IRRIGATION PROJECTS DOCUMENT REVIEW

APPENDIX C:
NEAR EAST AND AFRICA

WATER MANAGEMENT SYNTHESIS PROJECT
WMS REPORT 1

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Prepared by

Philip S. Coolidge - Research Assistant
David R. Daines - Water Law and Administrative Specialist
George H. Hargreaves - Research Director, International Irrigation Center
David W. Miller - Research Assistant

Utah State University
Agricultural and Irrigation Engineering
Logan, Utah 84322

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WMS Report 1

INTRODUCTION

Members of the staff of the USAID-sponsored Water Management Synthesis Project have written this project document review to serve as a resource paper indicating general directions of irrigation project investments in developing countries.

The bulk of the documents obtained were written preliminary to project execution and therefore did not attempt to evaluate either an ongoing or a completed project. It is thus clear that these papers do not purport to represent the projects' actual attainments and shortcomings. For this reason, the reviewers have not attempted to critically assess the merits of executed projects on the basis of this documentation, but rather, have summarized information contained in these documents to arrive at descriptions of individual projects as perceived during the planning stage.

Taking collectively, these summaries afford an overview of methods and strategies used by USAID and IBRD (World Bank) in facing the problems of irrigation development.

METHODOLOGY

Each of the following summaries is divided loosely into three sections. The first section is an outline giving the project's location, approximate area, expected cost and brief entries on the goals of the project and how these goals are to be achieved. Following this outline are more detailed descriptions of selected aspects of the projects. These descriptions come under the headings "Technical," "Environmental," "Social," "Institutional" and "Economic," headings which generally correspond with those used to organize World Bank appraisal reports.

USAID project papers are less standardized in format with the result that individual project papers may not specifically address certain topics, while having extensive coverage of others. Also, aspects which may sensibly be viewed as one type of factor by the authors of some project papers may legitimately be classified under another heading by other authors. These judgments are reflected in the summaries.

Environmental aspects are not consistently addressed in either USAID or IBRD papers, although in general, the later the document, the more attention is paid to environmental questions. The institutional emphasis in the documents of both organizations pertains mainly to the official channels designated for the construction and operation of projects without casting much light on how water is to be managed by the farmers themselves or on the level of rapport anticipated between irrigators and project personnel.

The third section of the summaries is composed of tables usually including an implementation schedule, a cost breakdown and estimates of present and future productivity within the project area. USAID project summaries also include a copy of the project logical framework, whenever this was available.

ACKNOWLEDGMENTS

The permission of FAO and the World Bank (IBRD) to perform this project and their assistance in bringing it to completion are gratefully acknowledged.

Recognition of this cooperation, however, in no way implies the support or endorsement of these bodies for this study.

EXPLANATION OF SYMBOLS

The documents included in this review are organized first by country, then grouped within each country by donor organization, and finally assigned a number within each group. Thus, for example, CV-A-1 stands for Cape Verde-AID-1.

The full project title may be found in the index of projects. The number in parenthesis after the key word is an indication of the frequency of use of the word or words.

Donor Code	
A	USAID
F	FAO
W	World Bank

INDEX OF PROJECTS SUMMARIZED IN APPENDIX C:

NEAR EAST AND AFRICA

INDEX APPENDIX C (Continued)

TITLE: Irrigation Investigations and Training

PROJECT NO.: 655-0005

COUNTRY: Cape Verde

REGION: Africa

KEYWORDS: Irrigation water supply (5).

SUMMARY: The project will test the feasibility of irrigating 600 ha in the Tarrafal region. The investigations will include the drilling of 50 test wells, exploration of 10 horizontal gallery sites, investigation and design of two 30 m storage dams with related tunnels and canals, study of terraces and dikes to control erosion and runoff, study of appropriate irrigation systems and crop technologies, and 13 man-years of related technical training.

LOCATION: Tarrafal, on São Tiago Island

CLIMATE: BWH

CROPS: Banana, potato, pepper, onions. SOILS: Volcanic.

TARGET GROUP: Initially, this will benefit the personnel of the Ministry of Agriculture, as well as the well and gallery construction workers. Potentially, the 6,000 people who might benefit from increased crop production.

BEGIN: December 1977 END: December 1979 AREA: 600 ha

NUMBER OF FARMS: 500

CONTRIBUTION:

U.S.	1,600K	
GOCV	303K	(from sale of PL-480 food donation U.S.)
Direct	634K	
TOTAL	2,537K	

GOALS: Increase income and employment for small farmers and rural workers in the Tarrafal region of Cape Verde.

SUBGOAL: Assist the GOCV in planning and training personnel for the expansion of arable land under irrigation in the Tarrafal area, and the identification and utilization of optimal watershed conservation and irrigated agriculture technologies.

PURPOSE: Provide the GOCV with the equipment, technical assistance and training required for carrying out investigations and planning regarding a proposed 600 ha expansion in land under irrigation in the Tarrafal region.

TYPE OF PROJECT: Planning, research and training for potential irrigation.

TECHNOLOGY USED: Wells, horizontal galleries, bulldozer.

DOCUMENTS REVIEWED: Project paper (90 pages).

PROJECT ORIGIN AND BASE LINE DATA: Planning is based on some limited geological reconnaissance by a French engineering firm, and on a 30 ha irrigated pilot project. However, this project is intended to collect data for future investments.

BENEFICIARY INVOLVEMENT: The project was organized by the personnel of the Ministry of Agriculture.

ACTUAL STARTING DATE: December 1977

LOGICAL FRAMEWORK: not available

PERT CHART: Not available.

GENERAL PROJECT DESCRIPTION

The project will examine the feasibility of a 600 ha irrigation scheme. It is intended to investigate sources of irrigation water, possible cropping methods, and to provide training for Ministry of Agriculture personnel, so that they may conduct such investigations in the future. It is clearly stated that AID makes no commitment toward supporting the actual irrigation project, should that prove feasible.

TECHNICAL

The country is subject to a climate of heavy erosive rains alternating with long droughts. In the project area, about 5% of rainfall goes to groundwater recharge, an amount sufficient to irrigate 150 ha annually. In addition, the groundwater reservoir presently contains enough water to irrigate 450 ha for 20 years, if there is no saltwater encroachment.

About 50 wells will be drilled, with 20 of the later ones being large-diameter production wells. All wells can be used to monitor drawdown and salt intrusion.

In the highlands, horizontal galleries 2 x 2.5 m^2 can be excavated up to 1,000 m into the rock. Construction costs are higher than for wells, but the technology is much simpler and there are almost no operating costs. Flow cannot be controlled and some storage is necessary. Ten gallery sites will be investigated and some excavation made to determine feasibility.

In order to maintain irrigated agriculture beyond 20 years, by conserving more rainfall, a surface storage system is necessary. Optimally, up to 20% of rainfall could be exploited in this way. A professional hydrologist will model runoff in order to better understand surface resources. A sedimentation expert and geologist will be hired to examine dam sites and train GOCV personnel in interpretation of data from a new core-drilling machine. Two dam sites will be chosen and investigated.

Use of terraces and dikes to control erosion and runoff will be investigated by GOCV employees, with some U.S. technical assistance. Other assistance will be provided in agronomy, cultivation, agricultural economics, and irrigation engineering. Finally, 13 man-years of technical training, most of it overseas, will be provided to GOCV personnel.

INSTITUTIONAL

All implementation will be by the Ministry of Agriculture and Water. The Department of Agriculture will be concerned with agricultural technologies, and the Department of Water will be responsible for most project activities, including investigations into hydrological resources, terracing and dikes, dams, etc.

Purchasing will be via contract with the Afro-American Purchasing Center in New York.

SOCIAL

In the future project, 500 ha will be divided among 500 families organized into a cooperative. Land rent and water consumption charges will be at true value. The remaining 100 ha will be used for a government experiment station.

FINANCIAL/ECONOMIC

Annual project costs are given on p. 37 (attached).

PL-480 food sales will cover local contract labor costs and locally procured commodities, totaling $303K.

There is no IRR for the training and investigations project. Future project benefits are estimated at $1,385/ha for bananas, yielding an IRR of 28%. Water costs are estimated to be 7¢/m^3. The B/C for the full project is 1.30, at a discount rate of 15%, assuming that all water comes from wells. If one dam is built, B/C = 1.19, and with two dams, B/C = 1.09.

Fairly detailed project costs for wells, galleries, investigations and training are given on pp. 39-44 (attached).

Table 8
COSTING OF PROJECT OUTPUT/INPUTS
(in thousands of U.S. dollars)

Project Number:
Title Number: Cape Verde - Groundwater Development (Tarrafal)

Project Inputs	Project Outputs[a/] 1	2	3	4	5	6	All Outputs	Totals
AID Appropriations								
(1) Well Exploration Equip. and TA (see descrip.)	981.5							1,001.5
(2) Gallery Equipment		125.5						125.5
(3) Dams, Tunnels and Canals Equip. and TA			69.9					89.9
(4) Terracing and Dikes Equip. and TA				116.8				116.8
(5) Agronomy/ Economics TA					82.5			82.5
(6) Training						130.0		130.0
Contingency							53.8	53.8
Subtotal								1,600.0
GOCV Contributions								
(1) Wells (Labor and Consultants)	57.0							57.0
(2) Galleries (Labor and Consultants)		66.0						66.0
(3) Dams			--					--
(4) Terracing and Dikes (Labor and Consultants)				180.0				180.0
(5) Agronomy/ Irrigation					—			--
(6) Training						65.0		65.0
Land Cost							528.0	528.0
Permanent Staff							41.0	41.0
Subtotal								937.0
TOTAL								1,537.0

a/ 1 = wells; 2 = Galleries; 3 = Dams, Tunnels and Canals; 4 = Terracing and Dikes; 5 = Agronomy/Economics; 6 = Training.

Project Costs, pages 39-44

TABLE 10

BUDGET BREAKDOWN

AID Contribution

(1) Wells

1 drill rig, combination rotary percussion, capable of drilling rotary 12-inch diameter to 1,000 feet, using 3-1/2 O.D. If drill rod, Speedstar 72R or equivalent. Trailer mounted with four hydraulic leveling jacks and diesel engine. Spare parts for two years' operation.	$150,000
1 mud pump, trailer mounted, diesel motor 5 x 8 Gardener-Denver or equivalent. Capable of circulating cuttings in 12-inch hole from 1,000 feet. Spare parts for two years' operation.	22,000
1 water truck, four-wheel drive, with 1,500-gallon water tank mounted for easy removal. Truck must be equipped for towing mud pump or other drilling equipment. Spare parts for two years' operation.	20,000
1 truck, four-wheel drive, flat bed for hauling drill casing, etc. Should be capable of hauling 14,000 lbs. Front winch. Equipped for towing drill rig.	25,000
Casing: 4-inch, 8-inch, 12-inch.	500,000
Initial order: 3,000 ft. - 4-inch 2,000 ft. - 8-inch 2,000 ft. -12-inch	
Drive shoes for casing:	3,000
Initial order: 20 - 4-inch 10 - 8-inch 10 -12-inch	
Rotary bits. Hugdee Tricene or equivalent. Diameters adequate for setting of 4-inch, 8-inch, and 12-inch casing.	25,000
Initial order: Hard rock (basalt) 12 - 6-inch 24 -10-inch 12 -14-inch	

Project Costs, pages 39-44

TABLE 10 (continued)

(1) Wells (continued)

Soft rock (partially decomposed lava, limestone, etc.) 6 - 6-inch 12 -10-inch 6 -14-inch	
3 pickup trucks, 3/4 ton G.U.W. 7,000 4 W.D. with spare parts for two years' operation.	$ 30,000
Drill rod 1,200 ft. 2-3/8" I.F. medium-weight API threads 300 ft. 3-7/8" I.F. heavy-duty API threads 1,200 ft. 3-1/2" I.F. medium-weight API threads 100 ft. 3-1/2" I.F. heavy-duty APO threads	40,000
Subs and couplings for interconnecting various sizes of drill rod and rod to bit.	3,000
2 drill collars--6-inch by 20 ft.	4,000
Assorted tools and equipment for rotary drilling.	10,000
Casing jacks.	3,000
Drilling mud and mud conditioners.	10,000
Percussion bits for drilling holes to set 4-inch, 8-inch and 12-inch casing.	8,000
Percussion drilling tools and equipment, including slotter, undercanvas, casing spears, finishing tools, etc.	12,000
Electric welding equipment and assorted rods, including hard surfacing percussion and rotary bits.	5,000
10 Stevens or equivalent 90-day water level recorders complete with perforated tape floats, counterweights with repair parts, and charts for two years' operation	7,000
10 Stevens or equivalent weekly records complete with tape, floats, weight and spare parts and paper for two years' operation.	5,000
10 electric tapes, 100-meter capacity, marked in 1 and 10 meter increments, with spare parts for two years' operation.	3,500

Project Costs, pages 39-44

TABLE 10 (continued)

(1) Wells (continued)

1 electric logger, Gamma, Resistivity, self-potential, temperature caliper, fluid conductivity capacities. With spare parts and chart papers for two years' operation. Logger and paper must be adapted to metric use. Capable of logging to 300 meters. WIDCO or equivalent.	$ 30,000
1 test pump-deep well turbine to fit in 8-inch casing capable of pumping 400 g.p.m. from 100 meters. Complete with pump column, vertical shaft pump head equipped for flat belt drive. Spare parts for two years' operation.	12,000
1 test pump to fit 12-inch casing, capable of pumping 1,000 g.p.m. from 100 meters equipped as above.	18,000
1 diesel power unit to drive pump, 100 h.p. full trailer mounted.	7,000
Core barrels to cut 3-inch O.D. cores and repair parts.	
2 - 10 foot	3,000
1 - 20 foot	2,500
Diamond bits for core barrels	5,000
Carballoy bits for core barrels	1,000
SUBTOTAL	$ 964,000
Technical Assistance (Wells)	
Drilling advisor from drilling equipment manufacturer for three months assembling and testing equipment and two one-month return visits for advice and training.	37,500
TOTAL Wells	$1,001,500

(2) Galleries

2 air compressors, Ingersoll Rand or equivalent, complete with diesel engines, skid-mounted 7Kg/cm^2, 7m^2/minute, with spare parts for two years' operation and maintenance.	$ 14,000
5 jackhammers and related mining equipment (bits, rods, etc.) adequate for two years' operation and maintenance.	13,000

Project Costs, pages 39-44

TABLE 10 (continued)

(2) Galleries (continued)

Explosives (gelatinite)	$ 10,000
Rail, narrow-gauge, 3,000 meters (to make 1,500-meter track)	30,000
3 ore cars, 6,000-lb. capacity	14,000
Galvanized pipe, 1-1/2 inch, 3,000 ft.	17,000
Truck, 3-ton flat-bed stake body	9,000
Fuel and lubricants	18,000
TOTAL Galleries	$125,000

(3) Dams, Tunnels and Canals

Rotary core drill, diesel-powered, skid-mounted, self-contained mud pump, capable of directional drilling, cat-head winch, derrick, hydraulic feed, with meters for water pressure and volume, spare parts for operation and maintenance for two years' service.	$ 17,000
45 - 10-ft. lengths of size BW drill rod @ $100 each.	4,500
20 - 2-inch diamond bits suitable for drilling fractured basalt @ $250 each.	5,000
2 - 5-ft. double tube core barrels @ $1,250 complete with spare parts for two years' operation and maintenance.	2,500
20 - 2-inch Carballoy kits suitable for drilling decomposed volcanic rock (hardness comparable to limestone) @ $70.	1,400
1 - 10-ft double tube core barrel @ $2,000 complete with kits for maintenance.	2,000
SUBTOTAL	$ 32,400

Technical Assistance (Dams)

Geologist to oversee taking and testing of core samples and preparation of site maps. (3 months)	$ 22,500

Project Costs, pages 39-44

TABLE 10 (continued)

Technical Assistance (Dams)(continued)	
Sedimentation expert to assess the probability of sedimentation accumulation in the reservoirs and means to minimize this. (1 month).	$ 7,500
Surface water runoff expert to develop a stream-flow model and assess implications for dam design. (1 month).	7,500
U.S. parent agency assistance in preparation of two preliminary dam designs based on data collected and assessed above.	20,000
SUBTOTAL	$ 57,500
TOTAL Dams, Tunnels and Canals	$ 89,900
(4) Terracing and Dikes	
Equipment	
1 Caterpillar D-6 with angle dozer.	$ 50,000
1 tractor MF.	10,000
1 trailer.	2,000
1 truck (10-ton).	20,000
Spare parts (15%).	12,300
SUBTOTAL	$ 94,300
Technical Assistance (Terracing and Dikes)	
Soil conservation engineer (erosion control) to study possibilities of controlling soil erosion through plant cover, improved farming techniques, terracing, channelization of rain-fall runoff, dike preparation, etc. (1 month).	$ 7,500
Soils scientist (soil map capacity analysis) to determine the appropriate plant cultures, both in the watersheds and in the proposed irrigation areas (1 month).	7,500

Project Costs, pages 39-44

TABLE 10 (continued)

Technical Assistance (Terracing and Dikes)(continued)	
Hydraulic structures engineer to examine the possibilities for terracing and channelization of water to slow runoff (1 month).	$ 7,500
SUBTOTAL	$ 22,500
TOTAL Terracing and Dikes	$116,800

(5) Agronomy/Economics (All Technical Assistance)

Two short-term consultant teams for 1 month each (5 man-months) plus an additional unprogrammed 6 man-months for follow-up to these investigations.	
Agronomist (irrigation crops specialist) to study the soil fertility analysis done by the previous hydrology resources and soil conservation team and recommend optimal production technology packages for the proposed irrigation sites.	7,500
Agricultural engineer (cultivation methods) to observe traditional cultivation practices and, in light of recommended production technologies, to suggest adaptations in cultivation technology. (1 month).	7,500
Irrigation engineer/hydrologist to observe location of water sources, irrigation sites and proposed cultivation techniques and to design appropriate systems to transport water from sources to field and to apply water to crops. (1 month).	7,500
Technical Assistance for Irrigation Economics	
Agricultural economist to study project input/output data as developed by the Agronomy and Irrigation team. (1 month).	7,500
Agronomist (irrigation crops specialist) to interpret data generated by the Agronomy and Irrigation team and to assist the agricultural economist to carry out the economic analysis (1 month).	7,500
Technical Assistance for Follow-Up	
As yet unprogrammed (6 months)	45,000
TOTAL Agronomy/Economics	$ 82,500

Project Costs, pages 39-44

TABLE 10 (continued)

(6) Training

Hydrogeology	M.S. Degree	$ 20,000
Hydrogeology	Intensive	10,000
Hydraulic Engineering	Intensive	10,000
General Hydrology	Intensive	10,000
Irrigation Engineering	Intensive	10,000
Soil Conservation Engin.	M.S. Degree or Intensive	20,000
Agricultural Engineering (Intermediate Technology)	M.S. Degree	20,000
Project Planning & Analysis	Intensive	10,000
Soils Science	M.S. Degree or Intensive	20,000
TOTAL Training		$130,000

GOCV Contributions

(Estimated - Includes Land Costs, PL-480 Revenues and Direct Costs)

(1) Wells

5-man crews, 60 days per well, 50 wells, @ $3.00 per man-day.	$ 45,000
Two professional hydrologist consultants, one year each @ $6,000.	12,000
SUBTOTAL	$ 57,000

(2) Galleries

6-man crews, 300 days per gallery, 10 galleries, @ $3.00 per man-day.	$ 54,000
Two professional hydrologist consultants, one year each @ $6,000 each.	12,000
SUBTOTAL	$ 66,000

(3) Dams, Tunnels and Canals

SUBTOTAL	Perm staff

Project Costs, pages 39-44

TABLE 10 (continued)

GOCV Contributions (continued)

(4) Terracing and Dikes	
20-man crews, 300 project work days, 10 sites simultaneously @ $3.00 per man-day.	$180,000
SUBTOTAL	$180,000
(5) Agronomy/Irrigation	
SUBTOTAL	Perm staff
(6) Training	
13 man-years in training status at $5,000 per man-year for salaries	$ 65,000
SUBTOTAL	$ 65,000
Land costs (for 200 hectares assumed to be bought under irrigation at GOCV initiative during project period at $1,600 per hectare capitalized value).	$528,000
SUBTOTAL	$528,000
Permanent Staff relating to all the above inputs (25% of time of Department of Water = .25 x $164,945)	$ 41,000
SUBTOTAL	$ 41,000
TOTAL	$937,000

TITLE: Lake Chad Irrigation Agriculture

PROJECT NO.: 677-0001

COUNTRY: Chad

REGION: Africa

KEYWORDS: Polder land reclamation (5); resettlement (3); rural roads (3); health services (3); institution-building (3); pumping (3).

SUMMARY: The project includes four major activities: (a) construction of five dikes to reclaim a polder area of 800 ha for gravity-fed irrigation; (b) strengthening of the Lake Chad Basin Development Organization (SODELAC) by management studies, personnel training, and provision of a mobile road and dike maintenance brigade; (c) research activities, by supporting an experiment station and by surveying the socio-economic status of the local population; (d) an epidemiological survey and health services support.

LOCATION: Bol Prefecture on Lake Chad

CLIMATE: BShw

CROPS: Wheat, sorghum, corn, onions SOILS: Organic

TARGET GROUP: Small farmers (less than 1 ha in polder area)

CONTRIBUTION:

U.S.	$ 6.92 M	grant
	.92 M	Peace Corps
GOC	.65 M	
Other	12.0 M	
TOTAL	$ 20.49 M	

SECTOR GOAL: To achieve self-sufficiency in food crop production and improvement in the social and economical status of small farmers.

PURPOSE: To increase the output of food by small farmers and to transform SODELAC into an effective development institution capable of replicating the present project.

TYPE OF PROJECT: Medium-scale irrigation project with support activities.

TECHNOLOGY USED: Capital-intensive for construction and road maintenance, labor-intensive farming and gravity-fed irrigation.

DOCUMENTS REVIEWED: Project Paper (90 p.).

PROJECT ORIGIN AND BASELINE DATA: This type of project has been carried out in the area since 1900, and other donor groups have parallel projects.

BENEFICIARY INVOLVEMENT: Farmers have adapted well to this type of project in the past.

STARTING DATE: October 1977

LOG FRAME: Not available.

PERT CHART: Not available.

PROJECT DESCRIPTION

The AID grant will finance reclamation of one polder area (800 ha arable); there are adjacent polders being developed by IBRD, IDA, and BADEA for a total of $12M additional. These adjacent polders will receive the benefits of the SODELAC management, maintenance and research activities being financed by AID.

TECHNICAL

A. Polder Development

The Tandal polder area will require the construction of five dikes (180, 75, 90, 150 and 282 m in length, maximum height less than 11 m) with total fill of 260K m^3. Construction will be by dredge, truck and loaders. This will provide 800 ha of arable land. Nine and six-tenths kilometers of concrete-lined primary canal and 28.8 km of PVC pipe or concrete secondary canal will be placed in the area. At the center, a 1.5m deep main drainage ditch will collect water for drainage laterals, and this will be removed by a 1.5 m^3/sec pumping plant. Water will be supplied to farms by gravity at 15 liter/sec.

B. Mobile Maintenance Brigade.

A work brigade will be established for road and polder maintenance for the 12.5k ha or reclaimed land near Bol. It will consist of 10 machine operators, three line supervisors, and 20 laborers. Day to day operations during project initiation will be directed by a resident Peace Corps Volunteer. All 28 polders will receive repairs and improvement, to raise and broaden the crests to a standard dimension. Some areas will be flooded and then drained to leach concentrations of salts from irrigation waters. Also, 20 km of road will receive major maintenance, and all roads given minor maintenance, annually.

C. Research

1. Agronomic research will be carried out on a 20 ha experiment station in the Guini polder. Seed multiplication and the testing of all local crops will be the purpose of the farm. A full-time resident agronomist and full-time socio-economist will be supplied by AID.

2. Research on land and water use will be contracted to ORSTOM, the French governmental research organization which has experience and facilities in the area. Meteorologic and hydrologic data will be gathered, and solutions found for prevention of salinity in the irrigated lands.

3. Although the Tandal polder will use a gravity-fed lake-water distribution system, some experimental low-lift pumped wells will be installed to look for methods of avoiding salinization by groundwater. If this is feasible, old polder sites using groundwater may be reclaimed from saline build-up. Groundwater is the less expensive option in any future projects

4. The socioeconomist will conduct general research on present and changing status of farmers in the lake area.

D. Health Activities

1. An epidemiological survey will determine the baseline levels of disease and health care, attempt to predict future problem areas, and make recommendations to SODELAC concerning steps to control sources of disease. The preliminary survey is now complete, and further follow-up visits are expected.

2. Health services support by AID will include (a) continuous epidemiological monitoring; (b) repair and additions to the local medical facilities, plus purchase of microscopes; (c) a village rural health system consisting of villagers trained as paramedics and midwives, to be established in the area; (d) endemic disease control concepts will be applied to engineering structures (repair of drainage ditches by the mobile brigade).

INSTITUTIONAL

At present SODELAC is charged with both commercial and developmental activities, but they do not distinguish clearly between them, nor do they determine the profitability of their operations. There is an apparent need for reorganization, which will be based on recommendations to be made by an outside consulting firm.

Sixty thousand dollars will provide for out-of-country training. This will be in francophone countries, although some training can be given in Nigeria and at CIMMYT in Mexico. Training will be given to five extensionists, one seed specialist, two agronomists, one accountant, one business administration trainee, and four irrigation specialists.

SOCIAL

The system of polders has been carried out since 1900 by the French and the GOC. Farmers have adapted well to settlement in the new areas, and no significant social problems are foreseen.

Settlers will be chosen by SODELAC on the basis of (a) the number of people in the family, (b) agricultural experience, and (c) ownership of bullocks. Land will be rented for three year periods, and families must agree to certain technical cropping requirements and financial obligations. SODELAC will disk and level the field, and plant the first crop before the arrival of the settlers, who will harvest this first crop and then plant all remaining crops using traditional methods. Small threshers will be available during the harvest, which has a limited time span.

FINANCIAL/ECONOMIC

The annual budget summary follows.

For polders, the B/C on the macroeconomic scale is between .8 and 1.01 depending on which secondary benefits are accounted for. The IRR is 12 percent. Despite these low values, it is felt that the project is the most acceptable investment alternative.

By percentage of total, costs are 10 percent for personnel, 20 percent for commodities (pumps and construction machinery), and 70 percent for construction and local salaries. Overall cost is $5,500/ha, due to high external and internal transportation costs, and to the low level of experience in irrigation and civil works in government agencies.

On the microeconomic scale, by assigning one ha of double-cropped land per family (four to five people), in addition to upland traditional land, it is predicted that each farm will have a net cash flow of $462, compared to $131 on traditional agriculture. SODELAC will have to prepare a fee system applicable to all polders, to pay for project costs and maintenance.

BUDGET TABLE I

Polder Development Component--Annual Costs (000 $)

	Total	First Year	Second Year	Third Year	Fourth Year
Personnel					
Consultants	--	--	--	--	--
Commodities	644.0	400.0	144.0	100.0	--
Pumps Station	480.0	400.0	80.0	60.0	--
Materials	164.0	--	64.0	40.0	--
Other Costs	3,200.0	555.0	703.0	1,332.0	610.0
Salaries	340.0	85.0	85.0	85.0	85.0
Exploitation*	260.0	--	65.0	130.0	65.0
Roads	52.0	13.0	13.0	26.0	--
Leveling	168.0	15.0	75.0	78.0	--
Dikes	300.0	235.0	65.0	--	--
Pumping	80.0	60.0	20.0	--	--
Irrigation					
Headworks	400.0	100.0	100.0	200.0	--
Primary Canals	552.0	47.0	200.0	205.0	100.0
Secondary	840.0	--	80.0	400.0	360.0
Drains	208.0	--	--	208.0	--
Subtotal	3,844.0	955.0	847.0	1,432.0	610.0
Total Cost includes contingencies and 10% for 2nd year, 20% for 3rd year 30% for 4th year and rounding	4,405.0	955	930	1,720	800

*$260,000 to be used as a revolving credit fund.

BUDGET TABLE II

STRENGTHENING OF SODELAC - ANNUAL COSTS
Cost ($000)

	Total	1st Year	2nd Year	3rd Year	4th Year
Personnel	--	--	--	--	--
2 PCVs (work Supt. & Surveyor)					
Commodities	234.8	234.8	--	--	--
Bulldozer D4	52.0	52.0	--	--	--
Loader	40.0	40.0	--	--	--
Tractor & Low Bed	68.0	68.0	--	--	--
Truck	20.0	20.0	--	--	--
Vehicles (4)	32.0	32.0	--	--	--
Surveying Equipt.	8.0	8.0	--	--	--
Hand Tools	8.0	8.0	--	--	--
Site Equipment	6.8	6.8	--	--	--
Other Costs	341.0	--	60.0	111.0	110.0
Salaries + Costs (Works Supt. Topographers 7 operators 10 laborers)	-- 41.0	-- --	-- 10.0	-- 21.0	-- 10.0
Operations (fuel, oil, parts)	300.0	--	50.0	150.0	100.0
SUBTOTAL	575.8	234.8	60.0	171.0	110.0
Total cost including contingencies and 10% 2nd year 20% 3rd year 30% 4th year and rounding.	655	235.0	70.0	205.0	145.0

BUDGET TABLE III

Research Component - Annual Costs

	Costs (000$)				
	Total	1st Year	2nd Year	3rd Year	4th Year
Personnel	296.0	24.0	140.0	132.0	0
Socio/economist (12mm)	120.0	0	60.0	60.0	0
Agronomist (24m)	120.0	0	60.0	60.0	0
Consultants (12mm)	56.0	24.0	20.0	12.0	0
Commodities	159.6	59.6	50.0	50.0	0
Laboratory	8.0	8.0	0	0	0
Farming	14.0	14.0	0	0	0
Vehicles (4)	25.6	25.6	0	0	0
Material	12.0	12.0	0	0	0
Pumps	100.0	0	50.0	50.0	0
Other Costs	912.4	502.6	175.6	99.6	134.6
Houses (4)	204.0	204.0	0	0	0
Utilities	84.0	34.0	45.0	5.0	0
Repair House	40.0	20.0	20.0	0	0
Repair Lab	46.0		16.0	0	30.0
Salaries	112.0	28.0	28.0	28.0	28.0
Operation	226.4	56.6	56.6	56.6	56.6
Travel/Training	40.0		10.0	10.0	20.0
Contracts*	160.0	160.0	0	0	0
Totals	1,368.0	586.2	365.6	281.6	134.6
Total and Contingencies (10% 2nd yr, 20% 3rd yr. 15% 4th yr., and rounded)	1,500	590.0	400.0	340.0	170.0

*SODELAC management study

BUDGET TABLE IV

Health Activities ($000)

	Total	1st Year	2nd Year	3rd Year	4th Year
Personnel	-	-	-	-	-
Commodities	-	-	-	-	-
Other Costs	300.0	-	95.0	105.0	100.0
Hospital Program		-	20.0	15.0	18.0
Health Education Center		-	-	20.0	-
Elimination of Health Hazards		-	10.0	5.0	-
Paramedic Program		-	6.0	12.0	6.0
Service Centers		-	10.0	10.0	20.0
Endemic Disease Control		-	10.0	10.0	20.0
Water Wells		-	20.0	15.0	27.0
Village Rodent Proof Storage		-	4.0	8.0	4.0
Contingencies 10%		-	10.0	10.0	10.0
Subtotal		0	95.0	105.0	105.0
TOTAL COST	340.0	0	100.0	125.0	135.0

Includes contingencies and 10% for 2nd year
20% for 3rd year
30% for 4th year
rounded.

BUDGET TABLE V

SUMMARY TABLE ($000)

Budget by Activity and Year	Totals	Year 1	2	3	4
1. Polder Development	4,405	955	930	1,720	800
2. SODELAC Strengthening	655	235	70	205	145
3. Research	1,500	590	400	340	170
4. Health Activities	360		100	125	135
Total	6,920	1,780	1,500	2,390	1,250

Budget by Category	Totals	1	2	3	4
Personnel	340	25	155	160	0
Commodities	1,090	695	215	180	0
Other Costs	5,490	1,060	1,130	2,050	1,250
Total	6,920	1,780	1,500	2,390	1,250

TITLE: Irrigated Crop Production for Village Farmers

PROJECT NO.: 677-0009

COUNTRY: Chad

REGION: Africa

KEYWORDS: Pumps (3); animal traction (3); small-scale village irrigation (5).

SUMMARY: The project will pump water from the Chari River to a canal system. One hundred and fifty hectares will be irrigated, and farmers will be formed into an association and provided with plows and oxen.

LOCATION: Koundoul

CLIMATE: BShw

CROPS: Sorghum, rice, corn, wheat, vegetables

SOILS:

TARGET GROUP: Small farmers (1.5 ha).

BEGIN: April 1976 END: November 1979 AREA: 150 ha

NUMBER OF FARMS: 150

CONTRIBUTION:

USAID	$ 292.5 K	
SAWS	100.0 K	(Seventh Day Adven. World Serv.)
Farmers	15.0 K	Labor
TOTAL	$ 407.5 K	

GOALS: To increase grain production and farmer income.

PURPOSE: Cash incomes will be increased from subsistence levels to levels where farmers can participate in the cash economy while increasing the available grain supply.

TYPE OF PROJECT: Small-scale irrigation.

TECHNOLOGY USED: Tractors for land clearing and leveling, hand labor.

DOCUMENTS REVIEWED: Project Proposal (28 p.).

PROJECT ORIGIN AND BASE LINE DATA: A similar nearby FAO project will provide technical expertise, and serve as a demonstration to the farmer.

BENEFICIARY INVOLVEMENT: Farmers will contribute labor for canal building.

ACTUAL STARTING DATE: Not available.

COMPLETION DATE: Not available.

LOGICAL FRAMEWORK: Consists of one page attached to the reviewed documents.

PERT CHART: Not available.

TECHNICAL

The project will install two $10,000 pumping plants to feed a canal system. A single clay-lined canal will be constructed through the center of the project. Groups of five farmers will construct secondary canals to their own land.

Plows, bullocks and implements will be given to the participating farmers, one plow per five farmers.

INSTITUTIONAL

Participating farmers will join an association. This will begin informally, and then will be formalized after two and one-half years, when the farmers can decide the direction they wish to follow. Auditing and checking systems will be standard practice.

SOCIAL

There are three tribes in the village. The tribal groupings will be separated into unit subprojects of 50 ha each.

ECONOMIC

A budget is given on pp. 12-13.

No cost/benefit analysis is made.

A representative farm budget is given in Table 5 (attached).

Farm income will increase from $80/ha to $863/ha.

Budget, pages 12-13

Labor contributed by participating farmers (125 days at 80c/day)		$15,000.00		
Two staff members			$84,000.00	
Construction of two hours			42,000.00	
Rent for 6 months			7,000.00	
Tractors				$14,000.00
Plows				3,000.00
Discs				4,000.00
Harrows				4,000.00
Trailers				3,000.00
Two light vehicles				10,000.00
Two pumps				20,000.00
Storage room and office				12,000.00
Draft animals and equipment				
Clearing, leveling and improving 150 ha.			$105,000.00	
Seed and fertilizer			7,500.00	
14% of U.S.A.I.D. and SAWS commitment for contingencies, sprays, fuel, miscellaneous tools and equipment.			47,000.00	
Specific Items:				
tools for shop	$5,000.00			
survey tools	1,000.00			
hand tools	2,000.00			
wheel barrows	2,000.00			
hand sprayer	1,000.00			
fuel	3,000.00			
		$15,000.00	$292,500.00	$100,000.00

BUDGET, PAGES 12-13 (Continued)

Schedule of costs:

Inputs: AID	FY '76	FY'77	FY '78	Total
Personnel	$ 28,000.00	$28,000.00*	$28,000.00*	$ 84,000.00*
Commodities	33,000.00	16,500.00	5,000.00	54,500.00
Land preparation	17,500.00	35,000.00	52,500.00	105,000.00
House rent	7,000.00			7,000.00
House Construction	42,000.00			42,000.00
Total	$127,500.00	$79,500.00	$85,500.00	$292,500.00
Inputs: SAWS	**FY '76**	**FY '77**	**FY '78**	**Total**
Commodities	$ 58,000.00			$ 58,000.00
Construction	30,000.00			30,000.00
Draft animals and equipment	7,200.00	4,800.00		12,000.00
	$ 95,200.00	$ 4,800.00		$100,000.00
Inputs: Chadian				
Land clearing and canal construction	$ 2,500.00	$ 5,000.00	$ 7,500.00	$ 15,000.00

*24 Man Months Two Staff Members

Table 5.

Simulated "Representative" Farm

Crop	Area Cultivated hectares	Average Yield kgs/hec	Expenses	Revenue	Product Use On-Farm (kgs)	Product Use Mar (kgs)
Original Hectarage:						
Millet (traditional-rainy season)	*1.5	500	**--	75.00	750	
Sorghum traditional-dry season) (traditional-rainy season)	*1.0	750	**--	75.00	750	
Additional Hectare:						
Wheat (dry season)	.87	3000	$361.59	$ 600.00		2,61
Potatoes (dry season)	.13	10000	140.34	351.00		1,30
Cotton (wet season)	1.0	3000	185.50	600.00		3,00
			$687.43	$1551.00		
Total	Net Farm Income (2.5 ha)			$1,031.57		
Incremental	Net Cash Farm Income (1 ha)			$ 863.57		

*Land which farmers will continue to work with traditional methods.
**Traditional expenses are essentially labor.

TITLE: Pilot Project for Drainage of Irrigated Land

PROJECT NO: FAO

COUNTRY: United Arab Republic - Egypt

REGION: NE

KEYWORDS: High water tables in the Nile Delta have caused low productivity and even abandonment of land is some areas. The project is intended to study drain types, spacing and materials, feasibility of local tile manufacture, and comparison of hand labor and mechanical drain placement.

LOCATION: 32°E, 32°N

CLIMATE: BWh

CROPS: Wheat, berseem, rice, cotton.

SOILS: Heavy clay

TARGET GROUP: The study is a technical pilot project. The eventual beneficiaries will be those farmers isolated from the main drainage system.

DOCUMENTS REVIEWED: Final Report (50 pp).

TECHNICAL

Six pilot areas were studied and designed. One of these had to be abandoned because of changes in the main drain. At the end of the study, drainage systems were completed for three of the pilot areas, and a fourth area was almost completed, but was delayed by the cropping season.

Installation of drains by machine proved to cost 25% less than by hand labor. It was also more rapid and of higher quality.

Machinery for manufacturing collector drains was bought and installed, and proved successful. However, the tile-making machinery could not be made to work well; as much as 35% of the output was either cracked or too short. It was decided that the equipment was of poor design, and it will be replaced by that of another company. In the meantime, tile drains were obtained locally from other sources.

Although the pilot areas purported to be representative of different conditions throughout the Delta, it was found that the soils are highly varied. Therefore, all future drainage installations will have to be designed individually.

The main difficulties encountered were: inexperienced machine operators, inadequate repair and servicing of machines, inadequate supply of drain tiles due to defective machinery, and delays caused by poor planning of work as related to the cropping season.

INSTITUTIONAL

This was a UNDP Special Fund Project, administered by FAO and the government of the United Arab Republic. Actual management of the project was by a Dutch firm, NEDECO, subcontracted to FAO, in cooperation with the Drainage Investigations Inspectorate of the Ministry of Public Works of the United Arab Republic.

The Drainage Investigations Inspectorate (DII) was responsible for appointing and hiring all workers, providing construction (drainage outlets, roads, buildings), offices, stationery, transport vehicles (three jeeps), transport of all equipment within the United Arab Republic, and O & M of all equipment at government workshops.

SOCIAL

No social analysis was made.

ECONOMIC/FINANCIAL

Yearly cost breakdown is shown on pages 7-9 of the Plan of Operation.

Simplified per-acre costs of manufacture and installation of drain tiles is given on page 8 of the Final Report

Assuming that drainage produces a 10% increase in crop yields, then the cost-benefit ratio is 2.77. Investments are amortized at 5% (1963).

TITLE: Control of Waterlogging and Salinity in the Areas West of the Noubaria Canal

PROJECT NO.: UNDP/FAO EGY/73/048/1/01/12

COUNTRY: Egypt

REGION: Northern Egypt

KEYWORDS: Drainage (5).

SUMMARY: An irrigation project was developed which resulted in a very severe waterlogging problem and salinity. As a result, land is being salinized and some is being abandoned. Efforts are being made to solve the problems but the solutions are costly and perhaps not even practical.

LOCATION: Nile Delta (west side).

CLIMATE: Mediterranean.

CROPS: Alfalfa, citrus, wheat, barley, clover, tomatoes, melons.

SOILS: Medium-textured, predominantly calcareous.

TARGET GROUP: All farmers in the area.

BEGIN: February 1974 END: -- AREA: 80,000 ha.

NUMBER OF FARMS: ?

CONTRIBUTION: Extended several times. Several million US$

GOALS: Optimize productivity from irrigated lands west of Noubaria Canal through the adoption of measures which will control the currently rising water table and increasing salinity.

PURPOSE: The water table is rising because of the initiation of irrigation. The project is to determine methods to control the related waterlogging and salinity problems and to provide an estimate of costs of remedial actions.

TYPE OF PROJECT: Investigation and analysis.

TECHNOLOGY USED: Modern investigating and research methods.

DOCUMENTS REVIEWED: Project proposal and many reports contained in the FAO (Rome) files (more than 500 pages). Of particular interest were Working Papers No. 5 by Malik, "A Preliminary Study of Growing Salinity Hazard of Mechanized Farm Canal."

BENEFICIARY INVOLVEMENT: None.

GENERAL DESCRIPTION

This project is a complicated one to describe. The purpose of the project is to find a solution to what appears to be an almost impossible problem. The irrigation system was developed and the water table was initially 20 meters below the surface. Now it has risen to within one to three meters of the surface, and in fact, in some places it is at the surface. Obviously, this requires a drainage program.

In addition to the general drainage problem associated with the land which is predominantly flood irrigated, there is an even more severe problem. That is the result of the fact that the canals are cut deep below the land surface. The reason the canals are cut below the land surface is because the project's scheme involved pumping water into a canal which was running toward higher land. The canal runs in a deeper and deeper cut until the cut reaches a depth of some 10 meters. The pumping station is then placed on the canal to lift the water above the land surface once more, and the sequence is repeated. This process results in the canals acting as the drains. The result is that water of only 365 parts per million enters the beginning of the canal, while, at the end, the salinity is as high as 4,000 to 5,000 ppm.

Obviously, with very high salinity and a high groundwater table, land salinization is a severe problem. In fact, it is such a problem that lands are being abandoned. The solutions to this are very complex because the systems not only need to be drained, but the drainage water must be taken out of the project area and not allowed to intermingle with the irrigation supply. At present, a reasonable solution to the problem is not apparent. The investigation project is continuing, but the final outcome is still up in the air.

This project probably represents a case where proper initial planning could have been done and the whole difficulty avoided. Perhaps the ultimate solution to the problem will be to totally redo the project, putting in a high-line canal and using the existing canal system as a drainage works. Of course, we do not know that this is the answer, and we have read nothing that would indicate that is the direction in which it should go. We will not endeavor to deal further with the technical and institutional or social aspects of the project, but there are implications along these lines.

TITLE: Water Use and Management

PROJECT NO.: 263-0017

COUNTRY: Egypt

REGION: NE

KEYWORDS: On-farm surveys (5); on-farm testing of pilot projects (5); irrigation district delivery and drainage/hydrologic budget (5).

SUMMARY: Through adaptive research and demonstration, the project will develop and test a program of irrigation water management for later implementation throughout the Nile Valley and
project will work with small farmers in three
to adopt water management practices that increase
production and water use efficiencies, and de-
age problems. A water budget for the irrigation
trict will be made to determine improved delivery
and scheduling procedures.

LOCATION: Mansouria, Sakha, Abu Korkas.

CLIMATE: BWh

CROPS: Maize, cotton, sugarcane, citrus, rice, wheat.

SOILS: Loams, clay loams, sandy alluvials.

TARGET GROUPS: Peasant farmers (1.5 ha).

BEGIN: June 1976 END: 1981 AREA: 4,500 ha.

NUMBER OF FARMS: 3,000.

CONTRIBUTION:		
	USAID	$ 8.036 M Grant
	GOE	4.991 M
	TOTAL	$ 13.027 M

GOALS: To improve the social and economic conditions of the small farmer.

PURPOSE: (a) To develop and demonstrate replicable improved irrigation water management and associated practices that increase agricultural production; and (b) to increase the institutional capacity to develop and sustain improved on-farm water management programs.

TYPE OF PROJECT: Large-scale research and pilot project.

TECHNOLOGY USED: Advanced laboratory methods; field techniques appropriate to the farmer.

DOCUMENTS REVIEWED: Project paper (72 pp).

PROJECT ORIGIN AND BASE LINE DATA: None given.

BENEFICIARY INVOLVEMENT: Pilot projects will be carried out on actual farms.

ACTUAL STARTING DATE: N/A COMPLETION DATE: N/A

LOGICAL FRAMEWORK: Consists of 2 pages attached to the reviewed documents.

PERT CHART: Attached to the reviewed documents.

TECHNICAL

There are three basic components to the project. In Component A, the present on-farm water management practices will be researched to identify the constraints to increased production and efficient use of water. Component B will initiate village programs of soil testing for fertilizer recommendations and improved irrigation practices. Problems requiring further research will be given to the Research Institutes to define solutions as part of their ongoing programs. In the third year, pilot programs will be developed and tested in selected villages. Component C will gather data on the delivery system, to consider improvement in scheduling rotations, and to develop a water budget for the project area.

Component A will involve preliminary and detailed field surveys of water use and efficiency on individual farms, a year-long water course evaluation, a soil testing program on 250 fields in each of three villages, a physical analysis of selected soils and a survey of farm agronomic practices.

Component B will study possible changes in the delivery system (a demand system will be tested), changes in farm irrigation application methods, optimal management methods, salinity balance experiments, fertility experiments, and, finally, would test different proposed solutions on 3,000 pilot fields owned by the farmers

Component C will collect information on the hydraulic system including delivery efficiency, water stored, contribution of different canals to the drainage problem, and will suggest possible changes in water rotation systems.

INSTITUTIONAL

Administration of project activities will be in the Ministries of Agriculture and Irrigation. The Water Distribution Research Institute in the Water Research Center (Ministry of Irrigation), and the Soil and Water Research Institute, in the Agriculture Reseach Center (Ministry of Agriculture) are the designated participating agencies. Both Institutes have research activities throughout the country, with strong central staffs and facilities in Cairo.

SOCIAL

No significant inform ·ion given.

ECONOMIC

A Financial Summary is given on page 42 (attached).

An IRR of 40% is hypothesized for the research activities on the project.

Research solutions, if applied by farmers, should increase farm incomes by 36% for food crops (rice, wheat, corn) and by 18% for sugarcane (which is already quite profitable).

TABLE 2

FINANCIAL SUMMARY FOR THE PROJECT

(in thousands of equivalent US dollars)

(Note: Totals may not add due to rounding)

Item	1st yr		2nd yr		3rd yr		4th yr		5th yr		Total		
	GOE	AID	GOE	AID	GOE	AID	GOE	AID	GOE	AID	GOE	AID	Total
Professional Staff	113	663	206	868	206	970	206	972	206	905	937	4378	5315
Supporting Staff	146	29	266	29	266	29	266	29	266	29	1210	145	1355
Subtotal	259	692	472	897	472	999	472	1001	472	934	2147	4523	6670
Contingencies (10%)	26	69	47	90	47	100	47	100	47	93	215	452	667
Subtotal	285	761	519	987	519	1099	519	1101	519	1027	2362	4975	7387
Inflation (10%, GOE, 8% GOUS)	29	61	109	164	172	285	241	397	317	482	868	1389	2257
Subtotal	314	822	628	1151	691	1334	760	1498	836	1509	3230	6364	9594
Consultants	11	12	11	12	11	12	11	12	11	12	55	60	115
Equipment Purchases	55	311	20	137	14	44	14	44	14	44	117	580	697
Vehicle Purchases	0	180	0	34	0	60	0	10	0	10	0	294	294
Vehicle Operation	45	0	51	0	64	0	64	0	64	0	288	0	283
Training	0	56	0	57	0	57	0	57	0	57	0	284	284
Per diem in Egypt	26	0	57	0	57	0	57	0	57	0	254	0	254
Office Rent and Utilities	22	0	36	0	36	0	36	0	36	0	166	0	166
Other	31	1	29	1	29	1	29	1	29	1	147	5	152
Subtotal	190	560	204	241	211	174	211	124	211	124	1027	1223	2250
Contingencies (10%)	19	56	20	24	21	17	21	12	21	12	102	122	224
Subtotal	269	616	224	265	232	191	232	136	232	136	1129	1345	3474
Inflation (15%,GCE, 10% GCUS)	31	62	72	56	121	63	174	63	234	83	639	327	859
Subtotal	240	678	290	321	353	254	406	193	466	210	1761	1672	3433
TOTAL	554	1500	924	1472	1044	1638	1166	1697	1302	1728	4991	8036	13027

TITLE: PVC Pipe Drainage

PROJECT NO.: 263-0019

COUNTRY: Egypt

REGION: NE

KEYWORDS: PVC pipe drainage systems (5); PVC pipe manufacture (5); land reclamation (3).

SUMMARY: The project will provide drainage on 211,000 ha by (a) construction of three PVC pipe manufacturing plants; (b) importation of 17,600 tons of PVC resin; (c) construction of drainage systems; (d) consulting services; and (e) a bilharzia control program.

LOCATION: Upper Nile

CLIMATE: Bwh

CROPS: Cotton, sugarcane, wheat, maize, sorghum.

SOILS:

TARGET GROUP: All farmers.

BEGIN: June 1976 END: 1982 AREA: 211K ha

NUMBER OF FARMS: 147K

CONTRIBUTION:

USAID	$ 31 M loan
IBRD/IDA	50 M
GOE	202 M
TOTAL	$283 M

GOALS: To promote economic development.

PURPOSE: To halt deterioration of fertility and increase land productivity and total production of food crops and cotton in the project area.

TYPE OF PROJECT: Large-scale drainage project.

TECHNOLOGY USED: PVC factory and drainage trenchers for installation; mostly gravity flow for water removal.

DOCUMENTS REVIEWED: Project Paper (35 pp).

PROJECT ORIGIN AND BASE LINE DATA: IDA has been carrying out similar projects on 420K ha, but has encountered delays and inefficiency.

BENEFICIARY INVOLVEMENT: N/A

ACTUAL STARTING DATE: N/A COMPLETION DATE: N/A

LOGICAL FRAMEWORK: Attached to reviewed documents.

PERT CHART: Attached to reviewed documents.

GENERAL DESCRIPTION

After completion of the Aswan Dam in 1970, Egypt began to experience problems with rising water tables, waterlogging, and increasing soil salinity. This project is designed to counteract these problems. The AID component finances the construction of PVC pipe factories and importation of PVC resin; the World Bank finances the foreign exchange costs of drain installation; and the GOE pays for local costs. The following description is of the entire project, and not just the AID component.

TECHNICAL

1. The AID component will finance the construction of three PVC drainage pipe plants, each consisting of a building, standby power generator, and production equipment including extruder, corrugator and puncher. Seventeen thousand, six hundred tons of resin will be purchased over three years to produce 50,000 km of 80 mm drainage pipe.

The U.S. contractor will supervise the execution of the plants, and provide two engineers per plant for continued O&M over the three-year project life. After three years, the plants will be approaching their maximum estimated economic life, but they could be dismantled and moved if still operable.

2. Drains will be installed on 32 tracts of land (211K ha) in the Upper Nile. Trenching machines will install the PVC drains, as well as 6,000 km of 40 cm cement collector drains. Twelve hundred kilometers of new open drains will be built, and 350 km of existing open drains will be widened and deepened.

3. One drainage pumping station with a capacity of 3.5 m^3/sec will be installed.

4. Seven thousand hectares of former agricultural land will be reclaimed by leaching, subsoiling and gypsum application.

5. A bilharzia control component will be carried out by the Ministry of Health on 50,000 ha. The molluscide Bayluscide will be applied to the canals and drains.

INSTITUTIONAL

The program will be implemented by the Egyptian Public Authority for Drainage projects, an agency of the Ministry of Irrigation.

The EDADP will need to increase its work force by 40 civil engineers, 100 technicians, 12 mechanical engineers and 30 mechanics and electricians.

SOCIAL

The project will require 7M man-days of unskilled labor, and 2.4M man-days of skilled direct labor, as well as 280,000 man-days of labor each year of O&M.

ECONOMIC

The AID component cost estimate is given on page 15 (attached).

The IRR of the full project, with a 35-year life and excluding the bilharzia program, is 27%.

Farm owners will pay the capital costs of the drains, plus 10% administrative charge, by annual installments over a 20-year period in the form of land taxes. About 54% of the total project cost will be recovered from the beneficiaries, at a charge of approximately $45/ha/year.

Cost Estimates for PVC Pipe Production

2.07 Project costs are estimated, as follows:

	Item	Amount
1.	Plant & Equipment	$ 3,150,000
2.	Freight and Insurance	378,000
3.	Erection	330,000
	Subtotal	$ 3,858,000
4.	17,600 tons PVC Resin C.I.F. Alexandria	$16,650,000
5.	Technical Assistance for PVC Pipe Production (10.5 man years x $50,000 per man year x 80% Foreign Exchange)	840,000
6.	Other: Maintenance and Repair; Contractor's Overhead; Contractor's profit and risk	1,544,000
	Subtotal	$22,892,000
7.	Escalation	$ 4,868,000
8.	Physical Contingency	2,780,000
9.	Total Project Foreign Exchange Cost	$30,540,000
10.	Rounded Total	$31,000,000

Price escalation for plant and equipment has been calculated at 10 percent of CIF price; for raw materials at eight percent in 1977 and seven percent in 1978-81. Raw materials requirements for each year were calculated in ratio with the projected production schedule with the first two years combined. Price contingency for technical assistance was based on the foreign exchange cost divided by project period (five years) with 12 percent escalation for 1977 and 10 percent per year for 1978-81.

TITLE: Irrigation Pumps

PROJECT NO.: 263-0040

COUNTRY: Egypt

REGION: NE

KEYWORDS: Irrigation pumps (5); surface irrigation (3).

SUMMARY: The loan will provide for installation of irrigation pumps at 34 sites along the Nile River, comprising 3% of primary pumping facilities in the country. Seventeen pumps will replace old machinery, and 17 will be new installations.

LOCATION: Middle and Upper Nile Valley

CLIMATE: BWh

CROPS: Wheat, cotton, maize.

SOILS: Alluvial.

TARGET GROUPS: Farmers.

BEGIN: FY 1977 END: FY 1977 AREA: 133K ac

NUMBER OF FARMS: 37.7K

CONTRIBUTION:		
	U.S.	$11 M
	GOE	7.184M
	TOTAL	$18.184M

GOAL:

PURPOSE: To increase irrigated agricultural productivity in the project area.

TYPE OF PROJECT: Large-scale installation of pumps.

TECHNOLOGY USED: Large pumping stations (6-360K gpm/station)

DOCUMENTS REVIEWED: Project paper (55 pages).

PROJECT ORIGIN AND BASE LINE DATA: The Ministry of Irrigation has chosen this project to be top priority among those it administers. Louis Berger International carried out the feasibility study.

LOGICAL FRAMEWORK: Not available.

PERT CHART: Attached to reviewed documents.

TECHNICAL

1. Sizing of the pumps was based on fairly complex data and calculations, including cropping pattern, ET, air temperature, wind velocity, water management, and canal losses. In addition, these were compared with actual water requirement tests made in the last few years. The flow required is between 6K and 360K gpm/station.

Of the total of 104 motors and pumps to be acquired, the range of sizes will be kept small to allow standardization: six impeller sizes and 12 motor sizes. All pumps will be housed on concrete platforms over the river, and will be vertical shaft, direct drive, single stage mixed flow types. A spare pump will be supplied at each station for emergency use and spare parts will amount to 15% of pump costs and 10% of motor costs. The schedule provides for eight months of site preparation and eight months of installation and testing.

Weirs are being considered to measure pump flow, although more economical methods will be researched before final construction. Also, it is recommended that pump operators keep better records of operating times, repairs, power consumption and water delivery.

Electricity, rather than diesel fuel, was chosen as a source of energy because an economic analysis showed it to be less expensive when capital and operating costs are combined. Also, electric motors have almost twice the life (30 years) of diesel, and there is considerably stronger maintenance experience in Egypt for electric motors.

2. The sum of $1.76M will be used to improve the pump maintenance workshops of the Ministry of Irrigation. There are already six such shops (three permanent and three floating), and they will be provided with additional equipment such as air compressors, grinding machines, floor cranes, pressers, welders, and test equipment. Also, pickup trucks, flatbed trucks, mobile shops and crew boats will be procured.

3. A U.S. consultant will assist the GOE in writing specifications, evaluating bids and supervising installation of equipment.

SOCIAL

No major social effects are foreseen.

INSTITUTIONAL

Management of the project will be under the jurisdiction of the Mechanical and Electrical Department of the Ministry of Irrigation. Some coordination will be required from the Rural Electrification Authority and the Roads and Waterways Authority in providing local infrastructure. Additional consulting services are budgeted to assist the Ministry in preparation of equipment specifications, evaluation of awards, contract execution and monitoring. These will probably be provided by the firm of Louis Berger International.

The project does not impose any unique problems for the GOE, and no administrative difficulties are foreseen.

ECONOMIC

Costs of the project are shown on page 12 (attached). No IRR or B/C is given. No attempt will be made to amortize the project via a user charge, since this violates traditional practice. However, it can be noted that farmers contribute strongly to the national economy by receiving administered prices for products which are considerably lower than international or true economic prices.

Total annual benefits are estimated to be $9.12M/year. Farm benefits will provide a 25% increase in income to owners (reaching $510/year total income) and a 55% increase to renters (to $287/year.)

CAPITAL COST ESTIMATE

Item	Foreign Exchange (U.S. $)	Local Currency (L.E.)
A. Pumping Stations		
Pumps	2,151,186	331,280
Pump Spare Parts	322,678	30,490
Motors	3,510,913	334,070
Motor Spare Parts	351,090	33,180
Transformers & Switches		341,470
Transformer Mounting		24,090
Discharge Pipe		486,880
Transmission Line		1,481,700
Submarine Cable	694,048	65,560
Pump Platforms		280,500
Site Access Roads		51,000
Measuring Weirs		85,000
Subtotal	7,029,915	3,545,220
B. Support Equipment		
Transport Equipment	867,100	312,590
Spare Parts	130,065	12,290
Shop Equipment	306,665	28,980
Electrical Testing Equipment	74,855	7,070
Subtotal	1,378,685	360,930
C. Consultant Services	350,000	117.000
D. Equipment & Service Subtotal	8,758,600	4,023,150
E. Contingencies		
Physical 10%	875,860	402,320
Price 15%	1,365,540	603,430
f. Total Project Costs	11,000,000	5,028,900

TITLE: East Ghor Canal Extension

PROJECT NO.: 278-0175

COUNTRY: Jordan

REGION: NE

KEYWORDS: Canal system (5).

SUMMARY: The total project consists of a dam on the Zarqa River, a carrier canal to deliver water from the river to the East Ghor Canal, an 11-mile extension of the East Ghor Canal, the construction of laterals for the extended canal as well as some laterals related to an earlier five mile extension, and necessary land-leveling. The extended network will service 5,000 ha in the Jordan Valley.

LOCATION: Jordan Valley.

CLIMATE: Do

CROPS: Wheat, barley, fruit, vegetables.

SOILS: Alluvial.

TARGET GROUP: Local farmers.

BEGIN: 1974? END: N/A AREA: 5,000 ha.

NUMBER OF FARMS: N/A.

CONTRIBUTION:		
	USAID	$11.0M
	Kuwait Loan Fund	15.3M
	GOJ	12.1M
	TOTAL	$38.4M

GOALS: Not given.

PURPOSE: Not given.

TYPE OF PROJECT: Large-scale construction of distribution system.

TECHNOLOGY USED: Highly mechanized.

DOCUMENTS REVIEWED: Capital Assistance Paper (50 pp).

PROJECT ORIGIN AND BASE LINE DATA: The original Ghor Canal (69 km) was financed by AID prior to 1966. The irrigation network design was by NEDECO and Dar Al-Handasah (Beirut).

BENEFICIARY INVOLVEMENT: Low.

ACTUAL STARTING DATE: N/A

COMPLETION DATE: N/A

LOGICAL FRAMEWORK: Not given.

PERT CHART: Not given.

GENERAL DESCRIPTION

The overall cost of the Zarqa Irrigation Project is currently estimated to be $38.4M. Of this amount, $27.4M is required for the construction of the King Talal Dam on the Zarqa River and $11.0M for the irrigation works. It is proposed that the U.S. lend the GOJ adequate funds for the construction of the canal and associated irrigation works, and that Kuwait and the GOJ split the cost of the dam, approximately 60/40 percent, respectively.

TECHNICAL

1. The King Talal Dam on the Zarqa River will have a height of 92.5 m, crest length of 390 m, and a storage capacity of 40M cubic meters.

2. The diversion for the carrier canal is 4.5 km downstream from the dam. The carrier canal, 2.5 km, will deliver regulated releases of the Zarqa River into the East Ghor canal. Capacity of the carrier canal will be 7.5 m^3/sec.

3. The East Ghor Main Canal will be extended approximately 18 km, with a capacity of 11 m^3/sec.

4. The lateral network will carry water to several subareas. The network will contain 60,650 m of secondaries and 484,350 m of tertiary and quaternary canals.

5. Land-leveling to be accomplished under the AID-financed portion of the project includes 1,300 ha adjacent to the previously completed 8 km main canal extension and 3,500 ha adjacent to the 18 km proposed canal extension.

6. In order to reduce the danger of waterlogging, to increase crop yields, and to achieve a higher irrigation efficiency, it has been decided to eliminate night irrigation by the provision of night storage reservoirs. Forty-eight reservoirs will be constructed with capacities varying from 973 m^3 to 28,227 m^3.

INSTITUTIONS

The implementing agency will be the Jordan Valley Commission. The Commission was established by Royal Decree in 1972 with the function of preparing and implementing the plan for development of the Jordan Valley.

SOCIAL

The GOJ, through the JVC, will be expected to carry out the same land distribution and tenure process that was applied in the earlier East Ghor Canal Project area.

ECONOMIC

The benefit/cost ratio is 2.04, applying a 6% interest rate.

No financial expenditure table is given in the CAP.

TITLE: Zarqa Triangle Irrigation Project

PROJECT NO.: 278-0179

COUNTRY: Jordan

REGION: NE

KEYWORDS: Diversion weir (1); gravity-fed sprinkler irrigation (5).

SUMMARY: The loan will assist the GOJ in its program to increase the utilization of farmland in the project area by the installation of sprinklers to replace the existing gravity flow canal system. About 3,718 ac of land will be irrigated as a result of the project.

LOCATION: Zarqa, Jordan Valley.

CLIMATE: Cf

CROPS: Wheat, barley, tomatoes, maize, squash cucumber.

SOILS: Medium to heavy, fertile.

TARGET GROUP: Resident farmers with 3.0-20.0 ha (minimum and maximum) farms.

BEGIN: 1974 END: 1976 AREA: 3,718 ac

NUMBER OF FARMS: Average 3.9 ha

CONTRIBUTION:

USAID	$ 4.5M
GOJ	1.5M
TOTAL	$ 6.0M

GOALS: Not given.

PURPOSE: Upgrading of irrigation facilities in the Jordan Valley.

TYPE OF PROJECT: Large-scale sprinkler irrigation.

TECHNOLOGY USED: Not labor-intensive.

DOCUMENTS REVIEWED: Capital Assistance Paper (90 pp).

PROJECT ORIGIN AND BASE LINE DATA: The Jordan Valley Commission, AID and a Dutch engineering company have all carried out feasibility studies.

BENEFICIARY INVOLVEMENT: Low

ACTUAL STARTING DATE: N/A

COMPLETION DATE: N/A

LOGICAL FRAMEWORK: Not given.

PERT CHART: Not given.

GENERAL DESCRIPTION

Coordination of development assistance in the Jordan Valley has been achieved by an agreement between AID, World Bank, and West Germany to divide the area geographically. The Zarqa Triangle Project is one of several irrigation developments financed by AID in the area. Other projects are centered on other regions (such as the East Ghor Project), or on research and water management techniques.

TECHNICAL

The new irrigation development to be financed under the terms of this loan is briefly described as follows:

1. Diversion structure on the Zarqa River to deliver water to the Zarqa North and South main supply lines;

2. Zarqa Project North -- 2,630 acres sprinkler irrigation located north of the Zarqa River;

3. Zarqa Project South -- 123 acres of sprinkler irrigation located south of the Zarqa River;

4. Zarqa Zor -- 965 acres of sprinkler irrigation located between the Zarqa and the Jordan Rivers. This area will receive its water from a pipeline which will be fed by the existing East Ghor Canal. Since the project utilizes sprinkler irrigation throughout, only very minor land leveling operations will be required;

5. Diversion weir -- the height of the weir will be such as to provide a minimum water level of 135 m to maintain a gravity head of 3 atm in the main supply line, which is sufficient to operate sprinklers in the entire project area;

6. Main Supply Lines -- the main supply line for the north area will have a length of 18.3 km, diameter 800-400 mm and capacity 700 l/sec. The main supply line for the south area will have length 3.3 km, diameter 400-175 mm, and capacity 56 l/sec;

7. Secondary pipelines -- total length of secondary pipelines is 34.0 km;

8. The layout of the sprinkler irrigation system was based on farms ranging in size from three to five ha. A spacing of 12 m by 12 m between sprinklers has been selected, allowing a four hectare farm to be irrigated in six days with 18 moves of the equipment.

Application efficiency will be 66% for surface methods and 85% for sprinklers.

The minimum annual diversion through the canal will be 175 MCM.

Individual drainage problems will be resolved as they develop, on a case-by-case basis.

INSTITUTIONAL

The implementation of the project will be the responsibility of the Natural Resources Authority. Implementation of the project will consist of the redistribution of farmland in the project area, as provided in Law No. 12, and the actual construction phase. Subsequent to completion of the project, the Authority will operate and maintain the system up to and including the meter at the individual farm. Authority personnel will be trained, under AID grant-funded participant training and by other international lenders in the operation and maintenance of their individual systems by Authority and Ministry of Agriculture personnel at the Deir Alla Agriculture Station located in the Project area.

Engineering design and supervision of the construction project, to be funded by the GOJ, will be accomplished by the joint venture of Dah-Al-Handasah and Netherlands Engineering Company.

The JVC will be responsible for:

1. Providing overall policy guidance;

2. Formal issuance of tender documents;

3. Signing of contracts;

4. Establishment of payment procedures; and

5. Certifying payments.

The JFC also will be responsible for all matters pertaining to the preparation of final plans and specifications, the development of bid documents and the bidding procedures.

SOCIAL

The construction techniques will not be labor-intensive, due to the 1.5% unemployment rate in the area.

FINANCIAL/ECONOMIC

No project budget is given in the CAP.

For a 20-year project life, the B/C ratio will be 1.26 at 10% interest, or the IRR will be 12.9%.

In the smallest farm unit, a net income growth of 139% will be experienced.

TITLE: Water Management Technology

PROJECT NO.: 278-0192

COUNTRY: Jordan

REGION: NE

KEYWORDS: Research (5); training (5); sprinkler irrigation (5).

SUMMARY: The proposed project will carry out applied research and farmer training activities to establish an effective irrigation technology on approximately 3,000 small farms in the Jordan Valley. The project is in direct support of irrigation construction and equipment procurement projects covering approximately 9,300 ha.

LOCATION: Jordan Valley (East Ghor Canal Extension, Zarqa Triangle).

CLIMATE: BWh

CROPS: Tomato, beans, cucumber, banana.

SOILS: Alluvial.

TARGET GROUP: Initially, the staff of the University of Jordan, Faculty of Agriculture, and the GOJ Ministry of Agriculture. Secondarily, the farmers installing irrigation systems in the Jordan Valley projects.

BEGIN: FY 1977 END: FY 1980 AREA: 3,000 ha.

NUMBER OF FARMS: 1,000.

CONTRIBUTION:

U.S.	$1.32M	grant (one training expert, one resident expert)
GOJ	1.33M	
TOTAL	$2.65M	

GOALS: To support the GOJ's sector goals of increasing agricultural yields and production, improving farmers' welfare through increased incomes, and increasing foreign exchange earnings.

PURPOSE: Upgrade agricultural productivity in the Jordan Valley by systematically raising the efficiency of water utilization.

TYPE OF PROJECT: Research and training coordinated with research.

TECHNOLOGY USED: Sprinkle and trickle irrigation systems, slides and films, "hands-on" training.

DOCUMENTS REVIEWED: Project paper (130 pp).

PROJECT ORIGIN AND BASE LINE DATA: Project is the research and training component of the very large Jordan Valley projects. Much of the input comes from assessments written by Stevens and Keller.

BENEFICIARY INVOLVEMENT: The Ministry of Agriculture and the Faculty of Agriculture assisted in developing the research and training programs. The training is given to the farmers.

STARTING DATE: September 1, 1977 is a critical date for starting due to cropping season limitations.

PERT CHART: N/A.

GENERAL DESCRIPTION

Approximately 9,000 ha of land are being provided with pressure irrigation water supplies in the Jordan Valley with the intent that most of it will be used for sprinkler irrigation. The Water Management Technology project will develop training methods and materials for introducing the farmers to the new technologies. A complementary research program will adapt the technologies to the Jordan Valley by establishing three new research farms in the area.

TECHNICAL

1. Training. The training program will be carried out in stages. A Core Staff will devise the training materials and these will be tested on the Training Teams (four members each). The Training Teams will first practice their skills on other members of the administrative staff, then finally work with the farmers. In this way, the materials will be well-tested, and all staff members will be familiar with the farmer training. In the field, a Training Team will meet with 18 farmers to give a demonstration. Each Trainer will then meet with six of the farmers to provide hands-on experience. Enough equipment will be provided so that mistakes can be demonstrated (stripped threads, etc.). Ten days later, and at regular intervals, a technician will visit each farmer to provide additional advice.

Forty extension agents and 1,000 farmers will be trained within the first year, and 3,000 farmers by the end of three years.

2. Research. Three new experimental farms will be set up, and an old one incorporated into the system. Possible research areas are:

a. Irrigation and water management (sprinkler use, application to specific crops, optimal water use, greenhouses and plastic mulch);

b. Frost control;

c. Socioeconomic effects;

d. Disease control;

e. Insect management;

f. Fertilizer and salt management;

g. Weed management; and

h. Varietal selection.

INSTITUTIONAL

The Jordan Valley Authority has overall authority for the project, but much of its activity will involve coordinating other agencies: the Ministry of Agriculture, the Faculty of Agriculture at the University of Jordan, and the Jordan Valley Farmers Association.

SOCIAL

Not given.

ECONOMIC

The annual budget summary is given on page 34 (attached). It is estimated that the project will produce within five years a farm income level that otherwise would require 20 years to be realized. Final income is estimated at $4.5-6 OK/owner-operator, an increase of 25%-200% depending on the crop and initial conditions.

For the entire Jordan Valley project, IRR = 13%-17%.

Table 6. Water Management Technology Project, Financial Summary. Costs in $1000.

	Fiscal Year				
	1978[a]	1979[a]	1980[a]	1981[a]	Total
I. US INPUTS					
A. Research Component					
1. Commodities[b]	150.0	--	20.0	—	170.0
2. Personnel					
a. Resident					
man-months funded	12	12	12	—	36
man-months on board	9	12	12	3	36
cost	100.0	100.0	100.0	--	300.0
b. TDY					
Man-months	3	2	2	2	9
Cost @ $8000/mm	24.0	16.0	16.0	16.0	72.0
c. Local administrative					
Man-months	8	12	12	3	35
Cost	4.0	6.5	6.5	2.0	19.0
3. Participant Training					
Man-months	2	6	8	8	24
Cost @ $3800/mm	7.6	22.8	30.4	30.4	91.2
Research Total Cost	285.6	145.3	172.9	48.4	652.2
B. Training Component					
1. Equipment[b]	82.0	--	19.0	--	101.0
2. Personnel					
a. Resident					
Man-months funded	12	12	11	--	35
Man-months on board	8	12	12	3	35
Cost	100.0	100.0	92.0	--	292.0
b. TDY					
Man-months	2	--	2	1	5
Cost @ $8000/mm	16.0	--	16.0	8.0	40.0

TITLE: Doukkala II Irrigation

REPORT NO.: MO-W-1

COUNTRY: Morocco

REGION: Africa

KEYWORDS: Sprinkler irrigation (5); land consolidation (5).

SUMMARY: The project would provide sprinkler irrigation and supporting services for 16,600 ha in the Doukkala perimeter. It would directly benefit a farming population of 20,000 persons. Water would be obtained from the Oum Er R'Bia River in conformity with the Oum Er R'Bia Water Master Plan. To improve the quality of life and create an improved rural environment, the project would also provide village infrastructure.

LOCATION: Doukkala perimeter.

CLIMATE: Bn

CROPS: Wheat, maize, beans, barley, tomatoes.

SOILS: Relatively heavy, suitable for low intensity sprinkle irrigation.

BEGIN: 1977 END: 1982 AREA: 16,600 ha.

NUMBER OF FARMS: 2,500

CONTRIBUTION: Total project costs are estimated at US$121.0 million, with a foreign exchange component of US$46.5 million. The proposed Bank loan (US$41 million) would finance approximately 88% of the foreign exchange costs. The National Agricultural Credit Bank (CNCA) would provide credit for farm development in an amount equal to US$3.2 million, and the government would finance the remaining foreign and local costs (US$76.8 million).

GOALS: At full development, net incremental production would equal DH 64.5 million per annum (US$14.7 million) in economic prices. Increased production would result from adequate and timely irrigation which would:

1. Increase yields;

2. Permit effective application of about 8,600 tons of fertilizer, further increasing yields;

3. Permit introduction of crops (sugar beets, cotton, vegetables, alfalfa, and berseem) which cannot be cultivated successfully under rainfed conditions in the province; and

4. Permit double cropping.

ORMVAD's extension services, input supply, pest, and disease control would facilitate this development, as would the use of agricultural credit and access to markets. The project would increase annual production of main crops as follows: maize - 16,550 tons, sugar beets - 211,750 tons, vegetables - 9,500 tons, cotton - 2,450 tons, milk - 13,600 tons, and beef - 1,550 tons. Incremental production would be for export or for import substitution. At full development, the annual net incremental production value would amount to US$14.7 million. The average annual per capita income would increase from the present low level of US$165 to US$390, compared to a present absolute poverty level of US$195.

TYPE OF PROJECT: Large-scale sprinkle irrigation and supporting services.

TECHNOLOGY USED: Canals, underground concrete pipe, hydrants, pumps, mobile sprinkler laterals.

DOCUMENTS REVIEWED: Staff Project Appraisal, Report and Recommendation of the President.

PROJECT ORIGIN AND BASE LINE DATA: The proposed project was appraised by a Bank mission in October 1976. Negotiations for the proposed loan were held in Washington in March 1977. The moroccan delegation was led by Mr. Oulad Chrif, Director of Construction, MARA.

BENEFICIARY INVOLVEMENT: Operation and maintenance costs will be recovered through water charges. For equity reasons, the amount recovered will be consistent with farmers' ability to pay. For growth reasons, very little will be recovered until after farmers exhause productive investment outlets for their incremental income (about year seven). A betterment levy will be increased to the maximum in order to insure some progressivity.

GENERAL DESCRIPTION

Morocco's Third Development Plan (1973-1977) emphasizes improvement of the trade balance of agricultural products, increased agricultural production and farm income, and reduction in income inequalities. The plan aims to accelerate expansion of areas farmed under irrigation and to intensify investment and services in rainfed areas. The proposed Doukkala II Irrigation Project, along with the adjacent Doukkala I Project, would contribute to the realization of these objectives by producing export and import substitute products in an area with considerable agricultural potential, but constrained by lack of rainfall.

The project would provide sprinkler irrigation on 16,600 ha of presently dry-farmed land for the production of wheat, maize, sugar beets, cotton, and forage for livestock development. Production would serve primarily to substitute for imports. The project would serve 20,000 people for whom per capita income would be increased above the absolute poverty level. It would increase annual labor requirements by 5,400 man-years, and thus reduce migration to urban centers which already have high unemployment rates. The project would consist of four sectors in the Tnine Rharbia subdivision, one sector in the Faregh subdivision, and one sector in the Sidi Smail subdivision. Each sector would be served by its individual pumping station and underground distribution network.

TECHNICAL

The purpose of the project is to provide for the most economical development of irrigation in the main Oum Er R'Bia basin in order to increase agricultural production, a substantial share of which would benefit the poorest members of the population. The project covers an area of 16,600 ha of land presently cultivated under rainfed conditions. The project consists of:

1. Enlargement of the main supply canal over 22 km, construction of about 10 km of feeder canals and installation of automatic flow regulators;

2. Construction of six pumping stations with a total installed capacity of 11,300 kW, each with an elevated equalizing reservoir;

3. Construction of 31 km of 60 kV and 62 km of 22 kV power transmission lines and a substation for pumping stations;

4. Land preparation and consolidation including farm roads, windbreaks and drainage;

5. Installation of 450 km of buried pipe distribution systems, including hydrants, each serving about 16 ha, and associated mobile sprinkler equipment;

6. Construction of main drainage channels entailing about 300,000 m^3 excavation; and

7. Construction of buildings, provision of equipment for extension, operation, maintenance, artificial insemination, and telecommunications between ORMVAD's El Jadida headquarters and the project area.

ORGANIZATION AND MANAGEMENT

The project is part of an ongoing program for which the Regional Agricultural Development Office for Doukkala (ORMVAD) is the primary executing agency. ORMVAD would be responsible for construction, operation and maintenance of the irrigation and drainage works, construction of treated water supply facilities, project buildings and farm roads, provision of extension and other agricultural services, and would supervise construction of the village centers except for the schools. The Agricultural Research Directorate (DRA) personnel serving El Jadida province, with ORMVAD assistance, would be responsible for agricultural research. The Ministry of Education would be the executing agency for construction and operation of schools. The Directorate of Animal Production of the Ministry of Agriculture would advise ORMVAD in implementation of the crossbreeding program. The National Power Authority (ONE) would be the executing agency for the construction of power lines in the project area and the Roads Directorate of the Ministry of Public Works would be the executing agency for construction and improvement of the main road network.

The Project Coordination Committee established under the Doukkala I Loan Agreement, with representation of all government agencies involved in project implementation, would be responsible for project coordination. The committee reviews past achievements and future work programs for each of the participating organizations, and on the basis of experience to date, is expected to adequately coordinate the agencies involved in the project.

A deficiency requiring correction under Doukkala II is the communication between ORMVAD headquarters in El Jadida and the project area. Assurances were obtained that ORMVAD would establish a system of telecommunication between its headquarters and field offices, for which equipment would be provided under the project. In addition, ORMVAD is establishing, under the Doukkala I Project, subdivisional offices in the field for (a) construction, (b) operation and maintenance, and (c) agricultural development. All field

services will be directed from these subdivisional offices. Based on present performance, no organizational or staffing problems are foreseen. Consultants chosen by ORMVAD with the concurrence of the Bank would provide their services for the Doukkala II Project. ORMVAD agreed to retain adequate staff to carry out the project.

ORGANIZATION OF FARMERS AND COOPERATIVES

Following the trend observed in areas already irrigated in the Doukkala, farmers would establish independent service cooperatives to meet their needs for medium and short-term credit, bulk marketing, and co-ownership of equipment (mobile sprinkler equipment). ORMVAD, which has previous experience in the establishment of cooperatives and has an ongoing training program for cooperative managers, would provide assistance to farmers for this purpose. ORMVAD has been effective in establishing milk collection cooperatives over the last four years and would establish and manage four such cooperatives in the Doukkala II Project area.

Following the experience in other irrigation projects in Morocco, farmers would group into Water Users' Associations to organize water allocation. Farmers' water users' associations would select among themselves a representative responsible for equitable allocation of water and to serve as contact with ORMVAD ditchriders. Small farmers' interests are adequately accounted for in these associations.

SOCIAL

All land in the project area which is to be farmed is privately owned. About 78% of the holdings are less than five hectares, 18% between five and 20 ha, and 4% above 20 ha.

Presently, fragmented parcels benefiting from the project would be consolidated as a first step in project implementation. Main objectives of existing legislation are to stabilize ownership patterns and establish viable family holdings by eliminating fragmentation and future subdivision.

ECONOMIC

The project ERR is assumed to be 11.6%. Attached are tables which give a projected farm budget, rent and cost recovery indices, a schedule of activities, and a typical irrigation system layout.

The report also includes some comparisons between the projected streams of economic benefits resulting from sprinkle and surface irrigation.

The 2,700 ha sample area served by gravity irrigation includes 560 farm households (4.82 ha per household), with a population of 3,250. The 1,100 ha area, served by sprinkler irrigation, studied during appraisal, contains 220 farm families (five hectares per family), and 1,320 people. The 1,100 ha were distributed to these families under Morocco's agrarian reform. Not all of the beneficiaries had been farmers, and all began without any farm equipment and livestock. Results of irrigation have been as follows:

	Income Per Hectare		Income Per Capita
	Crop (US$/ha)	Livestock (US$/ha)	Total (US$ Per Capita)
Sprinkler	540	200	620
Gravity	380	185	470
Dry Farming	125	80	170
Poverty Income Level	---	---	196

The present value, discounted at 10% of the stream of economic benefits from sprinkler irrigation, equals US$4,760 per ha, while that from gravity irrigation equals US$3,895 per ha, for a difference of US$865 per hectare. The information available shows sprinkler irrigation to cost US$640 per hectare more than gravity irrigation (measured as a present value discounted at 10%). The incremental benefits of sprinkler over gravity irrigation exceed the incremental cost by US$225, and therefore, sprinkler is economically more desirable. The efficiency of water use under sprinkler irrigation is about 80%, while it is 60% for gravity irrigation in the Doukkala area. Therefore, under sprinkler irrigation, 33% more area can be irrigated with the same amount of water. Therefore, to the US$225 per hectare increment in net benefits under sprinkler, compared to gravity irrigation, should be added the net value of production less costs of sprinkler irrigating, another third of one hectare, equal to US$170 when discounted at 10%.

KINGDOM OF MOROCCO

DOUKKALA II IRRIGATION PROJECT

Procurement[1/]

Item	No. of Contracts	US$ Million[2/]
Category I: Civil Works		
Canals	3	6.7
Pumping Stations	2	4.8
Equalizing Reservoirs	1	5.2
Underground pipe Network:		
Prestressed Concrete Pipes; Supply	1	14.3
Prestressed Concrete Pipes; Laying	1	8.4
Small Diameter Pipes; Supply	1	10.2
Small Diameter Pipes; Laying	1	3.7
Drainage Network and Farm Roads	1	9.6
Classified Roads	4	6.8
Subtotal		69.7
40% Disbursement		28.0
Category II: Equipment		
Mobile Equipment	1	6.0
Electromechanical and Filters	2	3.9
Hydrants	1	3.0
Telecommunication	1	0.3
Operation and Maintenance Equipment	1	0.2
Subtotal	21	13.4
60% Disbursement		8.0
Category III: Consultants		
Foreign Consultants		2.5
100% of Foreign Cost		1.5
Category IV: Unallocated		3.5

1/ All civil works and equipment through ICB
2/ Includes price contingencies.

KINGDOM OF MOROCCO

DOUKKALA II IRRIGATION PROJECT

Farm Budget

A. Crop Operating Costs and Returns Before Labor Costs, Water Charges, and Taxes at Full Development[1/]

Item	Farm Budget 1.6 ha Gross Return	Production Cost	Net Return	Farm Budget 4.0 ha Gross Return	Production Cost	Net Return	Farm Budget 8 ha Gross Return	Production Cost	Net Return
Soft Wheat	900	238	662	2,250	594	1,656	4,500	1,188	3,312
Spring Maize	--	--	--	--	--	--	2,555	553	2,002
Summer Maize	1,752	341	1,411	3,205	639	2,566	2,190	426	1,764
Sugar Beet	2,200	416	1,784	5,500	1,041	4,459	11,000	2,082	8,918
Cotton	--	--	--	2,025	343	1,682	4,050	685	3,365
Watermelon	--	--	--	--	--	--	3,000	372	2,628
Green Beans	--	--	--	--	--	--	--	--	--
Turnips	--	--	--	--	--	--	1,000	117	883
	4,852	995	3,857	12,980	2,617	10,363	28,295	5,423	22,872
Without the Project	1,214	275	939	3,035	687	2,348	6,070	1,374	4,696

1/ Yields are shown in Annex 5, Table 1, quantities of inputs per hectare in Annex 5, Table 3; prices of inputs and outputs in Annex 7, Tables 2 and 3; cropping pattern with and without project in Annex 15, Table 1.

Farm Budget (Continued)

	Farm Budget 12 ha			Farm Budget 24 ha		
	Gross Return	Production Cost	Net Return	Gross Return	Production Cost	Net Return
Soft Wheat	6,750	1,782	4,968	20,250	5,346	14,904
Spring Maize	2,555	553	2,002	5,110	1,106	4,004
Summer Maize	6,351	1,235	5,116	17,082	3,323	13,759
Sugar Beet	16,500	3,123	13,377	22,000	4,164	17,836
Cotton	6,075	1,027	5,048	8,100	1,370	6,730
Watermelon	3,000	372	2,628	3,000	372	2,628
Green Beans	1,000	177	823	1,000	177	823
Turnips	--	--	--	1,000	117	883
	42,231	8,269	33,962	77,542	15,975	61,567
Without the Project	9,105	2,061	7,044	18,210	4,122	14,088

KINGDOM OF MOROCCO
DOUKKALA II IRRIGATION PROJECT
Proposed Rent and Cost Recovery Indices

Item	1,450 1.6 ha Farm	1,250 4.0 ha Farm	500 8.0 ha Farm	140 12.0 ha Farm	150 24 ha Farm	3,490 Total Farm
	(DH million)					
Present Value at a 10% discount rate						
Net Incremental Cash Income	36.7	79.1	56.0	22.4	41.7	235.9
Less Incremental:						
Imputed Value of Family Labor	4.4	11.2	7.4	0.6	0.2	23.8
Imputed Value of Management Services	5.5	11.9	8.4	4.5	8.3	38.6
Cost of Borrowed Capital	2.6	5.2	3.4	1.4	2.8	15.4
Return on Own Capital and Allowance for Risk	10.2	18.1	8.2	3.4	6.9	46.8
Equals Rent	14.0	32.7	28.6	12.5	24.0	111.3
Rent as a Percentage of Net Cash Income (%)	38	41	51	56	58	47
Water and Power Charges	11.5	24.6	19.7	8.3	17.8	81.8
Land Betterment Levy	--	--	2.5	1.6	6.0	10.1
Incremental Income Tax	1.8	5.3	4.0	1.7	2.7	15.5
Total Charges	13.3	29.9	26.2	11.6	26.5	107.4
Rent Recovery Index (%)	95	91	92	93	110	96
Recovery of Cash Income Net of Investment Cost (%)	39	40	50	55	68	49
Public Sector Outlays for Irrigation (Capital, Operation, Maintenance)	31.7	68.3	54.6	22.9	49.2	226.7
Cost Recovery Index (%)	42	44	48	51	54	47

Proposed Rent and Cost Recovery Indices (Continued)

	(DH)					
Farmers Income Per Capita in 1989, at Full Development	950	1,620	2,585	3,490	5,000	—
Poverty Level 1976	—	—	—	—	—	855
Estimated Critical Consumption Level in 1989 (1.5% Growth p.a.)	—	—	—	—	—	1,040
National Per Capita Income, 1976	—	—	—	—	—	2,080
Estimated National Per Capita Income, 1989	—	—	—	—	—	3,250
Relative Farmer Affluence; Before, After Project	d1 to d1	d1 to d2	d2 to d2	d2 to d3	d3 to d3	

d1 = below poverty level
d2 = between poverty level and national per capita income
d3 = between national per capita income and twice national income

KINGDOM OF MOROCCO

DOUKKALA II IRRIGATION PROJECT

Cropping Patterns and Cultivated Hectares

Item	1.6 ha Farm	4 ha Farm	8 ha Farm	12 ha Farm	24 ha Farm
			(ha)		
With Irrigation					
Alfalfa	0.4	1.0	1.0	2.0	4.0
Soft Wheat	0.4	1.0	2.0	3.0	9.0
Summer Maize	0.8	1.5	1.0	2.9	7.8
Sugar Beet	0.4	1.0	2.0	3.0	4.0
Green Peas	--	--	--	0.5	0.5
Turnips	--	--	0.5	--	0.5
Spring Maize	--	--	1.0	1.0	2.0
Berseem	--	--	2.0	2.0	3.0
Cotton	--	0.5	1.0	1.5	2.0
Melon and Watermelon	--	--	1.0	1.0	1.0
Barley Peas	0.4	0.5	--	--	--
Cropping Intensity (%)	150	137	143	140	137
Without Irrigation					
Durum Wheat	0.6	1.5	3.0	4.5	9.0
Barley	0.6	1.5	3.0	4.5	9.0
Spring Maize	0.2	0.5	1.0	1.5	3.0
Beans and Peas	0.2	0.5	1.0	1.5	3.0
Cropping intensity (%)	100	100	100	100	100

Hectares Cultivated Under Each Crop at Full Developme

	1,450	1,250	500	140	150	
Item	1.6 ha Farm	4 ha Farm	8 ha Farm	12 ha Farm	24 ha Farm	3,490 Farm
			(ha)			
Alfalfa	580	1,250	500	280	600	3,210
Soft Wheat	580	1,250	1,000	420	1,350	4,600
Summer Maize	1,160	1,875	500	406	1,170	5,111
Sugar Beet	580	1,250	1,000	420	600	3,850
Green Peas	--	--	--	70	75	145
Turnips	--	--	250	--	75	325
Spring Maize	--	--	500	140	300	940
Berseem	--	--	1,000	280	450	1,730
Cotton	--	625	500	210	300	1,635
Melon and Watermelon	--	--	500	140	150	790
Barley Peas	580	625	--	--	--	1,205
Total	3,480	6,875	5,750	2,366	5,070	23,541

TITLE: Niamey Department Development Phase I

PROJECT NO.: 683-0205

COUNTRY: Niger

REGION: Africa

KEYWORDS: Integrated area development (3); lowland marsh irrigation(5); sprinkle irrigation (3); trickle irrigation (3); hand-pumped irrigation water (5).

SUMMARY: The project is the first two-year phase of an integrated rural development project designed to improve the agricultural production, net income and quality of life of 57,000 farm families in the Department of Niamey. Starting in three priority development areas (40 villages each), the project will develop the government's infrastructure and organizational capabilities necessary to introduce and test simple innovations which are acceptable and profitable to small farmers. A credit and cooperative structure plus agricultural advisory services will be installed to deal with the 120 villages in the priority areas and finally in the 550 villages in the total project area. Demonstrations and experimentation will take place in the areas of dry land food crop production, irrigated cultivation, livestock production, soil and water conservation, and appropriate village level technology.

LOCATION: Niamey, Quallam, Filingue

CLIMATE: BShw

CROPS: Millet, sorghum, niebe.

SOILS: Tropical ferruginous and humic river bottom.

TARGET GROUP: Rural villagers.

BEGIN: 1977. END: 1979 AREA: 231,000 ha.

NUMBER OF FARMS: 38,480.

CONTRIBUTION:

USAID	$1.866M grant
GON	1.852M
TOTAL	$3.718M

GOALS: The strengthening of the agricultural sector in Niger, the increase in domestically produced food grains, and an increase in export revenues.

PURPOSE: (1) Establish the necessary infrastructure and the technical and operational capability at the Department, Arrondissement and Village level to implement the major production-oriented portion (Phase II) of the project; and (2) establish the detailed plan for Phase II of the project so that the requisite activities can continue uninterrupted and without loss of momentum and interest on the part of the participants at all levels.

TYPE OF PROJECT: Preparation of infrastructure and research for large-scale project.

TECHNOLOGY USED: Low-level.

DOCUMENTS REVIEWED: Project paper (120 pp) and Technical Annexes (120 pp).

PROJECT ORIGIN AND BASE LINE DATA: Similar regional development projects are underway in four regions, financed by FED, FAC, and IBRD.

BENEFICIARY INVOLVEMENT: Villagers will provide much of the direction for development in their areas.

LOGICAL FRAMEWORK: Attached to reviewed documents.

PERT CHART: Not available.

GENERAL DESCRIPTION

The project will be divided into two phases. The first phase (two years) will have the character of building up the organizational and technical capabilities within the project zone, testing new technologies and methods of intervention and putting into place a basic infrastructure as well as performing the studies necessary for planning the second or major implementation stage (four years) of the project.

The major components of the project are:

1. Capacity of the GON developed at the Departmental and Arrondissement levels to plan, manage, and implement an integrated development effort that takes account the constraints and potentials for improved agricultural production within various localities of the project zone;

2. A system of cooperatives and village mutuals established in the project zone which expands local organizational, technical, and financial capabilities for improving agricultural production as well as solving locally identified problems;

3. An agricultural production support system developed and functioning in a way that farmer supplies and services are provided on a correct and timely basis;

4. Strategies developed for improving livestock production;

5. A village level soil and water conservation program developed, tested and introduced to counter the problems of soil erosion and exhaustion;

6. Improvement of the social and economic infrastructure in those areas of the project zone where this is a major constraint to improved production;

7. Appropriate village technology, including animal traction, developed and tested to increase the efficiency and profitability of farm operations; and

8. An information system established to monitor project inputs and outputs, to evaluate the effects of the project on farm family production and income as well as the overall development of the project zone, and to diagnose why various activities have (or have not) been successful.

TECHNICAL

During the first phase, trial experiments will be conducted with low-cost irrigation systems and appropriate crop technologies. The PP team's irrigation specialist has identified five low-cost systems which could be tried on an experimental basis: two systems which use local materials and three which require imported equipment. It will also be necessary to determine whether there are alternative designs for wells using local materials and more village labor.

In the second phase, the successful systems will be replicated on a larger scale. Long-term technical assistance by both a village irrigation specialist and production agronomist will probably be required. Also, for the second phase, funding has been programmed for the purchase of irrigation equipment, the construction of wells, and the preparation of marshland areas.

Annex E of the PP contains a 60 page, in-depth feasibility study of the irrigation component of the project.

The first phase of the soil and water conservation component will be purely experimental, aside from the provision of minor support for the expansion of the Gao tree-planting project. An American soil and water conservationist with experience in the development of village level programs will work with the Water and Forestry Service on a study to determine what interventions can be introduced and carried out by village groups. After determining the potential interventions (catchments, drainage ditches, windbreaks, shrubbery, and tree planting, woodlots, etc.), the Water and Forestry Service and the conservationist will select three villages to conduct the initial experimentation. They will work with village leadership to develop and implement a land use and conservation program.

INSTITUTIONAL

The project will be implemented through the Department Developmental Committee (COTEDEP) and the three Arrondissement Development Committees (COTEARS). The Minister of Rural Development will have direct policy responsibility and the Union Nigerian de Credit et Cooperative (UNCC) will have direct supervisory responsibility.

SOCIAL

The project is highly dependent on successful modification of the villagers' traditional practices. Much effort and expenditure is being devoted to researching the best means of introducing change and educating the villagers.

Several approaches will be tried. First, there will be various farmer training programs carried out through the village mutual and cooperative structure. Second, the project will determine the potential of working through existing groups: the youth groups, the primary schools and teachers, and informal women's groups. Third, the project will use various rural communications methods. With the presence of television in the project area, there is a unique opportunity to see how programs on improved health or agriculture practices will affect farmer behavior. Radio and mobile audio-visual units will also be tried.

ECONOMIC

A project budget is given on page 56 (attached).

A detailed economic analysis is given on pp. 74-87, but the results are not presented in terms of benefit-cost ratio, or internal rate-of-return, and so are not easily compared with other projects.

SUMMARY COST ESTIMATE -- FIRST PHASE

Project Inputs	First Year			Second Year			Total			
Source	AID	GON		AID	GON		AID		GON	
References	FX	CP	LC	FX	LC	LC	FX	LC	CP	LC
Technical Assistance--Long Term	165	--	--	165	--	--	330	--	--	--
Technical Assistance--Short Term	216	--	--	160	--	--	376	--	--	--
Training	20	65	64	10	108	77	30	108	65	141
Commodities and Equipment	171.6	98.5	105	42.3	111.5	405	213.9	111.5	98.5	510
Other Costs										
Infrastructure	--	161.3	20	--	101	20	--	101	161.3	40
Personnel	--	26.9	134.9	--	52	156.7	--	52	26.9	291.6
Programs	60	112	65	65	141	72.8	125	141	112	137.8
Operational	7	132.6	6.5	--	140.9	16.5	7	140.9	132.6	23
Subtotal	639.6	596.3	395.4	442.3	654.4	748	1081.9	654.4	596.3	1143.4
Inflation Factor	--	--	--	31	98.2	112.4	31	98.2	--	112.4
TOTAL	639.6	596.3	395.4	473.3	752.6	860.4	1112.9	752.6	596.3	1255.7

Note: GON contribution includes resource commitment by local population
GON inflation rate is calculated at 15% compounded.
US inflation rate is calculated at 7% compounded.

TITLE: Casamance Regional Development

PROJECT NO.: 685-xxxx

COUNTRY: Senegal

REGION: Africa

KEYWORDS: Regional development (5); saltwater intrusion (5); farm credit (5); polders (3).

SUMMARY: This project is designed to provide the capital and institutional infrastructure necessary to increase and market food crop production in the Casamance. It will initially be a five-year effort to provide:

1. Support to the regional development organization (SOMIVAC) which will plan and coordinate development in the whole Casamance area;

2. Establish a program management unit (PRUSAIDBAC) to implement a program of integrated development activities in the Lower Casamance;

3. Rice and maize research, development and reproduction of improved seeds, and dissemination through a well-conceived extension program of recommended cultural practices and agricultural inputs, including intermediate technology equipment;

4. A survey of surface and subterranean water resources of the Casamance watershed which is necessary as a basis for the long-term development of large areas of currently unused lands particularly in Lower Casamance;

5. A village-level credit system for small farmer groups, including youth and women's associations;

6. Improvement of the farm-to-market road system; and

7. Community development activities in the Lower Casamance.

LOCATION: Casamance River Basin.

CLIMATE: Aw.

CROPS: Rice, maize, groundnut

SOILS: Gray soils, deep water rice soils.

TARGET GROUP: Small farmers (three to five hectares).

BEGIN: 1978 END: 1982

CONTRIBUTION:

USAID	$28.043M	grant
GOS	11.241M	
TOTAL	$39.284M	

GOALS: To assist Senegal in its efforts to become self-sufficient in food production by increasing agricultural production in the Casamance, while placing maximum concentration on social and economic equity.

PURPOSE: To provide the capital and institutional infrastructure necessary to increase and market food crop production in the Casamance.

TECHNOLOGY USED: Not clear.

DOCUMENTS REVIEWED: Project Review Paper (50 pp plus 150 pp annexes).

PROJECT ORIGIN AND BASE LINE DATA: Both IBRD and FED have agricultural production projects in the area.

GENERAL DESCRIPTION

The overall developmentof the three parts of the Casamance will be carried out as a multidonor effort, tied in with Four-Year Plan priorities. Existing projects and institutions will be integrated into the regional development as necessary. The AID grant will contribute to the following components:

1. Support SOMIVAC (Societe de Mise en Valeur de la Casamance) SOMIVAC was created in July 1976 to serve as a regional development agency, corresponding to an ecologically homogeneous zone, and responsible for overall development of the Casamance and for coordinating donor activity within the region.

SOMIVAC will be leanly staffed as it is not an implementing agency and will not require the heavy bureaucracy of a field staff. Its personnel requirements will rather be for a small group of technical and planning experts. AID has been requested to provide some of the initially required expatriate staff and to finance higher training for Senegalese to eventually take over their functions. The proposed expatriate staff will include a hydraulic engineer, an agricultural economist/planner, an information specialist, an accountant, and short-term consultants. AID would finance six Senegalese for three-year training to the M.S. level in the U.S.

2. Create PRUSAIDBAC (Project Management Unit for Rural Development in the Lower Casamance), the agency with responsibility for implementation of development in the lower one-third of the project area. Its duties will include:

a. Creation of an intensive and efficient field level extension service;

b. Creation of a rural works division in order to prepare, construct and maintain small hydro-agricultural improvements;

c. Provide seasonal and medium-term credit, mainly for rice production, to farmers and youth associations;

d. Provide primary marketing channels for rice, and possibly later for other farm or fisheries production;

e. Encourage the introduction of laborsaving equipment, including animal traction, carts, threshers, and small rice mills; and

f. Improve rural access by improving feeder roads, and introduce motorized water transport.

It is proposed to provide three expatriate consultants: one agronomist/extension specialist, one hydrological engineer, and one credit and cooperative specialist.

3. Support for Agricultural Production. This will include:

a. Improved rice production, by means of better water control and management, research on local soils, a new rice extension service with improved varieties and fertilizers, credit and training, newly-designed small equipment for farmers;

b. Development of 1,000 ha of rice on several irrigated perimeters; and

c. Construction of a seed multiplication and research farm in the Kolda Department.

4. Finance planning for water resources development. Between 50,000 and 100,000 ha of land are suitable for rice cultivation in the Lower Casamance. First, however, a comprehensive integrated plan for utilization of the water resources must be developed. Such a plan would start with an extensive data collection program to fill the gaps of existing data and would include topographic mapping, soils classification, hydrological and groundwater studies. AID inputs would include funds for engineering studies and investigations to select and determine the technical and economic feasibility of developing several small polders.

5. Develop a system of small farmer credit. The present government credit bureau, ONCAD, is ineffective in reaching individual farmers or those not growing rice. This project component would develop a system of credit, probably built around village credit unions, which would be available for most types of investment needs, and for innovative individuals and groups, including youth groups and women's associations.

6. Repair and construct a system of feeder roads. Currently rural travel is severely hampered in the dry season by the condition of roads which are little more than tracks, and in the rainy season, many of these roads are impassable. At the present state of development, the roads cannot be justified on economic grounds, but in the longer term, they are a necessity. The total mileage of road improvements suggested is 551 km.

With the multitude of waterways available, it would seem desirable to consider the feasibility of developing water transport. This would be a function of the SOMIVAC studies bureau when it is established.

7. Provide preventive health care. The PRP design team did not include a rural health specialist and no specific health activities are recommended in the PRP. The PRP reserves $2 million for financing rural health care in the Casamance.

ECONOMIC

A summary cost estimate is given on page 39 (attached).

The costs of developing irrigated perimeters are given on page F-23 (attached). An initial estimate of the B/C ratio is 1.0 at 12% interest rate, but is believed that this can be improved if better rice yields are considered.

Table VI-1

VI - FINANCIAL PLAN

Summary Cost Estimate
(U.S. $000)

	AID		GOS		TOTAL		
	FX	LC	FX	LC	FX	LC	TOTAL
1. Somivac	1110	750 2860	—	4900	1110	5650	6760
2. Lower Casamance project: organization and operations	1073	2999	—	1100	1073	4099	5172
3. Agricultural research and seed multiplication	427	1372	—	1100	427	2472	2899
4. Irrigated perimeters at Kolda	933	1769	--	500	933	2269	3202
5. Water resource use	2650	610	—	300	2650	910	3560
6. Small farmer credit	163	1463	--	200	163	1663	1826
7. Feeder roads	1000	2000	—	400	1000	2400	3400
8. Prevention Health Care	500	2000	—	--	500	2000	2500
9. Community development	85	300	—		85	300	385
Total, base cost	7941	13263 21204	--	8500	7941	21763	29704
Contingencies (15%)		3181	--	1275	1191	3264	4456
		24385		9775	9132	25027	34160
Inflation Factor (15%)		3658	--	1466	1370	3754	5124
Total		28043	—	11241	10502	28781	39284

TITLE: Small Irrigated Perimeters (Bakel)

PROJECT NO.: 685-0208

COUNTRY: Senegal

REGION: Africa

KEYWORDS: Flood control dikes (3); pumps (3).

SUMMARY: The project will finance the expansion of an existing "grassroots" project to provide flood control dikes, pumps, and land clearing for small (less than 100 ha) village irrigation systems. Approximately 1,800 ha in 23 villages will be irrigated. In addition, the project will provide health surveillance and services to the villages.

LOCATION: Bakel, on the Senegal River.

CLIMATE: BShw.

CROPS: Rice, sorghum, maize.

TARGET GROUP: All farmers (and family members) in the chosen villages who are willing to participate.

BEGIN: FY 1977 END: FY 1982 AREA: 1,800 ha.

NUMBER OF FARMS: 31K population.

CONTRIBUTION:				
	US	$5.859M	US	One Peace Corps volunteer
	GOS	2.132M		Seven man-years technical assistance
	TOTAL	$7.991M	Farmers	164K labor

GOALS: To maximize utilization of water resources, in order to increase food production. To ameliorate the problem of emigration.

PURPOSE: To introduce the technologies of irrigated culture in 23 villages along the Senegal River in the Bakel area and to demonstrate the feasibility, both technically and economically, of irrigation in the area.

TYPE OF PROJECT: Small-scale irrigation projects.

TECHNOLOGY USED: Pumps, heavy equipment for dikes, canals, and laterals built by hand.

DOCUMENTS REVIEWED: Project paper (120 pp), log frame not available.

PROJECT ORIGIN AND BASE LINE DATA: Initial work began with a farmer's request for assistance; Centre International du Development Rural worked for two years in the region on 115 ha of prototypes of this project.

BENEFICIARY INVOLVEMENT: Farmers initiated project concept, and will be involved in land clearing, construction, and all operation and maintenance of the systems.

COSTS

Cost per Hectare to Develop Perimeters

Perimeter Items	Cost per Hectare in Dollars
Perimeters:	
Topographic surveys	30.
Soil surveys	25.
Tree and shrub removal, leveling, terracing, canals, dikes, concrete	1000.
Pump[1/] (on basis of one for 15 hectares)	415.
Pipes	75.
Spare parts	125.
Contingencies	260.
Subtotal	1930.

Cost of Developing Perimeters

Considering perimeters ready for development after surveys are made: 225 hectares, divided as follows:

180 hectares in rice	Subtotal	347,400.
45 in corn or other crop	Subtotal	86,850.
	(a) Total	434,250

Cost of Developing Potential Perimeters

Land adjacent to perimeters listed above,

775 hectares	(b) Total	1,495,750
Combining (a) and (b) above	Total	1,930,000

GENERAL DESCRIPTION

The project concept was formed when a local farmer asked CIDR (Centre International du Developement Rural), a French volunteer organization, to help him. CIDR worked in the area for two years, building very simple irrigation systems with great success, with financial support from War on Want, OXFAM, and AID. AID now believes that the same approach can be multiplied to many more sites.

TECHNICAL

The project will build small (30-50 ha) irrigation systems on 1,800 ha along the Senegal River and tributary sources of water. Water will be pumped by 170 m^3/hr pumps. The GOS Societe de Amenagement et Exploration des Terres du Delta (SAED) will arrange for the land to be bulldozed clear of stumps and given rough leveling, and for two-meter flood protection dikes when necessary (70% of systems). The villager will organize themselves into work crews to carry out the final land leveling and canal construction.

A small field trial station will be established to test crop packages before presentation to the farmers.

Also, a health component will provide for continuous health surveillance of the villages, using the GOS Antimalarial Service, and will provide some medical supplies to local dispensaries.

INSTITUTIONAL

The technical design and implementation will be under the charge of SAED, which is already experienced in large-scale project management. In addition, project management will be by SERDA, an offshoot of CIDR, the French volunteer organization which first introduced the small irrigation systems in the area. A waiver will be required to permit contracting a non-U.S. group.

SOCIAL

There appears to be a natural formation of farmer groups to carry out the work. These groups of 75-100 people choose a leader and then are broken down into work teams of eight to 10 people under a team leader. All members of the village, including women, appear to work well in this context.

FINANCIAL/ECONOMIC

The annual budget is given on page 89 (attached).

Contingencies are set at 15% and inflation at 12%.

The project shows an IRR of 26%, assuming total crop loss one year in five.

It is estimated that farm income will increase from $0.15 per person/day to $0.29 on irrigated areas. (However, irrigated crops are seen only as a supplement to normal dryland farming, at least for the present).

Direct costs are $1,500/ha and total costs (including administration) are $3,500/ha.

Farmers are expected to amortize the pump cost, so that pumps can be replaced in seven years, at a rate of $170/ha/year. In addition, fertilizer costs are estimated at $280/ha. Total income for double-cropped land is estimated at $1,000/ha.

Project Paper - Pages 89-92

BUDGET
Total Project Costs, Table 3.F.1
1977-1980

	Total	Dollars Costs	Local	USAID Dollars Costs	USAID Local	USAID Total	GOS Dollars Costs	GOS Local	GOS Total
1. a. Central Infrastructure Construction									
Houses 4 @ 60.000	240		240		240	240			
Office 1 @ 60.000	60		60		60	60			
Shop 1 @100.000	100		100		100	100			
Warehouse 1 @100.000	100		100		100	100			
a. Total Construction	600		600		600	600			
b. Equipment									
3 landrover @ 12.000	36		36		36	36			
3 Peugeot 404 @ 5.000	15		15		15	15			
1 Peugeot 504 @ 10.000	10		10		10	10			
3 Trailers @ 2,000	6		6		6	6			
1 5-T truck	17		17		17	17			
1 10-T truck	25		25		25	25			
2 small boats	5		5		5	5			
2 large boats	12	12		12		12			
10 Mobylettes	8		8		8	8			
Office equipment	5		5		5	5			
Shopt tools	20		20		20	20			
Spare Parts (25%)	33		33		33	33			
1. Total	792	12	780	12	780	792	-0-	-0-	-0-
2. Farm Infrastructure									
a. Pumps 75 @ 5,500	412	309	103	309	103	412			
Pumps Equip @ 2,500	213	107	106	107	106	213			
Parts (25%)	167	-0-	167	-0-	167	167			
a. Total Pump. Equip.	792	416	376	416	376	792			
b. Construction									
Dikes	950		950		950	950			
Mech. Clearing (D-6 bulldozer)	120	120		120		120			
Spare Parts	30	30		30		30			

Budget Continued

	Total	Dollars Costs	Dollars Local	USAID Dollars Costs	USAID Local	USAID Total	GOS Dollars Costs	GOS Local	GOS Total
Discing 1781 @ $35	63		63					63	63
Land Clearing	62		62					62	62
Hand Construction	100		100					100	100
Cement Structures	64		64		64	64			
Culverts	50		50		50	50			
b. Total Construction	1439	150	1289	150	1064	1214		225	225
c. Tools & Equipment									
Hand Tools	4		4		4	4			
46 Animal Traction @ $500	23		23		23	23			
50 ox carts @ 100	5		5		5	5			
50 threshers @ 100	5		5		5	5			
c. Total	37		37		37	37			
Rotating Fund									
d. Farm Annual Supplies									
Fertilizer	75		75					75	75
Other	89		89					89	89
Water Cost (Annual)	190		190					190	190
d. Total	354		354					354	354
e. Village warehouses 24 @ 6,250	150		150		150	150			
2. Total	2772	566	2206	566	1627	2193	-0-	579	579
3. Technical Inputs									
a. Staff									
T.A. 7 yrs @ 35,710/gr	250		250		250	250			
Senegalese	172		172					172	172
a. Total	334		334		162	162		172	172
b. Studies									
Topographic @ $90/ha	160		160		160	160			
Evaluation	50	25	25	25	25	50			
b. Total	210	25	185	25	185	210			
c. Training									
Materials	10		10		10	10			
Visitations (Senegal)	15		15		15	15			
Total	25		25		25	25			
3. Total	657		632		460	485			

Budget Continued

	Dollars			USAID			GOS		
	Total	Dollars Costs	Local	Dollars Costs	Local	Total	Dollars Costs	Local	Total
4. Administrative Operations									
Gas, Oil, Utilities	200		200					200	200
Parts and Maint.	70		70					70	70
4. Total	270		270	-0-	-0-	-0-	-0-	270	270
5. Misc.									
a. Field Trial Station									
Construction	20		20		20	20			
Storehouse	12		12		12	12			
Fence	4		4		4	4			
Cement, Culverts, etc.	5		5		5	5			
Pump	10	10		10		10			
Small tools	3		3		3	3			
Personnel									
Technician	13		13					13	13
6 Workers	45		45					45	45
6 Guard	9		9					9	9
Ag Inputs	15		15					15	15
a. Total	135	10	126	10	44	54		82	82
b. Capital charge for rotating fund for 2d above	73		73					73	73
5. Total	209	10	199	10	44	54	-0-	155	155
6. Health									
Surveillance									
1. Local data collection	125		125		125	125			
2. Consultants	150	150		150		150			
3. Misc. Equip. (vehicle)	20		20		20	20			
Health Services									
1. Nurses retrain (12)	6		6		6	6			
2. Equip. for disp. (12)	24	24		24	24				
3. Train. Sanit. (24)	6		6		6	6			
4. Local Training Cost for Disp.	5		5		5	5			
	6		6		6	6			

Budget - Continued

	Total	Dollars Costs	Local	USAID Dollars Costs	USAID Local	USAID Total	GOS Dollars Costs	GOS Local	GOS Total
6. Drugs & Med.	48		48		48	48			
7. Mobylettes (12)	12		12		12	12			
8. Salaries	60		60					60	60
Operation	40		40					40	40
6. Total	502	174	328	174	228	402		100	100
Total Cost	5202	787	4415	787	3139	3926		1276	1276
Contingency (15%)	780	118	662	118	470	588		192	192
Total Incl. Cont.	5982	905	5077	905	3609	4514		1468	1468
Inflation 12% annual	2009	560	1449	560	785	1345		664	664
Grand Total Cost	7991	1465	6526	1465	4394	5859		2132	2132
Prior Year Costs 1974-1977	565		565		290	290		275	275
Total Cost	8556	1465	7091	1465	4684	6149		2407	2407
% of Total	100	17	83			72			28
% of AID Contribution				24	76	100			

TITLE: Debi-Lampsar Irrigation Project

REPORT NO.: S-W-1

COUNTRY: Senegal

REGION: Africa

KEYWORDS: Irrigation polders (5).

SUMMARY: The project provides for civil works, agricultural development activities, consulting services, and technical assistance to achieve the following major objectives:

1. Continue the development of irrigation in the Senegal River Delta in the two perimeters at Debi and Lampsar for the production of irrigated paddy on about 3,000 ha and tomatoes on 340 ha; and

2. Prepare for the future integrated development of the entire river valley through strengthening the management, planning and research capabilities of the national development agency, SAED, (Societe d'Amenagement et d'Exploitation des Terres du Delta).

LOCATION: Northeast of Saint-Louis.

CLIMATE: BWh

CROPS: Rice, tomatoes.

SOILS: Clay alluvial.

TARGET GROUP: Small farmers (less than three hectares).

BEGIN: 1978 END: 1982 AREA: 3,300 ha.

NUMBER OF FARM FAMILIES: 1,100

CONTRIBUTION:

IAD	$20.0M
Kuwait	5.3M
France	2.7M
GOS	7.0M
TOTAL	$35.0M

TYPE OF PROJECT: Large-scale irrigation development.

TECHNOLOGY USED: Heavy equipment, tractors, threshers.

DOCUMENTS REVIEWED: Appraisal (110 pp).

PROJECT ORIGIN AND BASE LINE DATA: The present projects are modeled on the Dagana Polder Project (IDA-financed) which has produced an IRR of 14%. Engineering studies have been made by SCET International (France), and social and health studies carried out by Senegalese authorities.

PERT CHART: Attached to reviewed documents.

GENERAL DESCRIPTION

In 1975, development of the Senegal River Basin was begun by SAED with the construction of simple and inexpensive flood control irrigation perimeters. However, the Sahelian drought of 1969-73 showed these to be very sensitive to low flow in the river, and the decision was made to construct full water control irrigation schemes. Over 10K ha have thus been developed, and Debi and Lampsar are the only two major perimeters which remain undeveloped. This project provides for irrigating those areas.

TECHNICAL

The principal elements of the Debi perimeter are:

1. An irrigation network comprising primary, secondary and tertiary canals;

2. A drainage network to convey water back to the Senegal River;

3. A pumping station with the double function of irrigation and drainage, depending on the stage of the river, and with maximum discharge of 2.5 m^3/sec and maximum head of 2.6 m;

4. Hydraulic structures;

5. A road network; and

6. Land leveling.

Total irrigated area will be 1,100 ha.

The requirements at Lampsar:

1. A series of protective dikes along the river channels;

2. An irrigation network supplying 2,220 ha;

3. A drainage network;

4. Eleven irrigation pumping stations and three drainage pumping stations;

5. Hydraulic structures;

6. A road network; and

7. Land leveling.

Agricultural research to be carried out by SAED will include:

1. Soil surveys and land classification;

2. Drainage and groundwater surveys, and design and testing of drainage methods;

3. Laboratory support services for the above;

4. Crop research on planting dates for vegetables and cereals, and fertilizer tests;

5. Research on the best methods of mechanized agriculture; and livestock research.

The project provides for construction of houses, offices, workshop, storehouses, and other facilities within the perimeter.

Agricultural equipment and vehicles will be purchased.

INSTITUTIONAL

Administration of the project is by SAED (Societe d'Amenagement et d'Exploitation du Delta du Fleuve Senegal), a semiautonomous authority within the national government, with a staff of 840 permanent workers (15 expatriates) and 300 seasonal workers. SAED has so far developed 10K ha along the river, of which 5,000 ha have been developed in the last two years. In the future, SAED must adapt from merely implementing irrigation works to being an agency capable of executing integrated regional rural development programs.

The project will provide technical assistance to SAED, consisting of a financial controller, two agronomists, a livestock specialist, and a mechanical engineer.

The Banque Nationale du Developpement du Senegal (BNDS) will provide $1.2M in credit to farmers to meet the cost of agricultural inputs.

Farmers will be organized into small cooperatives ("mutual guarantee groups") of 50 farmers each, a system which has worked well in the past.

SOCIAL

Farmers will be selected by SAED on the basis of family size, age, agricultural experience, proximity to the project, and credit rating. A contract will be signed between SAED and the farmer (or

cooperative), with an obligation by SAED to provide mechanized cultivation and agricultural inputs upon request.

ECONOMIC/FINANCIAL

Budgeted costs for the project are given in Annex 9, Table 5 (attached).

Combined IRR for the two projects is 10%, if no technical assistance costs are included.

Investment costs are $4,100/ha at Debi and $5,000/ha at Lampsar. Total value of production will be about $3.3M/year. Per capita income will increase from $80/year to $127-$230/year, depending on the crop produced.

Costs of mechanical services and a farm budget are given on pages 53 and 55 (attached).

In the past, SAED has experienced difficulties in receiving its operating funds from the government. To ensure that SAED will maintain sufficient operating capital, the national government will be required to place operating funds for each quarter in a special bank account by the end of the previous quarter.

SAED collects a water charge, depending on area, type and value of the crop, and a mechanical service charge for field work. Present water charges are $125/ha for paddy, $175/ha for tomato, and plowing costs are $25-$40/ha. Collection rate is 86%. These fees will be increased in the future to achieve full repayment of operation and maintenance costs and about 12% of capital costs.

Total Project Costs

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange %
	----CFAF Million---			-----US$'000----------			
1. Debi							
- Irrigation and Drainage Networks	226	770	996	920	3,140	4,060	77
- Buildings	30	86	116	120	350	470	74
- Vehicles and Equipment	37	141	178	150	580	730	79
- Operating Costs	27	6	33	110	20	130	18
- Agriculture Inputs (incremental)	21	38	59	90	150	240	64
Total Base Costs Estimate	341	1,041	1,382	1,390	4,240	5,630	75
2. Lampsar							
- Irrigation and Drainage Networks	383	2,172	2,555	1,560	8,870	10,430	85
- Buildings	36	101	137	150	410	560	74
- Vehicles and Equipment	62	218	280	250	890	1,140	78
- Operating Costs	57	18	75	240	70	310	24
- Agricultural Inputs (incremental)	60	105	165	240	430	670	64
Total Base Costs Estim.	598	2,614	3,212	2,440	10,670	13,110	81
3. Technical Assistance							
- Studies	125	705	830	510	2,880	3,390	85
- Applied Research	89	76	165	360	310	670	46
- Technical Specialists	—	540	540	--	2,200	2,200	100
Total Base Costs Estim.	214	1,321	1,535	870	5,390	6,260	86
4. Refinancing of Debi Lampsar Engineering Credit	—	245	245	--	1,000	1,000	100
5. Total Project							
- Base Cost Estimate	1,153	5,221	6,374	4,700	21,300	26,000	72
- Physical Contingencies	159	560	719	600	2,400	3,000	78
- Expected Price Increases	292	1,175	1,467	1,200	4,800	6,000	80
TOTAL PROJECT	1,604	6,959	8,560	6,500	28,500	35,000	81

SENEGAL
DEBI-LAMPSAR IRRIGATION PROJECT
Costs per ha of Mechanical Services, Number of Working Hours and Equipment Requirements

CFA Francs	Actions (See Table 2)	Number of Hours Per ha	"Financial" Costs Per ha	"Economic" Costs Per ha	Taxes Per ha	Annual Number of Working Hrs.
Plowing (reversible plow)	1+4	4	18,172	10,732	1,524	1,360
Plowing (off-set)	1+3	1.5	7,761	4,409	711	3,330
Plowing (off-set+pulverizing)	1+3+5	1.5	8,313	4,578	785	2,820
Harrowing/seedbed preparation	2+5	1	2,876	1,846	204	2,220
Planting	2+7	1	2,727	1,813	184	1,880
Listing	2+6	2	5,478	3,646	372	680
Threshing	9	0.8 tons/hr	6,269	3,041	731	8,225
Transport tomatoes	2+8	3	8,349	5,385	555	1,020
rice	2+8	1	2,783	1,795	185	1,880

Equipment Requirements:
7 tractors (Crawler) 1/ 80-90 HP
9 tractors (Wheel) 2/ 60-65 HP 0.5 HP per ha
3 heavy reversible plows
6 off-set plows
3 pulverizers (Cambridge)
3 pulverizing disc harrows
9 planters (28 rows)
1 lister/bedding machine (2 rows)
3 harrows (5 segments)
9 trailers
19 threshers

1/ 1,073 working hours per tractor per year
2/ 853 working hours per tractor per year

SENEGAL

DEBI-LAMPSAR IRRIGATION PROJECT

FARM BUDGETS AT FULL DEVELOPMENT AND AT PRESENT

		Future with Project (W) Farmtype A	Future with Project (W) Farmtype B	Future Without Project (W)
CFA Francs				
Farm Size	(ha)	3	3	3
Annually Cropped Areas per crop: early rice	(ha)	1	1.5	—
late rice	(ha)	1	1.5	3
tomatoes	(ha)	1	—	—
Production: paddy	(tons)	7	10.5	2.4 1/
tomatoes	(tons)	30	—	—
A. Gross Revenue per Farm		740,500	435,750	99,600
B. Costs				
1. Farm Inputs	(CFAF)	141,565	63,075	25,200
2. Mechanical Services	(CFAF)	104,094	92,187	-- 3/
3. Water Charges 2/	(CFAF)	120,000	105,000	— 3/
Total Costs	(CFAF)	365,659	260,262	25,200
C. Net Revenue per Family	(CFAF)	374,841	175,483	74,400
	(US$)	(1,530)	(716)	(304)
Labor Days		515	248	150
Net Revenue per labor Day	(CFAF)	728	708	496
Net Revenue per hectare	(CFAF)	124,947	58,496	24,800

1/ Average yield of 0.8 tons/ha under flood control conditions; in reality yields vary widely from 0 to 1.6 tons/ha.

2/ Assuming fees of CFAF 35,000 per ha for paddy and CFAF 50,000 per ha for tomatoes in the future with project situation (W).

3/ In the future without project situation ($\bar{W}$), SAED would continue to provide water and mechanical services to the farmers free of charge in the average year.

TITLE: Integrated Agricultural Development

PROJECT NO.: 664-0277

COUNTRY: Tunisia

REGION. NE

KEYWORDS: Irrigation infrastructure (3); model farms (3); credit (3); institution-building (3).

SUMMARY: The project has two basic components:

1. The development of the Ghardimaou irrigation perimeter (5,000 ha); and

2. The establishment of a viable river basin authority regional office, capable of replicating the project in other areas.

LOCATION: Ghardimaou (Northern Region)

CLIMATE: BShs.

CROPS. Wheat, olive, forage, citrus, vegetables.

SOILS: Stratified, alluvial calcareous.

TARGET GROUP: All farmers (five to 10 ha).

BEGIN: 1973 END: 1978 AREA: 5,000 ha.

CONTRIBUTION:

USAID	$ 1,720K
GOT	3,270K
TOTAL	$ 4,990K

GOALS: To increase the income and level of living of the agricultural population.

PURPOSE: To demonstrate the beneficial effect, in terms of increased farmer income, of the proper utilization and integration of all agricultural production factors on irrigated land, and to develop the GOT capacity in the Northern Region to expand such an integrated program.

TYPE OF PROJECT: Medium-scale irrigation and extension project.

TECHNOLOGY USED: Labor-intensive.

DOCUMENTS REVIEWED: Project paper (45 pp).

BENEFICIARY INVOLVEMENT: Farmers will have considerable input into the extension phase of the project.

LOGICAL FRAMEWORK: Attached to reviewed documents.

PERT CHART: Attached to reviewed documents.

SUMMARY

The project has two components:

1. To develop and complete the irrigation infrastructure on 5,400 ha in the Ghardimaou perimeter; and

2. To provide the necessary research, demonstration and support to the farmers so that they will take full advantage of the system.

The latter component includes eight five-hectare model farms (owned privately), extension service developed, a farm credit program, a marketing cooperative, and support for the river basin development authority.

GENERAL DESCRIPTION

The project is broad in scope and covers a variety of interdependent agricultural production factors. Of the two components (development of the Ghardimaou irrigation perimeter and establishment of a viable OMVVM: Office for Development of the Medjerda Valley, regional office capable of replicating the project in other areas), it is the second which is considered most important because it will concentrate on improved production at the farm level. In effect, the irrigation system is considered incidental to improved agricultural practices.

TECHNICAL

The Ghardimaou irrigation perimeter will be developed as follows:

1. Exploitation of seven previously-drilled wells, producing 1.3 m^3/sec, and construction of a 13.5 km concrete-lined canal to bring water to 2,000 ha within the project area;

2. Construction of a low cost diversion on the Medjerda River, connection to the existing canal, and construction of an additional 13 km of canal; and

3. Construction of highline canals to collect natural river flow and carry it along the southwest and north sides of the valley.

A comprehensive marketing plan will be developed, and a marketing cooperative organized.

A seasonal and medium-term credit loan fund will be set up and made available to farmers. This will be administered at the project level for three to five years, at which time the credit system will be integrated into the national Agricultural Bank.

Eight farmers will be selected to provide demonstration farms in the project. They will be given credit and free technical supervision for five years. The farmers will be guaranteed a minimum income equal to their present income, and will be required to follow the farm plan, keep records, and allow visitors to observe their operations.

A demonstration team working with the farmers will plant and supervise 160 demonstration fields (one to two hectares), using the farmers' own equipment, methods and financing as much as possible. In the grant, the Government's contribution to the demonstrations will be flexible, but will slowly decrease with time, as the value of the demonstration is shown.

A parallel USAID livestock project in the area is attempting to develop forage and feed grain production, increase the number of livestock marketed for slaughter and reduce annual fluctuations of production, increase quality and weight of livestock, and establish a GOT administrative organization for continuing the program. The present irrigation perimeter project will promote the mixed farming method (crops plus livestock) to allow more options to the small farmer.

An OMVVM project office will be set up and require staffing by 130 people, including seven engineers, 25 technical assistants, six full-time expatriates, and additional short-term specialists. Thirty-eight Tunisian specialists will be given training in the U.S. or Third World countries, for periods of from two months to one year. This office will be responsible for canal construction, water management, and land redistribution plans. It is expected that the OMVVM will eventually expand to other irrigated areas, so that this project is a model for future replication, and the personnel thus trained will be moved on to other areas.

INSTITUTIONAL

The initial responsibilities of the OMVVM (Medjerda Valley Development Office) were restricted to the Medjerda Valley and included irrigation, infrastructure development and operation, applied research, extension, and public enterprise operation. In response to new policy initiatives related to irrigated agriculture, OMVVM will divest itself of public enterprise operations and concentrate on extension, operation, and maintenance of the system on <u>all</u> irrigated perimeters in Tunisia.

ECONOMIC

A table of yearly project inputs is given on pp 8-9 (attached).

The benefit-cost ratio for the project is estimated at 3.0.

Seasonal production credit will be provided by the OMVVM and is necessary to finance inputs such as seed, fertilizers, weed-killers, and insecticide. Medium- and long-term credit is provided by the Banque Nationale de Tunisie and will be used for irrigation installation, land-leveling, orchard development, implements and facilities.

D. STATEMENT OF PROJECT INPUTS

	Budget ($000) Schedule						
	1973	1974	1975	1976	1977	1978	Total
1. Inputs - U.S.							
a. U.S. Technicians							
Project Manager	25	25	25	30	30	30	165
Civil Engineer (Irrig)	20	20	20	25	25	25	135
Farm Development Engineer	20	20	20	25	25	25	135
Agronomist/Horticulturist	20	20	20	25	25	25	135
Farm Credit/Mktg Specialist	20	20	20	25	25	25	135
Equipment Oper/Maint. Advisor	15	15	15	20	20	20	105
Drainage/Soils Specialist	5	4	1	—	—	—	10
Org Mgt Specialist (Reg Off)	4	4	2	—	—	—	10
COOP Specialist	5	5	2	2	—	—	14
Short-term Experts/Consultant	5	10	5	5	—	—	25
Subtotal	139	143	130	157	150	150	669
15% USDA Overhead	21	21	20	24	23	23	132
USAID Direct-Hire Project Mgr.	35	35	35	35	35	35	210
Subtotal	195	199	185	216	208	208	1211
b. Commodities							
Equipment including farm implements for demonstration	—	100	50	20	10	5	185
Demonstration materials	—	15	20	30	10	10	85
Seed and fertilizers (demonstration and experimental)	—	5	5	5	5	--	20
Insecticides	—	1	1	1	1	--	4
Vehicles	3	9	3	—	—	--	15
Engineering equipment and supplies	--	30	10	5	5	5	55
Miscellaneous	5	5	5	5	5	5	30
Subtotal	8	165	94	66	36	25	394
c. Participant Training (Short-term 4 mos. Average)							
Short-term Observation	6	6	6	6	6	—	30
Farm Developmental Planning	3	6	—	3	—	--	12
Irrigation System Design and Land Shaping	3	3	—	--	—	—	6
Irrigation Practices	--	3	3	--	—	--	6
Drainage and Soils	—	3	—	--	—	--	3
Agronomist/Horticult. Pract.	—	10	6	6	6	—	27
Farm Credit	--	--	3	—	—	—	3
Farm Development Management	--	3	3	3	--	--	9
Agr. Services Cooperatives	--	3	3	--	--	--	6
Agricultural Marketing	--	3	3	3	3	--	12
Subtotal	12	40	27	21	15	—	115
GRAND TOTAL U.S. INPUTS	215	404	306	303	259	233	1720

2. Inputs - Tunisia

a. Inputs related to production aspect of Project (TD 000)*:

	1973	1974	1975	1976	1977	1978	Total
1. Construction and rough land shaping	200	400	500	500	400	250	2,250
2. Domonstration grants	6	9	9	9	5	2	40
3. Trust Fund Support for U.S. Contract Team	80	60	60	60	50	50	360
Total	286	469	569	569	455	302	2,650

b. Inputs related to OMVVM services in the whole regional area (TD 000)*:

	1973	1974	1975	1976	1977	1978	Total
1. Regional Office support	75	100	125	150	150	150	750
2. Perimeter Operation and Maintenance Expenses	50	50	30	40	80	110	360
3. Farm Credit Revolving Fund	—	—	—	—	—	—	480
Total	125	150	155	190	230	260	1,590

*1 TD = $2.12 @ 10-72

TITLE: Small Holder Irrigation Development

PROJECT NO.: 664-0312.3

COUNTRY: Tunisia

REGION: NE

KEYWORDS: Credit (5); large bore wells (3); on-farm water management (1).

SUMMARY: The loan of $4.4M will be used to finance selected irrigation infrastructure costs (principally shallow wells) at the farm level by providing new funds for the existing GOT small farmer medium-term credit channels. Grant funds ($400K0 will cover a series of short-term technical consultancies in water management and $40K for commodity costs relating to field tests of on-farm water management techniques.

LOCATION: Central Tunisia.

CLIMATE: BShs.

CROPS: Vegetables, forage, orchards.

TARGET GROUP: Small farmers

BEGIN: 1979 END: 1984 AREA: 3,000 ha

NUMBER OF FARMS: 3,000

CONTRIBUTION:

USAID	$ 4,400K	loan
	400K	grant
PL480	600K	
GOT	2,500K	
TOTAL	$ 7,900K	

PURPOSE: To optimize small farmer access to and income derived from agricultural groundwater in the CTRD zone primarily through on-farm irrigation infrastructure expansion and, secondarily, through the diffusion and institutionalization of appropriate on-farm water management practice.

TYPE OF PROJECT: Credit to farmers.

TECHNOLOGY USED: Large-bore wells with pumps, flood irrigation.

DOCUMENTS REVIEWED: Project Paper (30 pp).

PROJECT ORIGIN AND BASE LINE DATA: Feasibility report prepared 1978.

BENEFICIARY INVOLVEMENT: Farmers will be given credit to construct their own wells.

LOGICAL FRAMEWORK: Available in reviewed documents.

PERT CHART: Available in reviewed documents.

GENERAL DESCRIPTION

This is actually a subproject, part of a larger project to develop a broad range of irrigation infrastructure, including extensive deep well development, drainage, and small dams. Only the subproject is described below.

TECHNICAL

The project consists of:

1. Improvement of 300 existing on-farm shallow wells, by deepening to about three meters below the water table, lining and installation of electric or diesel pumps.

2. Installation of 200 new shallow wells. Each farmer will excavate his own well, and then credit will be available to allow him to hire local entrepreneurs for deepening and lining.

3. Improvement of 100 natural springs, by addition of concrete overnight storage tanks and portable outlet pipes to reduce seepage losses.

4. Development of three new irrigation perimeters based on four existing and unused deep wells. Loan and PL480 funds will be used to provide pumps, reservoirs, canals, interior roads and land-leveling.

5. A program of controlled field testing of alternative water management systems. This would consist primarily of $400K of technical assistance from a U.S. land-grant university.

INSTITUTIONAL

The CTDA (no explanation given of this acronym), when established in Kasserine, will absorb the present regional office of the OMVVM for the Kasserine Governate, and therefore will inherit a qualified, experienced staff that can provide direct supervision over the development of the three irrigation perimeters. The CTDA will recruit personnel specifically for the purpose of assisting the small farmers in obtaining credit for construction and improvement of surface wells.

ECONOMIC

The IRR for the shallow wells is 39%, and for the irrigation perimeters, it is 29% (11.5% if the cost of the existing deep wells is included).

Operation and maintenance costs are calculated at 0.0088 to 0.0128 TD/m^3, which is two to three times greater than the water duty of 0.004 TD/m^3, charged to the irrigators. Thus, the operation of these projects will imply continuous subsidies.

FINANCIAL PLAN

(000 U.S. Dollars)

	FY 1979	FY 1980	FY 1981	Total
U.S. COMPONENT (Loan & Grant)	2,710	—	2,090	4,800
Loan	2,500	--	1,900	4,400
Surface well improvements	1,400	—	1,800	3,200
Natural springs development	100	--	100	200
Small scale PIP development	1,000	--	--	1,000
Grant (Water Management TA)	210	—	190	400
Short-term consultant services	160	—	140	300
Short-term participant training	30	—	30	60
Project commodities for field tests	20	—	20	40
GOT COMPONENT	3,050	50	—	3,100
Appropriated Funds	2,450	50	--	2,500
Existing PIP rehabilitation**	1,750	--	—	1,750
New deep well development	500	50	—	550
Drainage and small dams	200	—	--	200
PL 480, Title I Counterpart Funds	600	—	—	600
PIP Development*	200	—	—	200
PIP rehabilitation**	400	—	—	400
PROJECT TOTAL	5,760	50	2,090	7,900

* Around existing unutilized deep wells
** Sbiba, Thala and Djilma

TITLE: Water and Soil Investigations for Agricultural Development

PROJECT NO.: UNDP/FAP UAE/73/008

KEYWORDS: Drip irrigation (5); sprinkle irrigation (3); furrow irrigation (3)

SUMMARY: The original project was intended to: inventory the country's water and soils resources; develop a water and soil laboratory; assist in the organization and management of agricultural research on the Digdigga Experimental Farm and other subsidiary farms; conduct agricultural economic studies; computer modeling of agriculture sector; and training.

LOCATION: South end of Arabian Gulf 25°N 60°E

CLIMATE: Arid-hot.

CROPS: Citrus, vegetables, pastures.

SOILS: Sandy, calcareous and gravelly terraces.

TARGET GROUP: Small farmers (two + hectares).

WATER: Saline - typical EC 2.4 mmhos

BEGIN: January 1975 END: July 1978 AREA: 6,000

NUMBER OF FARMS: 2,000+

CONTRIBUTION:	In cash	US $ 501,860	UNDP	US $ 444,130
	In kind	(Convertible currency)		
	In kind	OH 8,356,400 (Dirhams)		

GOALS: To increase agricultural production.

PURPOSE: To assist the Ministry of Agriculture and Fisheries in the use of the country's resources of water and soil to improve agricultural production and to assist the Government in securing proper surveys of the country's soil and water resources and to lay the foundation for the proper use of these resources for efficient and continuing agricultural production.

TYPE OF PROJECT: Research, demonstration.

TECHNOLOGY USED: Advanced irrigation technologies and modern survey practices.

DOCUMENTS REVIEWED: Project Contract (33 pp); four technical reports on water needs and irrigation practices experiments (148 pp); and Draft of Carry-On Project Proposal.

BENEFICIARY INVOLVEMENT: None.

GENERAL DESCRIPTION

Estimates of the land now being irrigated in the United Arab Emirates range between 4,000-6,000 ha. Studies have indicated that the resources of good quality water and suitable soils for agricultural development are very limited. The chief limiting factor is lack of good quality water. According to various estimates, more than 8,000 hectares of land in the Emirates deserve further study for possible agricultural development, provided that the local water resources are adequate.

Thus, further agricultural development must take into account two principal factors: water and soils, both of which are severely limited. Potentially cultivable soil is mainly confined to light textured deposits on the plains below the hills and on gravel terraces adjoining the wadis. In the western part of the coastal plain, the extent of the usable soil is further curtailed by encroachment of sand dunes from the west.

About 17% of the economically active population (approximately 14,000 people) earn their living either directly or indirectly from agriculture. In the past, before the discovery of oil, the main traditional occupations were trading, fishing and pearling. The contribution of agriculture to the total national product has been comparatively low.

The United Arab Emirates at present enjoys a high income from the sale of oil and natural, but not renewable, resources of the country. The government wishes to use part of this income to survey, develop, manage and conserve two major renewable natural resources, the waters and soil of the country, so that they may benefit present and future generations.

While some work has been done on the development and management of the soils and waters of the country, much remains to be done. Realizing this, the government called upon the United Nations and FAO to help them with their agricultural development.

The original project included all of the items which are listed in the previous summary statement. As it turned out, the only item which was carried out in any detail was the assistance in the organization and management of agricultural research experimental farming activities. This was done so successfully by a Mr. A.P. Savva, who is the FAO irrigation practices specialist assigned to the project, that the farmers throughout the Emirates have become aware of the fine work, and are beginning to try to follow the practices which were developed at the experimental station.

In fact, the experimental carryover has been so dynamic that a new project entitled, "Modernization of Irrigation and Land and Water Research Survey", is about to be initiated. This will be a three-year research project, beginning in January 1980.

TECHNICAL

This project concentrated on the experimental farm aspects. The technical activities involved developing irrigation technologies, specifically for the area and crop in question. Extreme climatic conditions, (which resulted in evapotranspiration peaks in excess of 10 mm/day), poor water quality with EC values of 2.4 millimhos, and sandy or gravelly soils, created an interest in trickle irrigation. Night-time sprinkle irrigation was also studied.

Results of the Hamrinakah Irrigation Practices Experiments Report, Technical Report #2 (June 1979), indicate:

1. Drip irrigation has increased the yield of cucumbers, squash, tomatoes and watermelon. Yield increases were as high as almost 200%.

2. For vegetables, a saving in water use of up to 45% can be achieved with drip over improved furrow irrigation; and up to 82% over the farmers' existing furrow irrigation systems.

3. For potatoes, sprinkle irrigation has demonstrated a savings of 25% in water and an increase in yield of 77%.

4. For young trees, a savings in water use of approximately 80% can be achieved with drip and bubbler over basin irrigation, without reducing the growth rate.

5. Very high salt accumulation in the top 15 cm of soils is a problem under both drip and furrow irrigation. After a few dry years, it is advised that a portable sprinkle system, coupled onto the same main and secondary lines as used for the drip system, should be used for leaching purposes.

6. The accumulation of salts at the surface of the soil and the periphery of the wetted zone under drip irrigation presents a constant threat during rain, since the rain may transport the soils to the intermediate salinity zone where most of the root activities take place. Under these conditions, it is recommended to operate the drip system during rain.

INSTITUTIONAL

The main institutional building aspect of the project was to strengthen the existing experimental farms and build some new ones.

Encouraged by the technical findings and the farmer interest resulting from the experimental farm activities, the Ministry of Agriculture and Fisheries has taken the following steps:

1. Personnel have been assigned from the extension wing of the Ministry to the project for training in various aspects of irrigation in order to better equip themselves for the process of disseminating the technical know-how of modern irrigation practices to the farming community.

2. Funds have been allocated to subsidize the implementation of drip and other modern irrigation systems in the fields of progressive farmers, as a first step toward modernizing the irrigation practices of the country.

SOCIAL

The farmers are encouraged with the results at the experimental station and seem eager to adopt the practices they have observed.

FINANCIAL/ECONOMIC

A summary of irrigation costs is contained in the aforementioned Technical Report No. 2. Because of the large amount of water savings, and the savings in pumping cost afforded by drip and sprinkle irrigation over the traditional methods of furrow irrigation, the actual costs of the advanced systems (including the fixed cost) is lower. These estimates suggest that irrigation of vegetables, such as cucumbers, squash, tomatoes and watermelon, by drip irrigation, can reduce the annual irrigation cost by approximately 20% over the farmers' existing furrow irrigation methods. The lower irrigation cost of drip is the result of reduced labor and water use, making this system more economical, despite its high initial cost.

It is estimated that farmers adopting well-designed and properly operated drip systems may expect to recover the annual cost of the drip systems from savings in pumping cost and labor, and increase their net annual benefits by a sufficient amount to pay for the system in the first year. The expected increase in net annual benefits, which is due to the lower irrigation costs plus the higher yields, is approximately 25,000-30,000 dirhams per hectare per year.