   - [illegible] the Mesqa 26 organization more functional as an organizational entity.

- Work on developing the farmer organization on Unit Area 4A with regard to the activity in the unit.
- Initiate work on establishing a canal-wide organization this fall.

2. Mansuriya
   - Work to make mesqa 10 scheduling a viable program through farmer cooperation. This depends on the situation of mesqa 10.
   - Work to develop farmer organization for the Hammami pipeline.
3. Kafr El-Sheikh
   - Complete the report on the farmer perceptions of the delivery system program.

Documentation of Farmer Organization Work

Work on completing the outline for establishing farmer organizations. TV Program is being prepared for use in establishing farmer organization.

Documentation of Existing Situation

Continue to develop a program to obtain data on criteria necessary for the establishment and the sustaining of farmer organizations.

Administration

The names of the personnel presently assigned to Task Group 3 are as follows:

Jim Layton - Coordinator, Farouk Abdel Al, and Eldon Hanson.

TDY support - Dr. Frank Santopolo. Dr. George Radosevich will come in Fall, 1983 and Dr. Dave Rogers will work for the task group in Winter, 1984.

TASK GROUP 4 - FARM MANAGEMENT AND PLANNING

Objectives

Farm Management and planning task group objectives are to evaluate alternative farming systems on Egyptian farms, to evaluate current agronomic practices as contrasted to recommended practices, and to evaluate the farmers' ability to implement improved agronomic practices.

Activities Completed During Past Quarter

Regarding the accessibility of farm land (event #2), the reports for the three sites have been completed and will be turned over to the Editor for publication as draft working papers.

A draft on crop calendar analysis at Kafr El-Sheikh and Beni Magdul has been prepared.

A draft working paper on opportunity time for crop production is still on hold, awaiting completion of the crop calendar from which it is derived.

A draft working paper on Enterprise cost studies for years 1979/80 - 1980/81 has been prepared. It will be turned over to the Editor for publication.

Draft Working Paper #100 (Crop Management Trials) has been completed. This report is a review of the previous studies on crop management trials. It also includes the crop management practices on project sites in the 1981/82 winter season.

Farm Management Survey Analysis - Project Technical Report #12 on Kafr El-Sheikh Farm Management survey has been completed. A draft paper on Mesqa 10, Farm management survey has been completed and it will be pushed to the Editor for publication.

An outline for a manual on farm record system was completed. A draft on a part of this manual is also completed.

An outline of a final technical report on farming systems has been done.

Work In Progress

Working on Irrigation practices using 1979/1980 - 1980/1981, farm records data for Manuriya site.

Working on a farm management survey analysis for Mesqas 7 and 26 at Abyuha site.

Working on opportunity time for crop production after completion of the crop calendar report.

Plans for Next Quarter

Continue to keep farm record books with the selected farmers to evaluate alternative farming systems in Egypt.

Conduct farm management survey - 2nd phase for mesqas 26 and 7 at Abyuha site - Mesqa 10 at Mansuriya site and the Manshia and Hammad mesqas at Kafr El-Sheikh site.

Work on technical report on irrigation practices in farming systems.

Conduct an outline for technical report on farming systems economic analysis.

Prepare an internal memorandum on crop management for summer 1982.

Names of personnel presently Assigned to Task Group 4

Farouk, Tinsley, Martella, Naim.

TASK GROUP 5 - THE WATER BUDGET

Objectives

The objective of the water budget work for the remainder of the project are as follows:

1. To continue to collect complete water budget data (surface inflow and outflow, precipitation, weather station data for evaporation and evapotranspiration, water table elevations, specific yield, hydraulic conductivity, water quality, surface outflow) at each of the project sites.
2. To conduct regular periodic analysis of water budget data for each site with subsequent reports of results.
3. To produce an annual water budget report for each site.
4. To produce a final comprehensive report of the water budget work.

Activities and Progress this Quarter

Monitored and assisted with routine data collection at each of the Project sites.

Worked on preliminary report of 1981 water budget for Om Sen.

Completed analysis of several months of Abyuha inflow and drain flow data for 1981.

Conducted a deep aquifer pumping test for study of vertical drainage at Beni Magdul.

Plans for Next Quarter

Continue to monitor and improve data collection at each of the Project sites.

Continue analysis of 1981 data for Abyuha.

Continue preparation of preliminary report of 1981 water budget for Om Sen.

Complete analysis of 1981 inflow data for Beni Magdul.

Suggested Modifications Including Additional Resources Needed for Implementing Long Range Plans

Due to excessive workload and inadequate staffing, it is proving very difficult to maintain quality control of field data collection, to keep storage and analysis of data current, and to prepare necessary reports.

Therefore, it will be necessary in the coming months to make it a top priority to keep levels of staff and TDY support high in order to accomplish the work plans.

Names and Contribution of Professional Staff This Quarter

Main Office Professional Staff:

M. Helal - On Leave in U. S.

M. Ibrahim - In Kafr el-Sheikh for Training

Azza Nasr - In U. S. for Training

Moheb Semaika - In Kafr el-Sheikh (Trainer)

T. K. Gates - Engineering, Computer Programming, Management

Main Office Support Staff:

Iman Saber - Computer Storage Technician

Laurette Gadel - Computer Storage Technician (part time)

Field Professional Staff:

Ahmed Abdel Hanim - Water Budget Coordination, Abyuha

Wadie Fahim - Water Budget Coordination, Mansuriya

Abdel Fattah Metawie - Water Budget Coordination, Om Sen

TDY:

Jim Warner (August 3 - 31) - Ground Water Engineering

W. O. Ree (August 17 - September 30) - Hydrologic and Hydraulic Engr.

Personnel Presently Assigned

T. K. Gates, Mahmoud Ibrahim, Moheb Semaika

TASK GROUP 6 - LAND LEVELING

Objectives

1. Collect and analyze all information on land leveling done by EWUP in the three work areas. Distinguish between land leveling (operations which involve considerable movement of soil or changing the original slope of the land) and land planing which is mainly for smoothing the land or for seedbed preparation.
2. Summarize the previous land leveling activities of the farmer, and evaluate his acceptance of new standards and practices.
3. Analyze the costs of precision land leveling.
4. Assess the impact of leveling on farm water management.
5. Establish training for farmers and other people who wish to improve their own land leveling skills.

Activities During the Quarter

A draft manuscript entitled "The Influence of Land Leveling on Irrigation Efficiency and Management of Irrigation Water" has been prepared and distributed to the three teams for review and amplication. The paper describes concepts of irrigation on leveled land and unleveled land. Data from team areas are presented to show how measurements in field trials compare with the concepts.

The data show in some instances that low water application efficiencies have been measured on well graded land using high rates of flow which should be favorable for achieving high efficiencies. In these cases the irrigation water was allowed to flow too long. This points out that farmers must be taught how to adapt to larger streams that may save irrigation time and improve efficiencies.

Some field data show that high efficiencies were measured with small streams which is contrary to the theoretical concepts.

Plans for next quarter and the future

Additional data will be obtained from teams for inclusion in the draft manuscript. The data will be reviewed to determine how well the results agree with theoretical concepts and reasons for deviation from these concepts.

Where favorable flow rates resulted in low efficiencies, special evaluation will be made to determine causes and recommended remedies.

Personnel assigned to the Task Groups

Bayoumi, Gamal and Hanson.

TASK GROUP 8 - SOIL CHARACTERIZATION

Objectives

1. To determine what soil management techniques are needed for best use of soil and improving water management.
2. To develop water management recommendations based on soil characteristics.

Accomplishments

1. Final Soil Survey Reports of both Kafr El-Sheikh and El-Minya were revised and discussed in detail while Dr. Schmehl was in Egypt.
2. An internal memorandum on problems of irrigation Vertisols in Egypt was revised and discussed with Dr. Schmehl. It is in the process of being published as a technical report.
3. A draft of report on root penetration of winter crops in Kafr El-Sheikh was revised by Tinsley.
4. A paper on soil properties in relation to irrigation was published as Draft Working Paper #101 by Dr. Assia.

Plans for Next Quarter

Following up our task group activities.

Personnel Presently Assigned to Task Group

Tahir, Tinsley, Assia, Naim, Semaika.

TASK GROUP 10 - CONJUNCTIVE USE OF WATER

Objective

1. Evaluate water collected from the main drains, canals and irrigation wells from the three project sites.
2. Classify the water from various sources for its suitability for irrigation.
3. Determine the consequences of using drainage water for alternative soil and crop situations.
4. Indicate special management practices necessary for using water of different qualities.
5. Determine the effect of using different combinations of water on the leaching requirements for alternative soil-crop situations.

Work Accomplished During the Quarter

Water samples have been collected regularly from canals, drains, and pumping and observation wells from the three Project sites beginning from March 1982 up to September 1982. Different chemical determinations for water samples have been carried out and the indices for pH_c, SAR, adj SAR, RSC have been calculated., Some determinations that include trace elements like (Fe, Mn, Mo, and Cu) and B_2, that have to be done twice a year on the samples of canals, drains and wells (according to Verne Scott report 1981) have been carried out in August.

Plotting the results as a function of time is going on as a step for interpreting the data and writing the final report which is due in April 1983.

Dr. Verne Scott completed a draft report on the State-of-the-Art of conjunctive use. It is presently being reviewed.

Personnel Presently Assigned to Task Group 10

Assia, Hanson, Taha, Ikram.

TASK GROUP 11 - IRRIGATION ADVISORY SERVICE

The Irrigation Advisory Service (IAS) component of Task Group 4 has focused on two major areas of analysis in order to examine the existing situation in terms of establishing such a service. First, there is the need to document how EWUP presents its different pilot programs to the farmers with the purpose of describing how a possible prototype to an IAS may actually perform. Next, an examination of the organizational environment into which the IAS must implement its objectives needs to be delineated. From these two areas of analysis, the objectives of the task group have been created and the work activities have been designed.

Objectives

1. Make explicit provisions for providing the technical advice and assistance to farmers and farm organizations served by the pilot studies which will at least:

   Provide technical advice and assistance to the individual farmer on irrigation practices and systems by cooperating with the existing extension service, village cooperative, and farmer organization.

   Provide technical advice and assistance to the farmer organizations, which will be needed if the farmer organizations are to be successful, on expected water requirement, irrigation scheduling, maintenance of mesqas and drains, etc.

   Establish the responsibility for specifying the nature of and the person responsible for providing the technical assistance for each pilot study.

2. Develop criteria and procedures for establishing a countrywide IAS.

   To define what should be the purpose and parameters of an IAS.

   To delineate how an IAS is to be organized in terms of its personnel, administrative structure, procedures and programs.

   To examine how the IAS is to be integrated into the existing institutional structure, i. e., what role will this service play in terms of other organizations.

   To examine the preparatory and training aspects of the staff members for this advisory service.

Tasks Completed

For this past quarter the work on the Irrigation Advisory Service has continued to focus on developing the conceptual underpinnings for analyzing such a service, and developing working procedures to demonstrate how such a service may operate. The activities performed this last quarter are:

- Evaluation of the various types of on-farm activities performed EWUP in terms of adoption of innovations. (Kafr El-Sheikh).
- Delineation of criteria to be used in examining how innovations are diffused to a specific type of receiver group.
- Initiation of specific work plans pertaining to the development of extension meetings for the farmers of the Kafr El-Sheikh site.
- Delineation of criteria to be used in examining the organizational parameters influencing the operation of the Irrigation Advisory Service.

Tasks Being Worked on Now and Future Plan

As an extension of last quarter's work, documentation of how EWUP implements its pilot projects will continue with the emphasis on interaction with the farmers. The conceptual delineation of criteria for both the innovation diffusion procedures and the organizational parameters of the IAS will be developed in more detail. The work on the organizational aspect of the IAS served as a foundation for Dr. Ed Knop's TDY.

Administration

The names of the personnel presently assigned to this task group are:

Jim Layton - Coordinator

Moheb Semaika

Gamal Ayat

TDY Support - Dr. Ed Knop

MAIN OFFICE

The technical work of the main office is done through eleven task groups. The work is performed by 27 professional staff members with TDY assistance as indicated in the "Backstopping," portion of this report. The main office and TDY staff work with field team personnel at each of the three Project sites to conduct demonstrations and field tests, collect data, and carry out plans for interaction with farmers and local government officials.

The following is a complete list of personnel assigned to the Main Office as of March 31, 1982:

Hassan Wahby	Project Director
Gene Quenemoen	Technical Project Director
Farouk Abdel Al	Economics Discipline Leader
David Martella	Economics Discipline Counterpart
Gamal Ayad	Senior Economist
Richard Tinsley	Agronomy Discipline Leader
Mohamed Abdel Naim	Senior Agronomist
Assia El Falaky	Senior Agronomist
Hamed Saleh (33% time)	Senior Agronomist
Moneb Semaika (66% time)	Senior Agronomist
Ahmed Maher	Engineering Discipline Leader
Eldon Hanson	Engineering Discipline Counterpart
James Layton	Sociology Discipline Counterpart
Yousria Allam (50% time)	Sociology
Mohamed Helal*	Computer Engineer
Azza Kasr*	Computer Engineer
Tim Gates	Engineer - Water Budget
Mahmoud Ibrahim	Computer Engineer
Iman Saber	Technician
Ahmed [illegible]	Farm Mechanization Engineer
[illegible]	Senior Engineer - Water Requirements
Abdel Atti Allam	Engineer - Water Requirements

Wadie Ragy	Engineer - Water Requirements
Mohamed Nabil Naguib**	Engineer - Water Requirements
Farida Abdel Meguidy	Engineer - Water Requirements
Ahmed Taher	Senior Agronomist
Mohamed Ahmed Salem	Senior Administrative - Personnel
Mohamed Said El Shatter	Senior Administrative - Expeditor
Salah El Din Salem	Junior Administrative - Secretary
Sayed Sakr	Junior Administrative - Storekeeper
Zeniab Abdel Ghany	Junior Administrative - Inventory
Ekhlas Abdel Ghaffar	Junior Administrative - Secretary
Magda Yassin Mahmoud	Junior Administrative - Photo Copier
Ashgan Abdel Zaher	Junior Administrative - Photo Copier
Magda Mohamed Mahraun	Junior Administrative - Secretary - Main Office
Maher Attalah	Junior Technician - Mechanical Work
Abdel Naby Youssef	Technician - Mechanical, Motor Pool
Ahmed Soliman Abdallah	Technician - Mechanical, Motor Pool
Ahmed Ibrahim	Junior Administrative - Motor Pool
Said El Said Elwi	Junior Administrative - Motor Pool
El Araby Mansour Shahin	Junior Technician - Electrician
Imam Sayed Kreiba	Technician
Osman Shaker	Junior Administrative
Ghaaban Mohamed Abdou	Telephone Operator
Boushra Soliamin	Senior Administrative - Accountant

Ahlam Abdel Rahman	Junior Administrative - Account
Taha Moustafa	Engineer - Water Laboratory
Ikram Mohamed	Engineer - Water Laboratory
Ahmed Ghanem	Technician - Water Laboratory
Susan Abou Shady	Junior Administrative - Library
Abdalla Gad	Technician - Motor Pool
Ahmed	Guard - Motor Pool
Saad Mansour	Management Assistant for Finance
Hamdi Ahmed Hamdi	Translator
Hanan Samuel	Secretary - Main Office
Mona Farouk Morsi	Secretary - Main Office
Mervat Hasan	Secretary - Main Office
Nawal Abdallah Ahmed	Accountant - Main Office
Moustafa Mahmoud Manran	Electrician - Motor Pool

* In training at CSU for 9 months.
** Training in Italy.

TRAINING

During the past quarter, the training component of the Project was involved in four major activities:

1. Sending personnel for several semesters of training to institutions abroad.
2. Sending personnel to short term training programs in the U.S.
3. Completion of the Projects' On-Farm Water Management Training Course Program in Kafr El-Sheikh.
4. Salt River Project - Ministry of Irrigation Exchange.

At present there are nine project professionals in training abroad. They are:

Aziz Nasr, Engineer, Colorado State University
Gamal Fawzy, Economist, Colorado State University
Kamal Fag Eldin, Engineer, Colorado State University
Mohamed Saad, Economist, Colorado State University

Amany El Kayal, Engineer, Utah State University (Peace Fellowship)

Mohamed Nabil Naguib, Bari Institute, Italy (Italian Government Fellowship)

Magdi Awad, Agronomist, Colorado State University

Ahmed El Said El Attar, Sociologist, Colorado State University

Mohamed Helal, Engineer, Colorado State University

Four of the Project professional staff attended the Utah State University course on "Irrigation Scheduling" from June 20 - July 16, 1982 at Logan, Utah.

- Dr. Mona El-Kady
- Engineer Esmat Wafik (Minya)
- Economist Elia Sorial (Minya)
- Agronomist Ahmed Ismaiel (Kafr El-Sheikh)

The On-Farm Water Management Training Program was held for its third year in Kafr El-Sheikh from August 1 - September 16, 1982. This program was followed by a field trip to the U. S. from September 23 - October 16, 1982 to examine different irrigation techniques and to see how a major U.S. river system is managed. For the Kafr El-Sheikh program, this was the first year that the training staff was comprised completely with Egyptians. The trainers were Abdel Fattah Metawie (Engineer), Lotfy Nasr (Economist), Mohamed Naguib (Sociologist), and Mahmoud Semeika (Agronomist). One American did serve as a liaison to the Project and performed the task of observing the progress of the program (Jim Layton - main office sociologist). The trainees numbered twenty with two agronomists, three economists, twelve engineers, and three sociologists. These trainees were either employed by EWUP or worked for the Ministry of Irrigation outside of the Water Management Institute.

A complete documentation of the training program will be included in next quarter's report. The field trip to the U.S. was similar to the previous field trips in terms of purpose and places which were visited and again more details will be included in the training report. The report will be designed to serve as a manual and a guide for the planning of the continuance of this training program outside of EWUP in the future years.

Two Egyptian engineers were processed for training under the Salt River Project - Ministry of Irrigation exchange. Engineers Abdel Rahman Shalaby and Salem A. Abdel Gaffar travelled to Fort Collins on October 9, 1982 for Fort Collins and later travelled to Phoenix, Arizona for an eight-week course of study. [illegible] arrived in Egypt on [illegible] and interaction with Egyptian engineers.

PUBLICATIONS

The Editorial Office has prepared a list of EWUP publications that includes all Project Technical Reports, Draft Working Papers and Manuals. Moreover, another list of TDY final and technical reports is now available. Copies of both lists can be obtained from Mrs. Mary Halim, Technical Editor, upon request.

During the past 3 months, difficulties have been met with in finding the grey cover paper for EWUP Technical Reports that was agreed upon during Dr. Richardson's last visit to Cairo. This was the main reason that delayed the appearance of Technical Reports, but in the meantime, all the backlog of Draft Working Papers was reviewed and put out with a quicker dispatch.

The Ed. Office also now bears the responsibility of supervising the distribution procedure in order that people might receive our publications in a more regular way.

The following publications were put out by the Project during the months of July - September:

DWP #95	Design of Level Furrows and Borders by Programmable Calculator by K. Ezz El-Din & K.E. Litwiller
DWP #96	Farm Record Summary and Analysis For Study Cases at Abyuha, Mansuriya and Abu Ray Sites, 1980-81 by EWUP Economics Team
DWP #97	Status of Zinc in the Soils of Project Sites by M. Abdel Naim
DWP #98	Summary of Farmers' Organization and On-Farm Water Management Data for Mesqa 10, Beni Magdul Canal by Tuneon, Farouk Abdel Al, W. S. Braunworth
DWP #99	Sociological Survey and Engineering Experiences on Mesqa [illegible], Beni Magdul Canal, Mansuriya District, Egypt by Mona El-Kady, Farouk Abdel Al, W. Fahim, W. S. Braunworth

DWP #100	Crop Management Trials by EWUP by M. Abdel Naim
DWP #101	On the Sugar Beet Yield and Soil Salinity Changes Under Long and Short Furrow Irrigation Systems by Assia El Falaky
PTR #13	The Role of Rural Sociologists in an Interdisciplinary, Action-Oriented Project: An Egyptian Case Study by J. Layton, Sallam
PTR #15	Village Bank Loans to Egyptian Farmers by G. Ayad, Skold, G. Quenemoen
PTR #26	Social Dimensions of Egyptian Irrigation Patterns by E. Knop, Sallam, Sheila Knop, Mona El-Kady
Manual #8	Thirty Steps to Precision Land Leveling in Egypt by A. Bayoumi, Shawky Boctor, Niel Dimick

The following table shows the status of papers now in process. Abbreviations are DWP for Draft Working Paper and PTR for Project Technical Report.

No.	Title	Remarks
DWP #84 (PTR #28)	Economic Evaluation of Wheat Trials At Abyuha, El Minya Gov., Winter 1979-80.	Proposed to be a Technical Report with Project Directors for approval.
DWP #88 (PTR #29)	Irrigation Schedules from Farm Records Data, Abuyha [illegible] Sites, 1979/80 - [illegible]	Proposed to be a Technical Report, with Project Directors for approval

No.	Title	Remarks
DWP #94	Accessibility of Farmlands on EWUP Pilot Sites	Incomplete manuscript submitted to Editorial office
PTR #9	Rice Related Studies of EWUP: Irrigation, Micronutrients, Fertility and Mechanization by EWUP	Editing Completed, with author for final revision
PTR #10	Soil Fertility Survey in Kafr El-Sheikh, El-Mansuriya, and El-Minya Pilot Projects by Zanati, Soltanpour, Moustafa, Keleg	Printed in 400 copies, awaiting distribution
PTR #11	Kafr El-Sheikh Farm Management Survey, Crop Enterprise Budgets and Profitability Analysis by Hilder, F. Abdel Al	Reviewed and ready for printing
PTR #12	Use of Feasibility Studies in the Selection and Evaluation of Pilot Studies for Alternative Methods of Water Dist. in Egypt by [illegible], F. Abdel Al, [illegible]	At the Printshop, to be reproduced in 400 copies

No.	Title	Remarks
PTR #14	The Challenge of Implementing an Irrigation Program in an Egyptian Village (Organization Development and Leadership Training Needs in the EWUP) by J. Mayfield, M. Naguib	To be processed in Fort Collins
PTR #16	Irrigation System Improvement by Simulation and Optimization, I. Theory, II. Application by J.M. Reddy, W. Clyma	To be processed in Fort Collins
PTR #17	Optimal Design of Border Irrigation Systems by J.M. Reddy, W. Clyma	To be processed in Fort Collins
PTR #18	Population Growth and Development in Egypt: Farmers' and Rural Development Officials' Perspectives by E. Knop, S. Knop	With author for final review
PTR #19	Effective Extension for Egyptian Rural Development: Farmers' and Officials' Views on Alternative Strategies by Hallam, E. Knop, S. Knop	With author for final review

No.	Title	Remarks
PTR #21	El-Hammami Pipeline Design by Sherith	To be processed in Fort Collins
PTR #22	The Hydraulic Design Of Mesqa 10, An Egyptian Irrigation Canal by W.O. Ree, Mona El-Kady, J. Wolfe, W. Fahim	With Editorial Office for review
PTR #24	Agricultural Pests and Their Control by Elwy Attallah	Typed and ready for printing
PTR #25	Problem Identification Report for El-Minya by Royal Brooks	With Editorial Office for final review
PTR #27	Alternative Approaches in Extension & Rural Development Work: An Analysis of Differing Perspectives by Callan, E. C. Knop	With author for revision
PTR #28	Economic Evaluation of Wheat Trials at Abyuda, El-Minya Govern. Winter 1979/80	With Project Directors for approval
PTR #29	Irrigation [illegible] from Farm Records Data, Abyuda & Ramaya Sites, 1979/80 - 1980/81	With Project Directors for approval

No.	Title	Remarks
PTR #30	The Role of Farm Records in the Egyptian Water Use and Management Project	With Project Directors for approval
PTR #31	Analysis of Farm Management Data From the Abhuha Project Site	With Project Directors for approval
Manual #6	Programs for Calculators HP-67 and HP-97	Reviewed and ready for printing

II. BACKSTOPPING

Planning and Coordinating Committee

Committee members worked on the training programs for Egyptian professionals who are taking non-degree graduate training, attended weekly meetings to plan project activities, reviewed and worked on reports, discussed work plans with the IDY's, took part in the Joint Advisory, P and C Committee meeting, provided orientation to Egyptians taking part in U. S. training programs and backstopped the discipline needs for the Egyptian and American staff in Egypt.

Dr. Lattimore completed scripts for TV programs on land leveling and farmer organization. The TV footage will be obtained next fall by Dr. Hilleman.

A joint meeting of the Project Advisory Committee and the campus Planning and Coordinating Committee was held in Fort Collins from September 13 - 17 1982. The attendees are in the appendix.

Mr. Tom Ley completed a draft paper entitled "Systems Analysis for Improvement of Surface Irrigation". Co-authors were Tim Gates and W. Clyma. Worked with R.L. Tinsley to combine a previous EWUP rice paper into a Project Technical report. A draft was sent to Cairo for review. He completed several drafts of action program for Kafr El-Sheikh and a draft paper on Level Irrigation System Design.

Mrs. Omnia El Hadia and Rashwan Ibrahim continued to work on their advance degree studies using Project data. Henry Horsey continued his M.S. studies on Energy and Irrigation in Egypt. He and Omnia conducted the Farm Water Management training tour in September.

Dr. Richardson along with Dr. Wahby took part in an Expert Consultation on Farm Water Management Training conducted by FAO in Rome in September after the Joint Meeting in Fort Collins.

Training

1. The field trip to U.S. Irrigation Institutions in the Western United States was organized and completed. The trip is the part of the on-Farm Water Management Short Course that was presented in Egypt by the Egyptian staff [illegible] to September 16, 1982. The field trip was

from September 23 to October 15, 1982. Eight senior officials and 20 trainees took the trip. The following persons took the field trip:

Trainees Traveling on the U.S. Field Trip -

Refaat Fahmy Fanous Soliman	Anahar Saleh Mohamed Rifaat (Miss)
Abdallah Mohamed Hussein Mostafa	Magdy Mohamed Badawy Helal
Nabil Kamal Faraq	Farida Abdel Meguid El Hssy (Miss)
Samir Abbas Saad	Mahmoud Ibrahim Ali
Maamoun Mohamed Abou-Zaid	Ahmed Ebrahim Ghoniem
Maher Sobhe Salama	Mohamed Farouk Ali Abu Hindia
Abd El Aliem Mohamed Okasha	Talat Helmy Youssiem
Yousria Ahmed Allam (Mrs.)	Sohair Kamal Yousef (Miss)
Farouk Ibraniem Hassanien	Nabil Mohamed Soliman
Saad Hussein Zaki	Safaa Fahmy Risho (Miss)

Officials Traveling on the U.S. Field Trip -

Abdel Aziz Amin Soliman	Deputy Minister of Water Distribution
Ali Abdel Rahman Ali	Deputy Minister of Sharkiya Governorate
Atfy Mohamed Aly	Deputy Minister of Fayum Governorate
Aly Rafie Ahmed Aly	General Director Monofiya District
Talaat Eshaq Idros	General Director of Sharkiya District
Abdel Meguid Abdel Wehab Badran	General Director of Dakahliya District
Mahmoud Ibrahim Issa	General Secretary of Water Research Center
Mohamed Abd El Naim Ahmed	Agronomy Discipline Leader - EWUP

2. Participant Training

Four participants successfully completed their summer session training. Their names, courses and grades are as follows:

NAME	COURSES		HOURS	
Ahmed Esmat	AE7?SAV	Irrigation & Drainage	2	B
	AE7?SV	Independent Study	3	A
	[illegible]	Hydrometry	3	B
	[illegible]	Applied Mathematics I	3	B

NAME	COURSES		HOURS	
Elia Sorial	AE795AV	Irrigation & Drainage	2	S
	USU	Irrigation Scheduling*	-	S
Ahmed Ismail	AE795AV	Irrigation & Drainage	2	C
	USU	Irrigation Scheduling*	-	S
Azza Nasr	M532	Applied Math II	3	A
	CE521	Hydrometry	3	A
	CE695H	Independent Study	2	S

*Special Short Course given by Utah State University June 20th to July 20th in San Luis Valley, Colorado.

After completing the summer session, Ahmed Esmat, Elia Sorial and Ahmed Ismail returned to their posts on the project. Miss Azza Nasr stayed at CSU for the fall semester.

The following students are taking the courses listed below for the fall semester 1982 at Colorado State University:

NAME	COURSES		HOURS
Azza Nasr	CE613	Hydraulics	2
	CE605	Exper. Fluid Mech. & Hydraulics	3
	AE538	Groundwater Hydology	4
	CE712	Hydraulic Struct. Design	Audit
Maggy Awad	AE505	Irrigation Scheduling	3
	AE538	Groundwater Hydrology	4
	AG560	Chemical Equilibria in Soils	3
	M340	Diff Equations	Audit
	AG795	Special Study	3
Gamal Fawzy	EAAC5	Agriculture Production Management	3
	EAAC5	Farm Records and Analysis	3
	EAAC5	Independent Study	3
	EC540	Economics of Natural Resources	3

NAME	COURSES		HOURS
Ahmed El Attar	S100	General Sociology	3
	S331	Community dynamics & Development	3
	AD590BV	Workshop: Community Education	4
	S795V	Independent Study	1
Kamal El Din	AE505	Irrigation Scheduling	3
	AE538	Groundwater Hydrology	4
	CE613	Hydraulics	2
	CE695	Special Study	1
	AE535	Surface Irrigation System	Audit
Mohamed Awad	AE505	Irrigation Scheduling	3
	AE535	Surface Irrigation System	3
	AG415	Crop Response to Environment	3
	AG795	Independent Study	3

3. Salt River Project Exchange

Drs. Richardson, Wanby and Abu-Zeid and Engineer Waguih Abbas visited the Salt River Project in September to review with SRP officials the exchange program. Everbody is very pleased with how the SRP exchange is being conducted. Minutes of the meeting are in the appendix.

Two exchanges from Egypt, Abdel R. Mohamed Shalaby and Salim S. Gaffar Mansa, are to start work in Phoenix in October and two exchanges, Jim McBride and Ron Markley from SRP are to arrive at work in Cairo in October.

Engineers Mahmoud Sayed and Ahmed Ahmed completed their work on the SRP and have returned to post.

4. Special Training

Dr. Mona El Kady attended the short course "Irrigation Scheduling" offered by Utah State University from June 20th to July 30th and then toured irrigation systems in Arizona and California.

Engineer Nevin El Gamal, Nafi El-Sheikh finished her work with Dr. [illegible] and returned to Utah State University where she is completing Master Degree on a "Peace Fellowship".

EQUIPMENT

AID approval was obtained for the Xerox 7,000 copier and it has been ordered.

Laboratory equipment for determining soil permeability has been ordered but has not been delivered.

Soil augers from the Netherlands are on hand and they will be shipped in the next air shipment.

The two control centers for El Hammami pumping plant have been shipped to Egypt on schedule. The few remaining items will be shipped, by air, after completion of the pump houses.

All other equipment, replacement parts and supplies have been purchased as requested from the field.

The two "Malibu" station wagons were delivered to Houston and they left the port on October 5.

All equipment for up-grading the water quality lab has been sent.

TDY's

The following people went TDY to Egypt this quarter:

Dr. Don Lybecker, Economist (August 8, 1982 - August 28, 1982) to work on publishing a farm record keeping manual, prepare a technical publication on crop-livestock relationships found in farming systems in Egypt.

[illegible], Economist (August 8, 1982 - August 28, 1982) to work on development of crop calendars and irrigation scheduling analysis for each of the three sites. Organize and begin writing publications on the above.

Dr. Robert Young, Economist (August 8, 1982 - August 28, 1982) to present a seminar, hold discussion with CAMP and personnel from Ministry of Irrigation Water Research Center on topic of water pricing.

Mr. Bill [illegible], Engineer (August 1[illegible], 1982 - September 1[illegible], 1982) to plan and evaluate construction activities on gravity distribution system at Abyadia.

Preparation of comprehensive report and accompanying manuals describing design and construction of gravity distribution at Abyuha. Planning, data analysis and preparation of reports for Water Budget work.

Dr. Bill Schmeal, Agronomist (July 29, 1982 - September 2, 1982) to write a draft report on correlation between soil survey data and soil fertility data. To write a draft report comparing the recent soil survey (EWUP) and the previous one (Min. Agric.) including general changes and recommendations. This will help the project modify irrigation systems according to existing soil surveys provided by the Ministry of Irrigation.

Professor Jim Warner, Civil Engineer (August 2, 1982 - September 4, 1982) to measure hydraulic properties of the clay silt aquifer at each 3 project sites and to quantify the volume of deep percolation that occurs.

Dr. Frank Santopolo, Sociologist (June 19, 1982 - July 31, 1982) assigned to farmer organization task group and irrigation advisory service task group to work under direction and supervision of sociology discipline. Follow-up on the evaluation procedures which the sociology discipline is using to study the effectiveness of farmer organizations and the irrigation advisory service work to date. Data analysis in preparation of final reports prior to phasing out.

Dr. Dave Sedgwave, Agronomist (June 8, 1982 - July 22, 1982) to work in the specific analysis of water tables and their influence on crop production. To write the draft report of soil water depletion as related to consumptive use and root penetration.

Work Plans

The Salt River Project exchange will continue with two Egyptians going to Fresno and two Americans going to Cairo next quarter.

Advisory service will be provided to the six Egyptians taking course work at CSU this fall quarter.

Planning will continue on the On-farm Water Management Conference to be held in Egypt in 1984.

Work will continue on writing, reviewing and finalizing project reports.

As requested by the Joint Advisory, P & C Committee meeting, the campus staff will make recommendations to the MOI on a Farm Water Management Implementation program.

III. PERSONNEL

Field Staff

Jim Layton was on home leave and vacation leave April - May 15, 1982.

Dick Tinsley and family were on home leave August 6 - September 6, 1982.

Bill Braunworth and wife were on home leave and vacation June 17 August 9, 1982.

Correction of 2nd quarter report: Mr. Dave Martella was not on home leave but was on leave in the U.S. for a month.

Campus

The following people will be in Egypt TDY next quarter:

E. V. Richardson	October 15 - November 5
George Radosevich	November 1 - November 26
Bill Ree	August 15 - November 11
Jim McDade (SRP)	October 11 - November 25
Ron Merkley (SRP)	October 11 - November 25
Richard McConnen	October 23 - November 28
Ralph Christoffersen	October 17 - October 22
Tom Ley	December 2 - February 3
Dan Hilleman	October 31 - December 11

APPENDIX

1. Joint Advisory, P & C Committee Meeting Agenda and Attendees

2. Pilot Program Accomplishments, Aug. 30, 1982.

3. Irrigation Water Management Improvement Program in Egypt: Basis for Program Implementation

4. Minutes of SRP Review Meeting of September.

	3:00 - 3:30	Break	
	3:30 - 5:00	Discussion of organizational structure for OFWM's Implementation program	Clyma El Hindi
Wednesday Sept. 15	8:30 - 9:30	Research needs in OFWM	Clyma Quenemoen
	9:30 - 10:00	Break	
	10:00 - 11:30	Discussion of Research needs in OFWM	Clyma Quenemoen
	11:30 - 1:00	Lunch Cafeteria Room 166 Student Center	
	1:00 - 1:30	EMUP Training Program Review	Sunada
	1:30 - 2:30	Training needs in OFWM	Schnehl Assiyuti
	2:30 - 3:00	Break	
	3:00 - 4:00	Discussion of Continuing Education in OFWM and Advisory Committee Response	Abu-Zeid Assiyuti Wafai
	4:00 - 5:00	Future of EMUP after 1983	Wahby Hanafi
Thursday Sept. 16	8:30 - 9:00 9:30 - 10:30	Instructional Services Tour Tour EEC	Jim French Richardson
	11:00 - 11:30	Break	
	11:30 - 12:00	Lunch Cafeteria Room 164B Student Center	
	12:00 - 2:30	Advisory Committee Summary Recommendations	Wahby Abu-Zeid
		Break	
	2:30 - 3:30	Planning session for OFWM Conference	El Assiyuti McConnen
	3:30 - 4:00		Richardson
Friday Sept. 17	8:30 - 10:00	To be arranged	Richardson

AGENDA AND PROGRAM
ADVISORY COMMITTEE MEETING
SEPTEMBER 13 - 17, 1982

Room 203, Student Center is reserved September 13-18, 1982 from 8:00 a.m. to 5:00 p.m.

Monday Sept. 13	8:30 - 9:00	Purpose of the meeting, etc. Introduction: review of agenda	Richardson
	9:00 - 10:00	Project Overview: Objectives, Historical Background, Procedures, Research Methodologies	Richardson Skold, Clyma, Sunada, Schmehl
	10:00 - 10:30	Break	
	10:30 - 12:00	Discussion	
	12:00 - 1:30	Lunch Longs Peak Room	
	1:30 - 2:30	Cash checks	
	2:30 - 3:30	Research progress report	Wahby Quenemoen
	3:30 - 4:00	Break	
	4:00 - 5:00	Presentation and Discussion of OEMI conf. in Cairo, Sept. 1983.	Wahby
	7:00 - 10:00	Dinner Cherokee Park Room	
Tuesday Sept. 14	8:30 - 10:00	Presentation of OEMI Improvement recommendations for Minya and Kafr El Sheikh Governorates	Richardson
	10:00 - 10:30	Break	
	10:30 - 12:00	Discussion of OEMI Improvement Program and Advisory Committee Response	Abu-Zeid
	12:00 - 2:00	Lunch Virginia Dale Room	
	2:00 - 3:00	Organizational framework for OEMI Improvement Program (Implementation supported by Research & Monitoring Program)	Skold

ATTENDEES

Joint Meeting - Advisory Committee and P&C Committee

September 13 - 17, 1982

Merle (Gene) E. Quenemoen	Professor of Economics, Montana State University, CSU Field Team Leader

ADVISORY COMMITTEE

Dr. Eng. Saad El Din El Kanafi	Deputy Minister of Planning and Vice President, Bank of National Investment Ministry of Finance
Eng. Waguih Abbas Abu El Ata	Chairman of the Irrig. Department Ministry of Irrigation
Dr. Kamel Hindi	Senior Under Secretary of State Ministry of Irrigation
Dr. Eng Mahmoud Abdel Halim Abu-Zeid	Chairman, Water Research Center
Dr. Ibrahim El Assiyuti	Head of Irrigation Division Faculty of Engineering Cairo University
Dr. Ali Serry	Vice Chairman Agricultural Research Center, Giza
Dr. Hassan Wahby	Director, Research Institute for Water Distribution and Irrigation Methods
Dr. Mohamed Wafai Abdel Salam	Head of Irrigation Division Faculty of Engineering Ain Shams University
Mr. Roger Bassell	U. S. Agency for International Development, Cairo

PLANNING & COORDINATING COMMITTEE

Dr. L. V. Richardson	Professor of Civil Engineering, CSU Campus Director
Dr. Wayne Clyde	Professor of Ag Engineering, CSU
Dr. Willard Schmehl	Professor of Agronomy, CSU
Dr. Daniel Zumada	Professor of Civil Engineering, CSU
Dr. Melvin Skold	Professor of Economics, CSU

AUGUST 30, 1982

REPORT OF
PILOT PROGRAM ACCOMPLISHMENTS

Applied research and testing of interventions is progressing at three field sites including Mansuriya, Kafr El-Sheikh and Minya. The interventions represent proposed solutions to problems identified early in the life of the Project.

Some problems are common to all sites, for example unlevel fields. Other problems are somewhat unique to specific sites. At least they take on different priorities in the minds of the farmers and professional Project staff. Consequently each package of technology gives special emphasis to certain interventions depending on the problems given priority at each of the three sites. This is reflected in the following brief summary of Pilot Program Accomplishments. More detailed reports are included in :

1. Project Quarterly Reports (one each quarter since March 1978).
2. Mid-Project Report, July 1980.
3. Draft Working Papers (99 published to date).
4. Project Technical Reports (10 published to date, 17 in process).
5. Manuals (3 published to date, 5 in process).

Work at the field sites indicates that substantial yield increases are possible if good irrigation practices are combined with optimum application of other production inputs. The yield increases experienced by IWUP are likely much lower than potential long-term increases. This is because farmers cannot adopt all the available technology. For example, some farms are not accessible for machines and consequently cannot take full advantage of improved, labor-saving irrigation technology until the access situation is improved. However, knowing about long level borders and furrows will make this technology easier to promote when infrastructure conditions improve.

This paper summarizes the highest priority problems and the most significant accomplishments at each of the three field sites. Two accomplishments stand out and have already been adopted for further implementation throughout Egypt.

Land leveling and related long furrow or long level basin irrigation is now being recommended by other projects working in the Ministry of Agriculture. Additional equipment is being imported to more rapidly implement the modern systems of controlled surface irrigation which have been field tested and demonstrated by IWUP.

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The second technology pioneered by EWUP through field tests and demonstrations, is the application of zinc sulphate to cotton, rice, wheat and beans. This technology was developed by the Ministry of Agriculture through research work. EWUP developed the methodology of field testing with farmers. This has led to an increase in productivity in areas of zinc deficiency in Egypt.

The process of field testing and demonstrating of on-farm water management technology continues at each of the three sites. Highly promising yield increases support the value of this methodology in the Nation's agricultural development.

MANSURIYA

Priority Problems Identified

1. Shortage of Water at The Tails of Meskas

The Mansuriya site consists of two tracts, one served by the Beni Magdul Canal and the other by the El-Hammami Canal. The former is a lined canal with a nyrpic gate. Water discharge from the Mansuriya Canal is carefully regulated according to water requirements of crops grown in the command area. With no scheduling of turns among farmers, those at the tails of the canal and meskas often suffer shortages of water.

El-Hammami canal serves a very sandy command area. Due to high conveyance losses and silting of sand into the distributary system, farmers at the tails of the canal and meskas often suffer water shortages, especially during peak irrigation seasons.

2. High Water Table

There are many areas in both Beni Magdul and El-Hammami where the water table is generally high and often fluctuating within irrigation turns thereby constraining the potential crop yields.

3. High Cost of Lifting Water

Nearly all of the irrigation water at the Mansuriya site is lifted from meskas into field ditches. The usual method of lifting is with an animal-powered sagia but human-powered tambours, diesel pumps are also used. The cost of human labor is higher at Mansuriya than the other two field sites. Consequently, the cost of lifting water is high, in some cases exceeding L.E. 60.00 per feddan per year depending on the

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opportunity cost of the farmer's labor, the size of the areas served, and the type of pumping device used.

4. Unlevel Fields

Topographical surveys indicated fields were not level enough for efficient irrigation.

5. Limited Access to Fields for Machines

Due to lack of roads and bridges, many fields are inaccessible for tractors, land leveling equipment and other machines.

6. Crop Damage Caused by Insects

Since the Mansuriya area is an important vegetable-producing region, the problem of reduced crop yield from insect damage is especially important to farmers.

Work Accomplished

1. Establishment of Burried Pipeline to Replace El-Hammami Canal

Two pump stations are being constructed to deliver water into a burried asbestos cement pipeline to replace El-Hammami Canal. Three-fourths of the pipe is laid, pump houses are being constructed, pumps and electrical control equipment are at the project site, and a water scheduling-control plan is being prepared. Farmers are being organized to assist with the management of the system.

2. Raising of [illegible] #10 for Gravity Irrigation and Irrigation Scheduling

A raised [illegible] of masonry construction has been provided to replace the old [illegible] #10. A pump station lifts water from Beni Magdul Canal into the [illegible]. A farmer organization has been established to manage the system and schedule irrigation turns.

3. Improvement of On-Farm Irrigation Layout

Demonstrations have been conducted in both Beni Magdul and El-Hammami areas for the farmers to observe land leveling, long furrow and long level basin on-farm irrigation layout. Although not fully adopted by farmers, these technologies are now a part of their awareness and may become widely used in the future.

4. Demonstration of Improved Insect Control Methods

Farmers were instructed as to the use of chemical insecticides for insect control. Project demonstrations indicated substantial yield in- [illegible] when use of insecticides is followed.

5. Organization of Farmers for System Control and Water Scheduling

An organization of farmers on *meeqa* #10 including a *meeqa* leader and gate coordinators has been established. This organization is being given instruction on pump management and is expected to take over the responsibility for operation of the pump station.

6. Demonstrations of A Package of Agronomic Technology

Demonstrations have been conducted each year for summer and winter crops to show the effect of timely insect control, appropriate seed varieties, proper fertilizer use, optimum plant stand density, and the best date of planting. Combined with water management, these technologies have increased production as much as 69 percent.

7. Lining of [illegible]

Trials have been conducted whereby *meeqa* were lined with plastic, cement bricks with plastic membrane, asphalt, and rubber sheeting. Except for asphalt, each of these methods appears to hold promise from a technical point of view. Economic evaluations are being conducted and will be included in final Project reports.

KAFR EL-SHEIKH

Priority Problems Identified

1. High Conveyance Losses in [illegible]

High losses of water in on-farm distribution channels between the point of lifting and the point of application reduces on-farm irrigation efficiency and contributes to the problem of a high water table. Measurements taken by Kafr El-Sheikh team shows that the on-farm conveyance loss in some cases exceeds 50 percent of the total water lifted into the farm distribution system.

2. Poor Design of On-Farm Irrigation Layout

Inappropriate size and length of *meeqa*, combined with small irregular basins and an inappropriate flow of water results in low irrigation efficiencies and requires unusually large inputs of labor and time.

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3. Unlevel Fields

Topographical surveys indicate fields are too unlevel for efficient irrigation, thereby reducing the amount of water required. Over-application of water leads to high water table and salinity which results in reduced crop yields.

4. Too Frequent Irrigations

Careful measurement of soil moisture indicates that farmers sometimes irrigate more often than necessary. This also contributes to high water table and salinity.

5. Ineffective Open In-field Drains

It was observed that field drains were choked with weeds and sediments. They often occupy as much as fifteen percent of the land area within a farm. Tests indicate they are ineffective in drainage of sub-surface water.

6. High Water Table and Salinization

The water table at Kafr El-Sheikh site rises up to 0.3 meters of the surface of the fields during many periods of the year. The groundwater is highly saline.

7. Lower Than [illegible] Yields

Field trials indicate that yields can be increased substantially by a combination of on-farm water management and improved agronomic technology.

Work Accomplished

1. Improved [illegible]

The Kafr El-Sheikh team has assisted farmers to construct and maintain new [illegible]. Plastic lining of [illegible] and lay-flat gated pipe has been used. Farmers are enthusiastic about the plastic lining but the lay-flat pipes have not proven to be very practical.

2. Land Leveling

The project has leveled approximately 15 to 30 feddans of land each season for cooperating farmers.

3. Improved On-farm Irrigation Layout

In combination with improved [illegible] and precision leveled land, the on-farm irrigation layout has been modified to achieve more efficient irrigation water application. The

length of *marwaa* has been reduced and long furrows or dead level basins have permitted more efficient water application. For example, efficiency was increased from 38% to 62% for wheat crops in 1980. Total water lifted for delivery to the fields has been reduced from 87 to 65 cm (a 34% reduction). The amount of time required to irrigate has been reduced by 33%.

4. Farmers Advised When To Irrigate And How Much Water To Apply

The Project team has measured soil moisture content and used this information to advise farmers on when to irrigate and how much water to apply. This has contributed to water savings and yield increases.

5. Open In-Field Drains Have Been Eliminated

Many cooperating farmers have eliminated some or all of the in-field open drains on their farms. This has resulted in making up to 15% more land available for cropping and has not had negative effects on crop yield or water table levels.

6. Farmers Have Been Advised On A Package Of Agronomic Technolog

The package of technology includes zinc application to rice, wheat and beans, use of appropriate seed varieties, improved plant stand density, and recommended planting dates. Wheat yields have been increased 12%, cotton 36%, rice 27% and maize 52%.

7. Farm Organizations Have Been Formed

Farmers have been organized in Kafr El-Sheikh Pilot Program areas for the purpose of cleaning drains and renovating and cleaning *meqqas*. Irrigation scheduling is being discussed but has not yet been tried on a wide scale.

MINYA

Priority Problems Identified

1. Ineffective Irrigation Network Served By Abyuha Canal

The Abyuha Canal and *meqqi* network served about one-third of the farmers by gravity, one-third were required to lift the water from the *meqqi* to their farms and the remaining one-third irrigated intermittently by gravity and lifting.

2. Unlevel Fields

Topographical surveys indicated the fields were too rough for efficient irrigation.

3. Farms Lacked Accessibility for Machines

The area contained a very poor network of roads which seriously limited the access to farms by tractors and machines in most of the time.

4. Inefficient Utilization Of Manpower

Because many of the farms were served by intermittent gravity irrigation, farmers were required to spend considerable amount of time checking their fields. Near the end of the on-period they spent much time waiting for water, particularly at the tails of *mesqa*. The result was inefficient utilization of manpower.

5. Lower Than [illegible] Yields

Because of a poor gravity system, many farmers cut the banks of the *mesqa* and left them open. At intermittent times, the water would cover parts of their fields nearest the *mesqa*. It often remained in parts of the fields near the *mesqa* several days whereby damaging crops.

6. Poor Plant Stand Density

It was observed, particulary with maize, that plant stand density was less than optimum for many fields.

7. Micronutrient Zinc Deficiency

Soil tests and field trials indicated that the area was deficient in zinc.

Work Accomplished

1. Development Of A Well-controlled Gravity Distribution System On *Mesqa* [illegible]

The banks of *mesqa* [illegible] were raised and the cross-section reestablished according to design criteria. A pump station was placed at the head of the *mesqa* and water was lifted from the Abyuha Canal. Gates were established along the *mesqa* and the farmers were trained to irrigate on a rotation schedule. A *mesqa* leader was elected and a leader was also elected for each turnout.

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2. Development Of A Well-Controlled Gravity Distribution System On *Meqqa* #7

There was sufficient head in Abyuha to serve *meqqa* #7 by gravity. An attempt was made to raise the banks of *meqqa* #7 and re-establish the cross-section with machines. A 65 horsepower, 2-wheel drive tractor with a toolbar was used to work the banks. A V-nose ditcher was used to re-establish the *meqqa*. Serious problems were encountered with wet spots in the field even though the work was attempted during the closure period in January. It was found to be extremely difficult to renovate a *meqqa* with this equipment. Action is currently being taken to get assistance from the Agricultural Mechanization Project to help solve the problem of *meqqa* rehabilitation.

3. A Well-Controlled Gravity Distribution System was Designed for the Abyuha Canal

Several man-months of time was devoted to designing a gravity distribution system for the Abyuha Canal. A computer program was developed for preparing the hydraulic design and this program should have widespread application for similar tasks in Egypt and elsewhere. A contract has been let to raise the banks of the Abyuha Canal and establish controlled turnouts on each *meqqa*.

A master plan has been prepared for complete development of roads and [illegible] within the Abyuha Canal command area. At the present time unit IV including *meqqas* #7, 9, and 11 is in the final stage of development. The farmers are discussing, through their organization, the potential for eliminating alternate [illegible], establishing roads on the [illegible] which are no longer needed, land leveling to facilitate longer irrigation runs, and improved on-farm irrigation layout. The completion of this work will facilitate improved irrigation efficiency, save more than 10% of the water now being turned into Abyuha Canal, and increase crop yields.

4. Farmers Have Been Organized for Improved System Management

The farm organizations have been involved in *meqqa* renovation and cleaning. They are handling the irrigation scheduling for *meqqa* #26. The farmers are assisting with the construction of roads and the consolidation of fields for land leveling. *Meqqa* leaders have been identified for the thirty *meqqas* in the Abyuha command area. *Meqqa* #26 has leaders for each turnout.

5. Demonstration Of The Package Of Agronomic Technology

A package of technology including zinc application, appropriate seed varieties, fertilizer use, plant stand density and planting dates has led to increases in yields of more than 50%. EWUP has collaborated with the Egypt Maior Cereal Improvement Project (EMCIP) to standardize a recommended set of agronomic practices. The Minya area was one of the first to field-test zinc application as recommended by the Ministry of Agriculture. The application of zinc sulphate resulted in yield increases for wheat, maize, cotton and beans of 33%, 7%, 45%, and 47% respectively.

DRAFT

IRRIGATION WATER MANAGEMENT IMPROVEMENT IN EGYPT:

Bases for Program Implementation

by

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and
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September 1982

AMERICAN EQUIVALENTS OF EGYPTIAN ARABIC TERMS AND MEASURES COMMONLY USED IN IRRIGATION WORK

Land Area	in sq meters	in acres	in feddans	in hectares
1 acre	4,046.856	1	0.96335	0.40469
1 feddan	4,200.8335	1.03805	1	0.42008
1 hectare (ha)	10,000.00	2.47105	2.38048	1
1 square kilometer	100×10^4	247.105	238.048	100.00
1 square mile	259×10^6	640.00	616.4	259.00

Water Use	in acre-feet	in acre-inches
1 billion m^3	810,710	
1,000 m^3	0.81071	9.72852
1,000 m^3/feddan (=238 mm of rainfall)	0.781	9.372
420 m^3 rainfall (= 100 mm of rainfall)		

Other Conversions	metric	U.S.
1 ardab	198 liters	5.62 bushels
1 ardab/feddan		5.41 bushels/acre
1 kg/feddan		2.12 lb/acre

Egyptian Units of Field Crops	Eg. Unit	in kgs	to convert Eg. units/feddan to tons/ha, multiply by
Cotton (unginned)	metric qintar	157.5	0.3749
Cotton (lint or ginned)	metric qintar	50.0	0.1190
Sugar, onion, flax straw	qintar	45.0	0.1071
Rice (rough or unhilled)	darita	945.0	2.2496
Lentils	ardab	160.0	0.3809
Clover (bersim)	ardab	157.0	0.3737
Broadbeans, fenugreek	ardab	155.0	0.3690
Wheat, chickpeas, lupine	ardab	150.0	0.3571
Maize, sorghum	ardab	140.0	0.3333
Linseed	ardab	122.0	0.2904
Barley, cottonseed, sesame	ardab	120.0	0.2857
Groundnuts (in shells)	ardab	75.0	0.1785

ABSTRACT

The Egypt Water Use and Management Project (EWUP) was established in January 1978 to study irrigated agriculture in the old lands of the Egyptian Nile Valley and Delta and to develop alternatives for improvement of agricultural production in those areas. This report describes the process EWUP has used in performing this task and the results which have been found. The irrigation system, and operation and management of it, is described. Priority problems constraining improved water delivery and distribution and better farm water management are outlined. EWUP studies to assess and evaluate alternative solutions to problems are summarized. Field tested solution packages have been further evaluated in pilot programs to assess their impact and their needs for successful implementation on a broader scale. Recommended action programs with this base of knowledge and experience are detailed.

Action programs for implementation in El Minya and Kafr El Sheikh Governorates, which focus on irrigation water delivery, distribution and farm water management improvements, are presented. Transition to improved delivery and distribution of irrigation water by gravity flow in branch canals and *mesqas* is emphasized at El Minya. Branch canal and *mesqa* development call for renovation of canal cross-sections to allow gravity flow delivery and water control capability at *mesqa* inlets. In Kafr El Sheikh improved maintenance and cleaning of branch canals and *mesqas* with water control capability at *mesqa* inlets is recommended. In both areas, farm water management improvement is based on land leveling to dead level and selection, layout and design of the farm irrigation system such as dead level border strip irrigation for basin crops.

A definite need for monitoring of the irrigation system and improvements to it, plus research in irrigation water delivery, distribution and farm water management to compliment and support the action programs is identified. Success of these programs will be strongly related to the availability of trained personnel. Recommendations for training: scope, types, topics are included.

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IRRIGATION WATER MANAGEMENT IMPROVEMENT IN EGYPT:

Bases for Program Implementation

INTRODUCTION

Efficient irrigation is the key to increasing crop production all over the world. It is a major factor to be considered in increasing world food supplies. The major portion of irrigated land in the world today is irrigated by some means of surface flooding (surface irrigation by gravity flow distribution). A significant need is thus identified to improve surface irrigation, a traditional means of water application, through improvement of both on-farm water management and the delivery and distribution of water to farms.

In Egypt, irrigated agriculture has been carried on for centuries. The traditional methods of irrigation are deep-rooted and have a tremendous basis of experience. These methods are inadequate, however, for use with the relatively recent implementation of the the Aswan High Dam. The old methods coupled with the year-round abundant water supply have led to inefficiencies in delivery and distribution of water to farms and in application and use of water on the farm.

The Egypt Water Use and Management Project (EWUP) was established to work with irrigated agriculture in Egypt, mainly with the Egyptian farmer, to determine irrigation practices and related agronomic practices that are best suited for improving irrigated agriculture in the old lands as constrained by Egyptian cultural and social characteristics. Project objectives are to (1) identify the major constraints to improve on-farm

water management and optimal water delivery system operations; (2) determine and establish the use of optimal irrigation and related agronomic practices at the farm level in representative pilot areas; (3) establish improved water control practices for the water delivery and drainage systems in the project areas; (4) develop plans for organization and implementation of expanded future programs based on results in the project areas; and (5) develop and train qualified scientists and technicians who will carry on and conduct on-farm water management activities.

The main purpose of this report is to describe an implementation program which can be developed for on-farm water management and delivery system improvement in Egypt. The bases for this program are the studies and findings of EWUP. First, the irrigation system in Egypt is described and the operation and management of it are outlined. Second, the results of intensive system studies made by EWUP are given. The results of those studies are the identification of priority problems and major constraints to improvement of on-farm water management and delivery system operation and management. Third, studies were conducted by EWUP to evaluate alternative solutions to the various identified problems. The field testing of suggested solutions has led to the development of solution packages of practices deemed most feasible for attaining the desired improvements. Continued testing of those packages of practices in pilot programs has allowed further evaluation of the solutions, assessment of the impact on irrigated agriculture, acceptance by the farmer and identification of needs to implement the successful programs on a broader scale. Thus, the experience and knowledge EWUP has gained, the failures as well as the successes, contribute to form the bases for the recommended action programs to be described in the final sections of this report.

BACKGROUND: Irrigation System Description and Operation

Water Delivery System

The Nile River Valley, extending from the Aswan High Dam in Southern Egypt to the Delta in Northern Egypt, and the two branches which form the Nile Delta are the crux of the irrigation water delivery system in Egypt. Barrages (diversion structures) have been constructed to divert water to an extensive system of public watercourses. Primary canals (main feeders and carriers) deliver water to main canals. Main canals serve several branch canals. Ultimately, branch canals serve the privately owned and operated canals known as mesqas. Regulated water releases to the system are possible with the control provided by Aswan High Dam. Continuous irrigation water supply, enabling year-round crop cultivation, is thus ensured. The Ministry of Irrigation, with responsibility for the operation and maintenance of the public canals and structures, assures the enormous task of delivery and distribution of water throughout the irrigated areas of Egypt.

Irrigation water is generally distributed in the main canals on a rotational basis. Under the rotational method, the area served by one main canal is divided either in two equal regions and called a double rotational system, or into three equal regions and called a triple rotational system. In each of these rotations, water is admitted to only one of the regions (during the so-called on period). Intakes to the other regions are closed (so-called off period). To enhance control of water distribution, a series of regulators are constructed along the main canals.

Branch canal intakes receive water from the main canals and further distribution of water is accomplished by the branch canal. When a region served by the main canal is designated for the on-period, regulators in the main canal are adjusted to maintain the desired water level at the upstream side of branch canal intakes. The designated branch canal intakes are opened and adjusted to keep the downstream water level at that specified. Water flow can be quantitatively measured through the branch canal intakes. Normally, the intakes have been calibrated and to achieve desired flows merely requires the maintenance of up - and downstream water levels, which are monitored through use of staff gages.

Branch canals are designed to carry water according to the crop requirements of the area served. Design water surface elevations along branch canal reaches are estimated for the maximum and minimum flow requirements. Regulators are often used in branch canals to facilitate water distribution and allow better control of water surface levels. Branch canal outlets to the private meqas are typically steel or concrete pipes laid through the canal banks. The crest of the pipe is legally to be set at 25 cm below the minimum design water surface elevation. These pipe outlets are designed (diameter) according to the area served, the outlet pipe length and on the basis of supplying some minimum water duty (i.e., 50 m^3/fredan/day) under a head of 25 cm. Under the assumption of steady state flow in the branch canal, such a system of outlets would presume a fairly equitable distribution of water to all areas served by the outlets.

A major component of current water resources policy in Egypt which is aimed at ensuring the most efficient use possible of available water resources and at increasing the agricultural production base is the control of water use control by generally, delivering water below the

prevailing land surface elevation. This requires farmers to lift water from 0.5m to 1.0m for application to their fields. Lifting of water directly from the branch canal occurs, but most often is from the private mesqa. Lifting is accomplished through the use of the hand-operated tambour (Archimedes screw), animal-powered saqia (water wheel) or by mechanical means such as small diesel pumps. In some areas, water is available by gravity flow directly from the mesqa to the on-farm distribution system. Such areas are more prevalent in Upper Egypt and the Upper Delta. In the Lower Delta, gravity flow occurs during periods of low water demand when the branch canals and mesqas are very full during on rotations. This is the exception rather than the rule, however.

The private mesqa may typically serve between 20 and 200 Feddans. The number of farmers served may range up to 75 or more. Operation and maintenance of the mesqa is the farmer's responsibility. (Further information on the water delivery system can be found in EWUP Technical Report No. 3 and EWUP Staff Paper No. 66.)

Water Removal System

Water removal in Egypt is accomplished through either a network of open surface drains, from field drains to collectors to secondaries to mains, or a network of sub-surface tile drains which ultimately drain into the large open main drains. Typically in Upper Egypt, the Nile Valley and the Upper Delta, drainage water is discharged back into the Nile River for re-use downstream. In the Lower Delta areas, water in main drains is typically pumped into the Mediterranean Sea, and is a loss to the system.

On-Farm Irrigation System

Once irrigation water has been lifted to farm level (or is available by gravity flow), the farmer will distribute the water to his various

fields through an often extensive system of distribution ditches or marwas. Outlets to fields being irrigated are merely breaches in the marwa banks opened and closed by hand tools or by hand. A generalized layout of the on-farm irrigation system, typical of much of Egypt, is given in Figure 1. Water application methods have evolved from wild flooding of basins to the present methods of irrigating row crops on ridges in small basins and other crops in basins without ridges (flat) by surface gravity distribution. In irrigating the small basins with furrows, farmers will generally start at the upper end of the field and irrigate several basins at a time. Once he feels adequate water has been applied, he will continue to the next set, and often will drain the excess water applied at the previous set into this set of basins. At the end of the irrigations, the farmer may drain excess applied water into an open surface drain. For irrigation of basins, water is applied until a standing depth deemed adequate by the farmer is achieved. Excess applications to these basins is also often drained after some period of time. Major row crops grown in Egypt are cotton, maize, sugar cane, sugar beets and vegetables. Major basin crops are rice, wheat, flax and birsim.

On-farm water removal is generally accomplished through use of open field drains which often are crop or farm boundaries. These individual farms field drains empty into open collector drains serving many farms. If the open field drains are not used, the mafmas are often used as drains. Water is drained into the mafma from fields and the mafma then is opened into the open collector drain. Extensive areas in Egypt have been provided with a subsurface tile drain system over the past 5 - 10 years. Current plans include further drainage development along these lines.

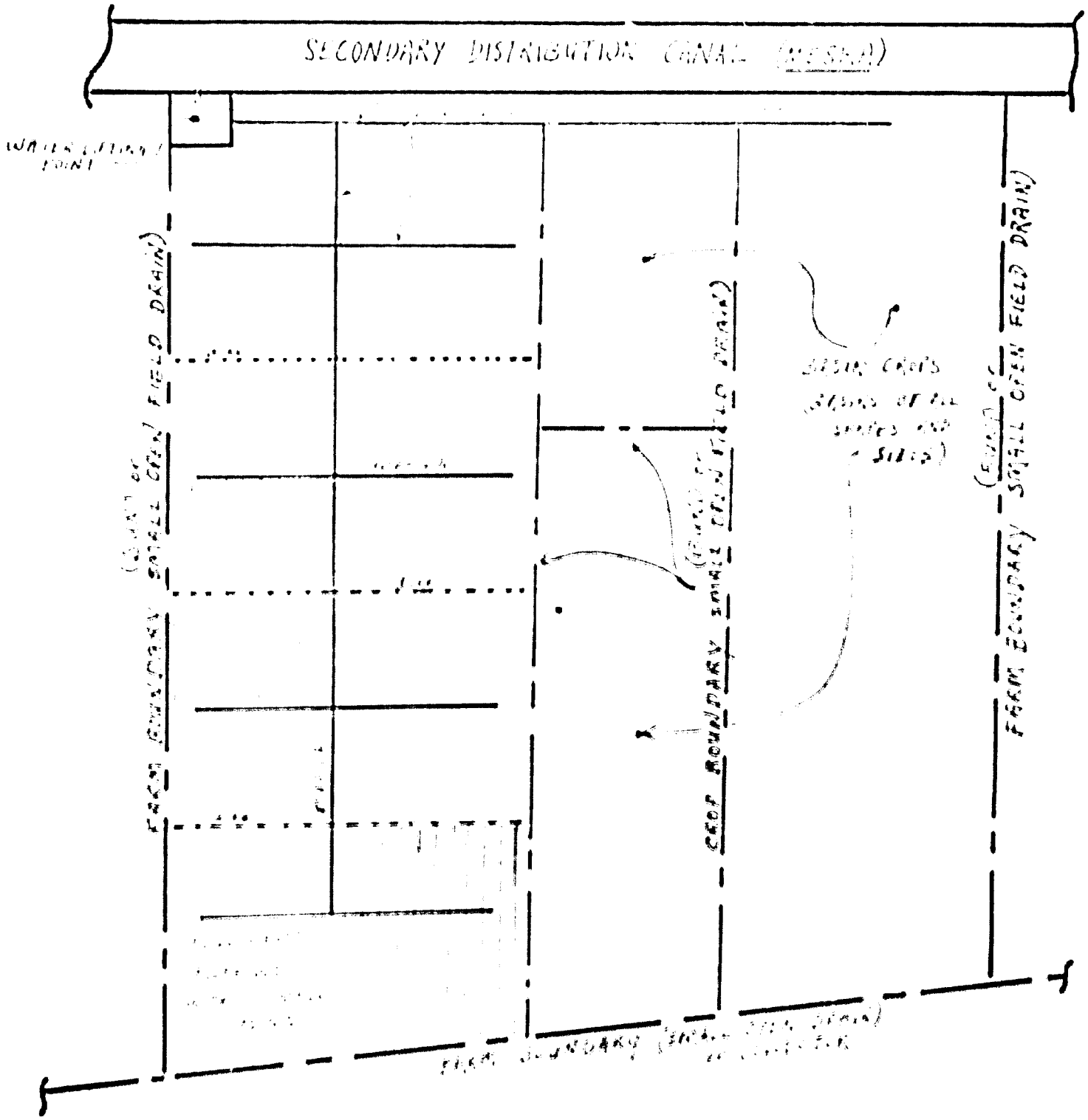

Figure 1. Generalized layout of traditional Egyptian on-farm irrigation system.

RESULTS OF EWUP SYSTEM STUDIES

History of EWUP

The Egypt Water Use and Management Project (EWUP) has worked on applied irrigation research at the farm level in three areas representative of irrigated agriculture in Egypt -- Mansouria, Kafr El Sheikh and El Minya since January 1978 (Figure 2). In its first phase, EWUP concentrated on identification of problems which obstructed the efficient use of water and the optimal production of crops. The second state of the Project consisted of proposing and testing alternative solutions to these problems, and evaluating them with respect to farmer acceptance, economic justification and technical feasibility. The third phase, which started in August 1980 and which is still going on, entails the implementation of those solutions which appeared most suitable. The results of this third stage lead to recommendations in line with the Project's objectives, and it is expected that these will prove useful to the Ministry of Irrigation (MOI) in its work throughout Egypt for the eventual upgrading of Egypt's entire irrigation system. Current plans call for this phase of the Project to be completed by June, 1984.

Priority Problem Identification

Identification of priority problems has been an important and on-going component of EWUP activities. Results which are presented in the following discussions are based on project data, project reports and the experience and knowledge of project personnel who have worked on EWUP over the past 4.5 years.

Water Delivery System -- Major problems identified with the present water delivery system in Egypt are related to operation and maintenance:

1) A lack of routine maintenance on many water courses has resulted in reduced operational time due to sedimentation. Irrigation water

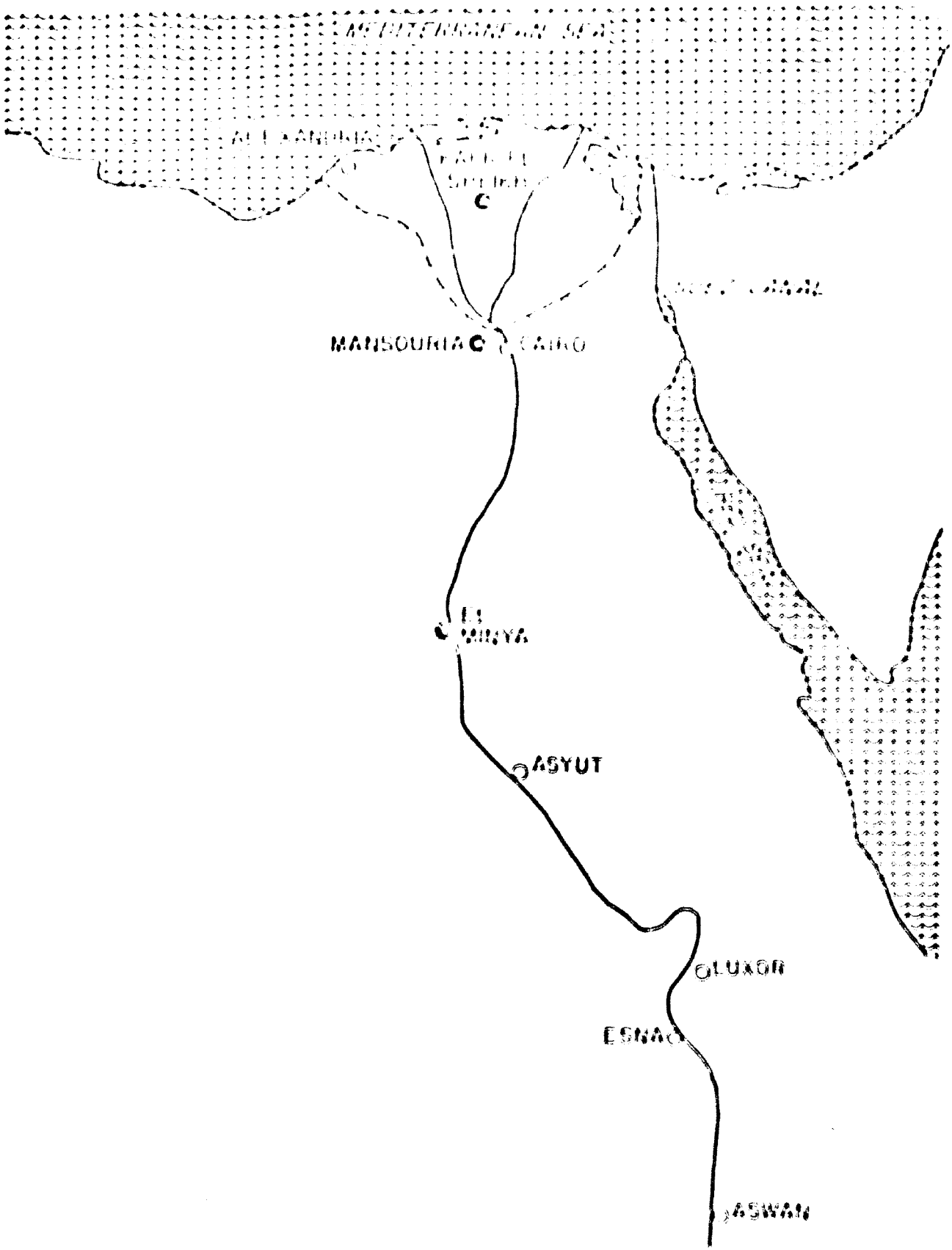

Figure 2. Location Map for Study Area.

discharge is reduced. Submerged and emerged weeds can become a severe problem. Increased head losses in the system reduces water available on water courses due to the nature of the system. The end reaches of watercourses tend to suffer excessively from these problems. The private mesqas, being the farmer's responsibility, lack maintenance and cleaning to an often moderate to severe degree due to a lack of effective organization to accomplish such tasks. Branch canals and mesqas are often wide and shallow, choked with weeds, and occupy more land than necessary.

2) Over-excavation of watercourses due to improper maintenance and cleaning, plus some farmer practices as bilcheading, causes water distribution problems. Canals and mesqas again are too large and too deep for the required flow and occupy too much land. An added factor of the excessive cross-sections is the increased amount of water lost to seepage and leakage from the watercourse, especially in the sandier soils.

3) Due to the nature of the system, poor distribution of water occurs. Water levels in the canals control canal discharge. Water users can get more water by using more because the gradient is increased. Users near canal intakes have more water available to them and consequently, those branch canals on the upper reach of a main canal rotation group have more water go through tail escapes to drains having less water available to downstream users.

4) Pipe outlets from branch canals to mesqas are designed for an average water duty. Consequently, water shortages occur during critical demand periods. This induces farmers to add outlets,

increase outlet size, etc. Such practice causes poor distribution of water, because it further removes the actual system operation from the assumptions governing the design of the system.

5) In some areas, for instance the EWUP site on Abuena Canal at El Minya, a mixed gravity/lift system is in use. The water delivered by gravity flow is available with insufficient head and of inadequate flow rate to allow efficient irrigation.

6) The rotational flow basis for water delivery necessitates the use of watercourses (branch canals and mesqas) of larger cross-section, thereby decreasing productive land area.

7) Delivery of water at levels below field elevation does not act as an incentive for farmers to use less water. Farmers will still tend to apply as much as they deem adequate, and because they spend more time lifting water than managing the application of it, low on-farm irrigation efficiency results.

Water Removal System -- Open surface drains also suffer from a lack of proper and routine cleaning and maintenance. Severe weed infestations cause significant head loss resulting in reduced water velocities, water backup and ultimately low drain performance. Such problems lead to water table and salinity problems which decrease crop production. This problem exists from the on-farm level of open field drains to the collectors, secondaries and main drains. Inadequate depth and reverse gradients along longitudinal sections reduced effectiveness of drains in the study areas.

On-Farm Irrigation System -- Detailed on-farm studies have shown several significant problems exist, common to most farms, which reduce on-farm irrigation efficiency:

1) Irrigation basins are not designed according to the local conditions of soil type, available flow rate, boundary conditions, etc. Efficient water application by surface irrigation (gravity distribution of applied water) can be achieved only if the systems are appropriately designed.

2) Unlevel fields reduce water application efficiency and hamper effective distribution of applied water. Farmers irrigate to cover high spots causing overirrigation in low areas. If the high spots are not adequately irrigated, salinity problems result. Excess water applied is often drained from the field contributing to low efficiencies and the problems of the water removal system. Overirrigation contributes to water table buildup and fluctuation. The end result is a reduction in crop production.

3) Irrigation timing and frequency tends to be a function of the rotation system rather than actual crop water use. Generally, farmers will over-apply water, irrigating too frequently rather than let the crop approach a stressed condition. This is due to a lack of knowledge on the part of farmers as to crop water requirements and possibly a basic mistrust of the water delivery rotation system. Studies show farmers will irrigate twice during the on-period because the water is available and they aren't sure of its next availability. Soil moisture monitoring and crop water use studies have shown excessive irrigation water application result.

4) In much of the area, Mayba (El Minya) water is delivered by gravity flow, however it is often of insufficient quantity and head to allow for efficient water application. The low flow

rates and head cause excessive amounts of time required by farmers to achieve the desired distribution of water over the field.

5) On-farm distribution ditches suffer from excessive cross-sections and poor maintenance. In Kafr El Sheikh, this problem is significant. The clay soils there tend to crack and swell upon drying and wetting. The large cracks which form cause significant leakage in on-farm conveyance channels. As much as 50% to 70% of the water lifted has been measured to be lost before it reaches the field for application. The average farm conveyance efficiency is only 60%. The losses are often to field drains or other irrigated basins. The result is very low on-farm irrigation efficiency, wasted time and effort by the farmer, wasted water, and decreased crop production next to the leaky marwas.

6) Poor on-farm water management contributes to the high water table problem, salinity problems and drainage problems, particularly in the Kafr El Sheikh area.

7) Crop production problems ranging from inadequate farm inputs such as certified seed or proper quantities of fertilizers to inability to till the soil for preparing adequate seed beds to lack of micronutrients in the soil to inadequate pest control all contribute to reduce the effectiveness of irrigation on the farm.

8) Farm layouts with extensive systems of ditches for water distribution and/or removal and irrigation basins of all shapes and size hamper effective on-farm water management, reduce productive land area and increase farm labor input. For instance, ineffective field drains in Kafr El Sheikh have been

shown to occupy 10 - 15% of productive land area. Present layouts of the on-farm irrigation system plus the layouts of farms along watercourses reduces accessibility to farms. The earlier noted lack of watercourse maintenance, excessive canal cross-sections, etc. add to this problem. The inability of farmers to bring machinery to their fields (tractors and tillage equipment) should be considered as a contraint to increased crop production. Lack of adequate farm access roads in all three Project areas may also be constraining the marketability of farm products.

DETERMINING AND EVALUATING SOLUTIONS TO IDENTIFIED PROBLEMS

Once priority problems at each of the three Project areas had been adequately identified, alternative solutions were developed and trials for applied or practical testing of the suggested solutions designed and implemented. This applied research has been conducted on both the water delivery system and on the farm to determine the most feasible and most acceptable solutions to identified problems. It has also been an on-going EWUP effort, in order to refine, develop and/or modify solutions as conditions change, such that the solutions continue to be feasible and acceptable.

Field Trials

Initially, field trials were conducted on the farm to test suggested improved on-farm irrigation and crop production practices versus the traditional methods used by farmers. Generally, several farms were chosen and the tests were run on strips or basins adjacent to the farmer - managed ones. This allowed the farmer to visually gage the changes involved and facilitated the measurement of all inputs and outputs to both. This work required significant cooperation on the part of the farmer, thus heavy initial effort to gain farmer trust and build mutual understanding between farmer and Project through mutual teaching and learning was an integral component. Project - farmer relations at the three areas have been very good as a result. The added benefits of increased farmer understanding and awareness of what the Project was trying to do should be obvious.

The on-farm field trials at the three Project sites generally focused on testing: a) land leveling to dead level to eliminate high and low spots, b) irrigation methods design (use of dead level border or long

furrow irrigation), c) advisory assistance to farmers on determining when to irrigate and how much to apply and d) crop production trials to test various fertilizers, varieties, effects of pest control, etc., as practices to improve on-farm water management. Field trials results generally showed that improving on-farm water management in these ways increased crop production and saved water, land and energy.

For instance, in Kafr El Sheikh, 1979 - 80 winter season trials on wheat fields showed that land leveling, dead level border strip irrigation, advisory assistance to farms on when and how much to irrigate and on fertilizer use and application of the micronutrient zinc plus introduction of a new variety all combined to increase grain production by 42%, increase on-farm irrigation efficiency by 60%, give water (and labor) savings of 34% and irrigation time (and labor) savings of 33%. The economic analysis showed a mean net farm income increase of nearly 10 Egyptian Pounds/feddan. Similar results were found on several different farms the following season (1980-81) demonstrating the validity of the practices to bring about improvements.

Trials in El Minya also showed crop production increases. A trial testing the application of zinc sulphate to wheat in El Minya showed a 90% increase in grain production. A field trial in the 1980 - 81 winter season at El Minya to test land leveling and the use of long dead level lengths of run (border strips or long furrows) demonstrated that this combination can produce irrigation time savings (39 hours per feddan for the leveled land vs. 72 hours per feddan for unleveled fields) and improved water application efficiency (70% on leveled land with border strips vs. 61% on the conventional methods fields). For the long furrows, irrigation time savings (33 hr/feddan for leveled land vs. 40 hr/feddan for unleveled land) and increased water application efficiency

(74% for dead level long furrows vs. 64% for the conventional method) were demonstrated. Yield levels on the trial fields were among the highest measured for the season. Irrigation improvements would be even more successful at El Minya if gravity flow were improved from the present poor condition of low head and flow rate. Solving this problem would allow more efficient irrigation.

In Mansouria, the small land holdings make land leveling less practical unless a large area can be done simultaneously. Also, the characteristics of water delivery in that area result in low flow rates and low heads after lifting which makes system layout changes (i.e., long furrows or long basins) less practical. It is presumed that if the water delivery were improved in these areas then the other practices such as leveling and irrigation design would give the same good results as found in Kafr El Sheikh and El Minya. The need for such improvements (leveling and system layout and management modifications) has been well defined. Crop production trials demonstrating the use of different varieties, fertilizer management and pest control have been very successful in improving vegetable production in Mansouria.

A trial to test suggested improvements to water delivery and distribution at the Mesqa level was initiated in the 1980 - 81 winter season on Mesqa 26 in El Minya. Mesqa 26 was eliminated and reconstructed at a higher elevation with the proper cross-section and gradient. Water is pumped into the elevated Mesqa from Abadia Canal. The result has been a much improved delivery of gravity flow water. Combined with land leveling and irrigation design, farmers made marginal improvements in their on-farm water management with the larger head and flow available at their farm turnout. With the experience of learning to manage the larger flow and head, the farmers should benefit significantly

from the combined improvements. Water savings in the Mesqa 26 area have been demonstrated with the improved gravity flow system. An effective farmer organization was developed for necessary mesqa level operations as scheduling of turns among farmers on the mesqa and for routine cleaning and maintenance.

Other field trials were conducted; all of the major crops, summer and winter, were included. The evaluation of suggested solutions and further testing of the more promising solutions lead to the development in the late summer of 1980 of pilot program packages. These were to be implemented at the Project sites to extend the successful practices on more farms in each area, further evaluate suggested solutions, and define other solution alternatives.

Pilot Programs

Improvement of water delivery and control received particular attention in the development of pilot programs at the El Minya and Mansouria sites. In Mansouria, various alternative schemes for water delivery are undergoing evaluation. These include replacement of the El Mammami Canal with a low pressure concrete pipeline as a means to control conveyance losses and the effect on the water table, and to improve distribution of water in the area served. Also, in Beni Magdul a mesqa has been eliminated and replaced with an elevated concrete lined channel. Water is pumped into the head of the new mesqa and delivered to farm outlets on a gravity - flow basis. Other channel improvements including lining are being evaluated in Mansouria. Where possible, improvements to on-farm water management with leveling and irrigation design are being further tested and evaluated. Being mainly a vegetable - producing area, a large effort to improve crop production practices at Mansouria to improve the effectiveness of water use has occurred.

Improvements in varieties, fertilizer management and use, pest control and general crop management should have a very significant effect in increasing production and supply.

In El Minya, a marked effort has been given to development of a design for the area served by Abdeha Canal to receive water by an improved gravity flow delivery system. The Abdeha Canal itself will be renovated by improving the cross-section and banks to receive and delivery water at a higher elevation. Mesqa inlets will be modified as well as the mesqas themselves to delivery water at an improved gravity flow condition. Mesqa improvements will be patterned after the Mesqa 26 trial. On-farm improvements such as land leveling, irrigation design and advisory assistance to farmers on system management are included in the package. The improved system permits better management and control of irrigation water decreasing the possibility of water-logging and salinity problems in the area. A significant element of the efforts in El Minya has been the development of farmer organizations on the mesqa level. These organizations are necessary for the operation and management of the improved mesqa system and can be of great assistance in the development, construction and future maintenance of the system.

In Kafr El Sheikh, the focus has been on development and improvement of on-farm irrigation systems. A package of practices for improvement of on-farm water delivery, application, use and removal is being implemented. Included are: re-design of the irrigation system layout with land leveling. Matwas are eliminated and reconstructed to fit the new layout. The new matwas are constructed to minimize dead storage and leakage losses. Lining with plastic sheets to further reduce losses is being tested. Dead level border strip and long furrow irrigation methods

are designed. In-field open drains are eliminated as possible to save land. Crop production and management advice is given along with advisory assistance on when to irrigate and how much to apply. The results of the work accomplished so far are very promising. Crop production increases, water, labor and time savings, and increases in on-farm irrigation efficiency have been demonstrated.

To improve water distribution in the delivery system in Kafr El Sheikh, farmers have been organized at the mesqa level to do manual cleaning and maintenance on their mesqas during the winter closure period. Farmer response has been very good and the expected benefit that farmers' would perceive better water delivery to their farm turnout was realized. An on-going study of water delivery in Kafr El Sheikh to determine a schedule (timing and amount of water) of deliveries to more closely fit the actual water requirements is being done. Preliminary findings strongly suggest that moving water control structures to the mesqa inlet level and changing the dates for switching from winter to summer and summer to winter rotations could save water and provide for better water distribution during critical demand periods.

The implementation of the pilot programs at the three project areas has allowed for refinement of the solutions considered most feasible and acceptable. Logistical, administrative, personnel and training needs have been identified. Ultimately, EWUP's work, experience and results have been evaluated and amalgamated to formulate action programs for implementation on a large scale in Egypt for the improvement of irrigated agriculture there. The purpose of this report is to define the bases for those action programs and describe them in detail.

ACTION PROGRAMS

Recommended action programs for implementation in the El Minya and Kafr El Sheikh Governorates are presented. An outline of the components of each program with details of the components specific to each area, will be given first. A concurrent need for monitoring and research in irrigation water management to support the identified action programs is discussed. Thereafter, details of the program components common to each area will be discussed and finally, the identified needs for successful implementation of such programs are detailed.

Action Program for El Minya Governorate

The recommended program for El Minya is comprised of two main components: development and improvement of water delivery and improvement of on-farm water management through the improvement of the on-farm irrigation system.

Development and Improvement of Water Delivery -- This component should be patterned after the present plans for the improvement of the Abusha Branch Canal and the *mesqas* it serves. The goal is to change the system so that water is delivered by gravity flow with sufficient head and flow rate for efficient irrigation. The branch canal improvements call for the following:

a. Align the canal to its original position by removing the canal cross-section to the design section.

b. In the process of renovation, the canal banks should be raised to accommodate the necessary raise in the water level for "good" gravity flow.

c. The main road along the branch canal should be rebuilt in this process also.

d. Modern head gates should be installed to replace "stop-log" structures where they are used at branch canal intakes and as regulators in the branch canal.

e. Facilities to measure inflow to the branch canal should be planned and inflow records maintained.

Improvement of branch canal cross-section and alignment are a necessity. Economic analysis should be done to determine if it is more feasible to raise the branch canal banks or to pump water into each mesqa for gravity flow in the mesqa.

Mesqa improvements must be made prior to or concurrent with branch canal improvements. Improvements include:

1. Elimination of old mesqa and reconstruction of a raised mesqa section to receive water from the branch canal on a gravity flow basis.

2. Installation of large - diameter vent pipes at the beginning of each mesqa to allow water to flow into the mesqa with a minimum of head loss.

3. Installation of head gates on each mesqa to control water delivery to the mesqas.

4. Construction of internal roads to improve farmer's ability to travel to their fields. The development plan in Abucha proposes elimination of each second mesqa and conversion into farm access roads. Access roads are thus away from mesqas so they may serve farms on either side. Land ownership patterns in Abucha will allow a large portion of the area to be developed in this way without reducing the water distribution network capability.

5. Consolidation of farm turnouts on the mesqa and use of farm head gates to control leakage.

6. Development of mesqa farmer organizations for the purposes of assistance in system construction, system operation once finished and system maintenance. Farmer organization will be discussed in more detail later.

Mesqas in areas where heavier soils are prevalent may be of earthen construction, but must have properly compacted banks. Lining of mesqas in sandier soils may be necessary.

Improvement of On-Farm Irrigation System -- Changes in on-farm water management and in irrigation methods will be necessary as water delivery is improved to a "good" gravity flow basis. To ensure the efficient use of water on the farm, the following developments in on-farm irrigation must occur.

a. Precision land leveling to dead level should be done. This is a necessity in those areas which will be receiving water from a different mesqa.

b. The on-farm irrigation system should be redesigned. Layout and design of on-farm distribution ditches plus design of water application methods are included. Dead level border strip irrigation for basin crops and dead level long furrow irrigation for row crops should be designed according to the local conditions (soil type, infiltration rate, crop requirements, available flow rate, etc.) It is expected that "good" gravity delivery will provide for a minimum head of 25 cm and a minimum flow rate based on area served at each farm gate turnout.

c. Establishment of on-farm water management advisory assistance in the MOI to provide assistance to farmers on irrigation timing, frequency and amount of application, plus crop production advisory assistance on varieties, fertilizer use, pest control,

etc. Improvements in crop production and in the use of management inputs in this way further improves the efficiency of water use.

Action Program for Kafr El Sheikh Governorate

The action program for Kafr El Sheikh is also comprised of the same two components as El Minya: water delivery and distribution improvement and on-farm irrigation system improvement.

Improvement of Water Delivery and Distribution -- The major emphasis of this component in Kafr El Sheikh should be on the renovation of branch canal cross-sections, longitudinal sections and alignment to the design and then maintenance of the watercourses in that condition. Branch canal structures such as "stop-log" head works and regulators should be replaced with modern head gates for better water control and reduction of leakage. The rotation schedule on the branch canals should be modified. Studies have shown that significant water waste occurs during the last month of the present summer rotation (4 on - 4 off for rice). This rotation could be curtailed and changed to the winter rotation up to one month earlier. Consideration to providing extra on days during the long off periods when rice nurseries are being grown is recommended. Peak water deliveries must be adjusted to provide enough water during the critical demand period when farmers are irrigating to puddle their rice fields during the last half of June. Studies indicate peak deliveries do not occur until July.

Control structures on branch canals such as head gates for each mesqa and improvement of vent - pipe outlets to each mesqa are recommended. Water control at the mesqa level will improve water distribution and reduce water waste. Presently, large amounts of water are lost from the system due to excessive amount of flow-through in the mesqas to the main

drains. Mesqa farmer organizations must be developed to handle mesqa operations, such as headworks control, and for maintenance and cleaning. Roads along mesqas can be effectively improved in this way also.

Improvement of On-Farm Irrigation -- A package of practices for improvement of on-farm water delivery, application, use and removal is recommended. The technical features include:

1. Renovation of on-farm water distribution system layout and ditches. On farm ditches should be constructed to minimize dead storage loss and with properly compacted banks to minimize leakage and seepage. Plastic lining is recommended for the severely-cracking soil.
2. Precision land leveling to dead level and selection, layout and design of the farm water distribution and application system. Recommended irrigation methods are dead level border strip irrigation for basin crops and dead level long furrow irrigation (with two rows per furrow or beds) for row crops.
3. On-farm water management and crop production advisory assistance. Advice to farmers on when to irrigate, how to irrigate and how much to apply plus crop management advice in terms of varieties, tillage, fertilizer use, pest control, etc., will all increase the effectiveness of on-farm water use.
4. In-field drainage ditches should be removed to save land. Bunds can be contructed and maintained as effective crop boundaries. Farm boundaries can eventually be transformed to bunds also, instead of the presently ineffective open field drains. With improved on-farm water management, the need for these drains is eliminated. Furthermore, the benefits of rice cultivation for salinity control and land reclamation have been studied by

EWUP. Rice cultiviation effectively reduces soil salinity in the root zone profile. With careful water management between the rice crop every two years, soil salinity in the profile can be stabilized.

The benefits of the on-farm water management improvement program have been well demonstrated in the Abu Raya area of Kafr El Sheikh. Consistently, the program has achieved crop production increases, increased on-farm irrigation efficiencies, and water labor, land and time savings. These improvements mean that mechanization on the farm can be facilitated by the new layouts, that water presently being lost by pumping into the sea is saved and available for use elsewhere, that salinity and high water table problems can be effectively controlled, and that with improved on-farm water management the need for field drainage systems (open surface or buried) may be eliminated. Open drains in Kafr El Sheikh should nevertheless, receive routine cleaning and maintenance. This applies particularly to the collector, secondary and main drains.

Action Program for Monitoring and Research

The need to routinely monitor the irrigation system in terms of continuously measuring and evaluating irrigation water quantity and quality in canals and drains, the conditions of canals and drains, delivery and drainage system problems and farm water management problems cannot be emphasized enough. As conditions change or problems develop an organization specifically formed to monitor this would be on top of the situation, could refer problems needing research to the proper entity (i.e., Water Research Center, etc.), and could channel solutions to problems back to the proper organization for implementation.

This need automatically mandates the need for continued research in irrigation water delivery, distribution, application methods, use and

removal. The research organization should necessarily concentrate on practical applied research of field problems. Results would be formed into feasible implementation packages for actual field development in the action programs.

The action program implementation teams, a monitoring organization and a research organization must work as a three-armed development process that works in a cyclical manner. Each arm would compliment and support the other such that improvements are constantly being developed that are feasible and implementable.

Common Action Program Components

Advisory Assistance -- It is recommended that an advisory service to provide farms with assistance in on-farm water management and crop production and management be established with each action program. Basically, such assistance would entail advising and helping farmers with improved irrigation practices associated with the dead level irrigation methods recommended, land leveling, [illegible] improvement, determing when to irrigate and how much to apply, farm record keeping, pest control, tillage practices, fertilizer use, etc. Ideally, the advisory assistance should be modelled after the present methods of assistance offered by EWUP's Kafr El Sheikh or El Minya field offices. Teams of engineers, agronomists, economists and sociologists are necessary to provide the desired assistance. Such a team would operate well at the MOI district engineer's office level and would act as a linkage between farmers and the MOI. The group would also act as liaison between the MOI and other entities involved in irrigated agriculture, particularly the Agricultural Cooperatives and Extension Service of the MOA. The effectiveness of all such entities to assist farm production should increase through mutual understanding and cooperation.

The advisory assistance recommended would actually be an integral task of the teams to be formed for implementation of the action programs in each governorate. These teams, modeled after the EWUP teams, would be established at a district level and implement the recommended program on a branch canal level. The teams would have the necessary training and background initially to start the programs and provide on-the-job-training to new personnel to allow for future program expansion.

Land Leveling and Irrigation System Design -- Land leveling requires equipment (tractor, scraper and land plane) and trained technicians to survey and stake the field for leveling. The tractor is normally available from the cooperative, or from local private owners. The land plane and scraper are not available in some Governorates, but they are manufactured in Egypt. Trained people and many of the smaller instruments, (such as rods, levels and flags) are not always available.

EWUP research shows that, when farmers see land leveling, they grasp its advantages. In both El Minya and Kafr El Sheikh, after seeing pilot projects, farmers have requested land leveling and have even removed land ownership markers to facilitate the leveling by combining fields.

This Action Program recommends the use of conventional surveying techniques in the initial stages of the plan, but it is hoped that eventually laser plane equipment for the purpose of land leveling will be acquired. Since leveling is only done between crops, the actual time for accomplishing the work is short. This is one of the boundary conditions for accomplishing land leveling in Egypt, and it will have to be dealt with by the use of additional equipment and good planning. In the future, private sector companies might do the actual land leveling, while the MOI, in the form of the advisory teams provides the surveying.

Dead level border strip and dead level long furrow irrigation methods are recommended. Well-trained irrigation engineers (with an agricultural irrigation background) will be needed to do the design work. When adequately designed, these methods can be expected to perform with high efficiencies and uniform distribution of applied water. However, the use of these methods relies on precision land leveling to dead level and the availability of irrigation water delivered at sufficient head and quantity.

Farmer Organization -- In the case of the recommended irrigation improvements, the farmer, both as an individual and collectively, will play a significant role in the success of the program. The farmer must implement the changes, accept them, learn how to use them and maintain them once they are in operation. Patticular stress is laid on farmer involvement and the development of effective farmer organizations for the success of the program.

It has been the experience on EWUP's three pilot project sites, that farmers will organize willingly to schedule turns for irrigation, to clean and improve their *mesqas*, to coordinate land leveling, to operate pumps and cooperate on other matters which affect the general well-being of the farming community along their *mesqa*. In other parts of the world where such experiments have been made -- Pakistan, India, Indonesia, and the Philippines -- farmers were equally willing to organize when they understood that it was for the improvement of their irrigation system, their own betterment and the good of the whole community.

This action program puts forward not single model for farmer organizations, but the Egyptian experience, as well as experience world wide, shows that trying to direct the control and management of an irrigation system from above does not work. Farmers are notorious all

over the world for resisting orders that come from above, but they do respond to incentives. EWUP studies have shown that farmer organizations must be voluntary associations if they are to have authority among their members. A correctly designed farmer organization provices the discipline without coercion and the means for coordination that irrigated agriculture requires.

Functions of the farmer organization will primarily center on establishing and enforcing a fair schedule of irrigation turns on the mesqa. If a pump is used at the head of the mesqa, the organization must also supervise its use and establish a rotation scheme with neighboring mesqas. Farmers of the organization will be responsible for cleaning and maintaining drains and the mesqa itself, and will work with the MOI to clean and maintain the branch canal.

The farmer organization is the link between the individual farmer and MOI technical advisors. It should serve as a conduit for information from the MOI and the MOA to the farmer by means of extension education programs which will help accustom farmers to proposed changes in their farming systems and teach them their proper use in the shortest possible time. It is also the link between farmers, the MOI District Engineer and the advisory assistance teams. Finally, farmer organizations provide a mechanism for the equitable payment of mesqa improvement costs.

With a typical farm size of five feddans or less, and with mesqas serving from 20 to 100 farmers, the MOI cannot afford to do all tasks without farmer assistance. Extensive water management improvements at the farm level are only possible with the voluntary help of local farmers, and experience shows that, all over the world, successful irrigated agriculture rests on giving farmers a meaningful voice in the control and management of their local irrigation system.

Identified Needs for Successful Implementation

Training -- For the first action program implementation, it is expected that the MOI will draw on EWUP personnel for many of the key staff positions. This is desirable because EWUP staff are experienced with the methods proposed here and could provide on-the-job-training to new staff while working in the field. However, a significant training need is identified for program expansion. The training should be in all aspects related to on-farm water management. A training program patterned after EWUP's on-farm water management short course specifically tailored to the needs of Egypt should be developed. Egyptian Universities should be encouraged to develop specialized courses in on-farm water management and on-farm irrigation. A formal agreement of cooperation and mutual assistance between the organization implementing the action programs and Egyptian Universities is strongly recommended in this aspect. Specialized courses and special training programs should be offered in the following subjects:

a. land leveling design and construction

b. surface irrigation principles and design

c. soil-water-plant relationships

d. small farm mechanization and farm machinery operation, maintenance and repair

e. farm - record keeping

f. rural sociology

Ministry of Irrigation personnel could also be sent to take advanced training in all aspects of irrigation and on-farm water management at U.S. Universities or other organizations. Educational study tours by professional staff of the MOI to U.S. irrigation projects, irrigation equipment manufacturers and irrigation institutions (including farmer

organizations, cooperatives and the extension service) are means to increase awareness and improve technical background in this area. Personnel also must be trained to understand the need and the benefits to be gained from systems studies and implementation of solutions from an interdisciplinary approach.

Monitoring of Improvements and Future Research - An irrigation monitoring organization is needed to support the actions programs, acting as the link between operations and research. Continuous evaluation of irrigation system operations and on-farm water management is needed, so that any new problems are discovered and dealt with. Problems needing research would be referred to the proper section. Research recommendations would be channeled back to the monitoring service. The monitoring organization would act with the advisory assistance teams operating the action programs to implement the recommendations. The monitoring service would also be responsible for irrigation water quantity and quality measurements. The monitoring service, with the advisory assistance teams, would evaluate the action programs and determine where changes or modifications are necessary to enhance program success.

Continued research on the irrigation water delivery and on-farm irrigation systems will be necessary. Some technical problems requiring further research (some of which IWUP is currently studying) include economic methods of canal lining, low pressure pipeline systems, conjunctive use of water, crop water requirements, effects of high water tables on crop production (i.e. contribution to crop water use from water table, management of high water tables, etc.), salinity control and drainage.

Research links to the action programs are necessary as boundary conditions, irrigation needs, etc. change. The establishment of such a connection will ensure that the action program design is flexible enough to incorporate justified changes. The research organization also provides the link to research in irrigation methods throughout the world, results from which may also benefit the programs.

Emphasis must also be placed here on the need for trained personnel to staff such organizations. Scope and emphasis of training may be slightly different, but the same types of activities and topics are necessary.

SUMMARY AND CONCLUSIONS

A review of the work and findings done by EWUP since its' beginning in 1978 until present has provided: (1) an overview of irrigation system operation in Egypt, (b) the priority problems constraining improved performance, (c) solutions which have been tested and (d) pilot programs being conducted to demonstrate that viable solution packages do exist which can bring about significant improvements. These are the bases, then, for recommended action programs to be implemented in El Minya and Kafr El Sheikh Governorates. These programs are comprised of two major components: to address improvements to irrigation water delivery and distribution, and to on-farm water management.

The programs outlined here are not crash programs which will result in immediate upgrading of system performance. Rather, they are recommended as a development process which will ultimately yield improvements to the physical structure of the system, system operation and performance and an institutional framework for sustained development.

With the nucleus staff available for implementation in the present EWUP field staff, the initiation and maintenance of the programs could be up to 100% Egyptian organized, staffed and supported. External support for equipment (land leveling, monitoring in field and lab, computers, surveying, etc.) acquisition and for training is necessary. As facilities, trained staff, experience and program results indicate, the programs should be scheduled form the initial two in El Minya and Kafr El Sheikh to on-going irrigation research - development programs in each Governorate with irrigated land. The ultimate goal, of course, being to increase crop production to stabilize the Egyptian economy.

ORM A2 5005

Memorandum

SALT RIVER PROJECT

Date September 15, 1982

TO Attendees

FROM Don Davis

RE: MEETING NOTES - SRP/EGYPT PEEP EVALUATION - Sept. 10, 1982

A meeting was held at the Salt River Project for the purpose of reviewing and evaluating the Professional Employees Exchange Program and taking any required actions to improve its effectiveness.

Attendees:

Engr. Wagih Abbas	John Lassen
Dr. Mahmoud Abu-Zeid	Jim McDade
Dr. Hassan Wahby	Ron Merkley
Dr. Ev Richardson	Alex Richards
Sid Friar	Reid Teeples
Don Davis	Don Weesner
Ed Kirdar	Don Womack

President John Lassen opened the meeting by welcoming our guests and noting the success of the program, to date. Dr. Abu-Zeid expressed his appreciation to SRP for their continued support and the chance to meet and review the program.

Dr. Richardson noted that, according to AID, this exchange program has been the best one they have been associated with and expressed his appreciation to all those involved.

Reid Teeples expressed his feeling that the program was proceeding smoothly, noting he had meet with all Egyptian exchange participants and all had indicated to him that they had learned something at SRP which could be taken back and applied to their work in Egypt.

Reid also noted that he hoped President Mubarak would soon visit SRP and that such an invitation would be initiated through our embassy in Cairo.

Dr. Abu-Zeid explained briefly how participants were chosen in Egypt. He asked if English language had been a problem with any participants. Those in attendance agreed that it was not.

Dr. Abu-Zeid requested that SRP participants should provide continuity by following up on previous participants' work so at the end of this phase of the program a specific goal, such as the broad crested weir, is completed.

After discussion of where SRP participants could stay, it was agreed that the first week's reservation would be made at the Meridian Hotel and then McDade and Merkley could make their own arrangements for the remainder of their time in Egypt. Dr. Richardson noted that arrangements can be made for them to eat at the American Embassy restaurant.

After discussion of per-diem payments to SRP participants, Dr. Richardson noted he would try to get per diem made directly to participants and let them use as they see fit. He noted that no more per diem could be paid than allowed by AID. When asked about making payments in two lump sums rather than each week, Dr. Richardson said he thought this could be done by requesting from Gene Quenemoen when participants arrive in Cairo.

Dr. Abu-Zeid noted that participants from Egypt had requested more training in computer science prior to coming to SRP. It was agreed by those present that this training was not necessary to participate in the program.

Ed Kirdar raised question of reimbursement of expenses when we take Egyptian participants on field trips on week ends. Dr. Richardson said money was available and he would follow up with a letter to SRP with details.

Dr. Abu-Zeid requested that he be furnished with more information about each SRP participant's education and work experience so he could plan better for their work assignments in Egypt. SRP will follow through and provide such information. It was noted that SRP participants basic assignments should be made in the following areas:

Ron Merkley	-	Construction & Maintenance equipment and procedures
Jim McDade	-	Water measurement
Don Womack	-	Design of pipeline, slipform and canal lining
Sid Friar	-	Water operations from Aswan to user

Don Davis requested copies of written reports of Egyptian participants. Dr. Abu-Zeid noted he would provide them through Dr. Richardson.

Dr. Abu-Zeid noted the next participants are to arrive at SRP on Saturday, October 16. Participants are:

Engr. Abd El-Rahman Shalaby, Director,
Planning & Management
(Ministers Technical Office for Projects)

Engr. Salem Abd El Gaphar, Garbia Irrig. Dist.

After discussion about future of the project, Dr. Richardson noted that he will address AID relative to Phase II of the program and keep all parties informed of the progress and status.

All present agreed that SRP participants' program should remain 6 weeks long.

Dr. Abu-Zeid noted that the evaluation meeting was worth the time and effort and proposed a second evaluation be made in Cairo around May of 1982. He suggested inviting SRP senior people from 7 to 10 days. Reid Teeples was in agreement with the proposal and said if enough advance planning is made the attendees might include Vice President Marcel Boulais, General Manager Jack Pfister, Don Weesner and Ed Kirdar.

Don Davis

Don Davis, Recorder

hj