AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D. C. 20523

PROJECT PAPER

MOROCCO: Supplemental Irrigation
(608-0197)

August 19, 1988

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: Original

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: Morocco

3. PROJECT NUMBER: 608-0197

4. BUREAU/OFFICE: USAID/Morocco — 03

5. PROJECT TITLE (maximum 40 characters): Supplemental Irrigation

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 93

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 88 B. Quarter 4 C. Final FY 93

8. COSTS ($000 OR EQUIVALENT $1 = 8.3 DH)

A. FUNDING SOURCE	FIRST FY 88 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(410)	(8,590)	(9,000)	(510)	(14,490)	(15,000)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		5,000	5,000		5,000	5,000
Other Donor(s)						
TOTALS	410	13,590	14,000	510	19,490	20,000

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) AG	280	064		none	none	9,000		15,000	
(2)									
(3)									
(4)									
TOTALS						9,000		15,000	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 073, 022

11. SECONDARY PURPOSE CODE: 213

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BF						
B. Amount	12,000						

13. PROJECT PURPOSE (maximum 480 characters)

To improve the selection, design, implementation, and management of approximately ten supplemental irrigation systems. This purpose recognizes the need for incorporating into the present program a more analytical and systematic approach to take into account the unique economic, technical, social, and environmental factors that bring about successful development interventions.

14. SCHEDULED EVALUATIONS

Interim MM 09 YY 91 — Final MM 09 YY 93

15. SOURCE/ORIGIN OF GOODS AND SERVICES

[X] 000 [ ] 941 [X] Local [X] Other (Specify) 935

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

USAID Morocco Controller's approval of proposed methods of implementation and financing.

Signature: Pamela A. Allen Title: Acting Controller

17. APPROVED BY

Signature: Charles W. Johnson

Title: Director USAID/Morocco

Date Signed: MM 08 DD 19 YY 88

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-4 (8-79)

ACTION MEMORANDUM FOR THE USAID/MOROCCO DIRECTOR

DATE: August 19, 1988

FROM: Kenneth G. Schofield, Supervisory Program Officer

SUBJECT: Supplemental Irrigation Project (608-0197)

PROBLEM:

Your approval is requested for the Project Paper and the Project Authorization for the Supplemental Irrigation Project (608-0197).

DISCUSSION:

USAID's agricultural strategy as described in the FY 1988 Country Development Strategy Statement (CDSS), focuses on the large, backward, rainfed sector. The strategy aims to increase food supplies and small-farmer incomes through training agricultural scientists, funding agricultural research, improving public policy, and developing institutions to carry out these activities. Project funding for the construction of small dams to be used for supplemental irrigation in these same disadvantaged rainfed areas adds an important dimension to the overall rainfed agricultural strategy. Risk of drought will be reduced, cropping possibilities will be increased, labor use will be intensified, and crop production increased. Moreover, the supplemental irrigation technology will be enhanced by USAID funded research at the Settat Aridoculture Center.

Project design preparations began in early 1988. USAID prepared and submitted the Project Identification Document (PID) for AID/W approval in May 1988. AID/W approved the PID in May 1988 in State 181075. A.I.D. Delegation of Authority 654 permits you to authorize this project in the field. While no serious issues were raised during the AID/W PID review, the PID approval cable raised a number of important concerns which are addressed in Section I. of the project paper.

On August 15, 1988 the Mission Review Committee reviewed and recommended approval of the Supplemental Irrigation Project with minor revisions. The final, revised document is attached.

The goal of the project is to increase farm incomes and the overall standard of living among rural households in the semi-arid regions of the country. This will be achieved by strengthening the GOM's process for selecting, designing, implementing, and managing supplemental irrigation systems. These systems consist of a small dam, associated up-stream watershed protection

works, and down-stream supplemental irrigation installations. The project has a life of project AID funding level of $15.0 million and a PACD of September 30,1993. The project will finance a series of interrelated activities, all aimed at establishing viable supplemental irrigation systems in Morocco's rainfed agricultural sector. The activities are designed to complement, and not replace, the GOM's own efforts and to lead to supplemental irrigation systems that will be worthy of being replicated. Project activities can be broadly categorized into three areas: 1) the selection and design of viable supplemental irrigation systems, 2) the construction of such systems, and 3) the operation, maintenance and monitoring of such systems.

A Congressional Notification for this project was forwarded to Congress on August 10, 1988 and is expected to expire on August 25, 1988. The Project Agreement will not be signed until the Mission receives notification that the waiting period has expired.

RECOMMENDATION:

That, according to the authority granted to you in AID Delegation of Authority 654, you sign the Project Paper Data Sheet and the attached Project Authorization, thereby approving the Supplemental Irrigation Project with a life-of-project funding of $ 15.0 million and a PACD of September 30, 1993.

APPROVED: Charles W. Johnson Date: August 19, 1988 DISAPPROVED: _____

Charles W. Johnson
Director

Clearances:
ACONT:PCallen PAC
RLA:KTurner KT
PROG:KSchofield KS
ADO:REhrich REE

PROJECT AUTHORIZATION

Name of Country: MOROCCO

Name of Project: SUPPLEMENTAL IRRIGATION

Number of Project: 608-0197

1. Pursuant to Section 531 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Supplemental Irrigation Project for Morocco (the "Cooperating Country") involving planned incremental obligations of not to exceed $15,000,000 in grant funds over a five year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of project is five years and one month from the date of initial obligation.

2. The project will improve the Grantee's process for selecting and designing irrigation systems, consisting of a small dam, associated watershed protection works and downstream water distribution systems necessary to provide supplemental irrigation; fund construction of approximately ten such systems in the dryland agricultural zone referred to as the "Settat command area"; transfer supplemental irrigation technology to farmer beneficiaries and; improve management and maintenance of supplemental irrigation systems by water user's associations.

3. The Project Agreement shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by AID with grant funds shall have their source and origin in Morocco or in the United States except as AID may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services financed by grant funds shall have Morocco or the United States as their place of nationality, except as AID may otherwise agree in writing.

Ocean shipping financed by AID under the project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States. The requirements of the Cargo Preference Act will be met with respect to all commodities financed by AID that are transported on ocean vessels.

Conditions Precedent and Covenants

The Project Agreement will contain the following conditions precedent:

First Disbursement:

Prior to the first disbursement under the Grant, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. a statement of the names of the persons holding or acting in the office of the Grantee specified in the Project Agreement, and such other additional representatives as may be designated by the Grantee, together with a specimen signature of each person specified in such a statement.

Reimbursement for Feasibility Studies and Construction:

Prior to the first disbursement under the Grant for this purpose, or to the issuance of documentation pursuant to which such disbursement will be made, the Parties will agree in writing (except as Parties may otherwise agree in writing) to:

- content of the feasibility studies to be undertaken;
- procedures for approving and executing feasibility studies;
- procedures for site approval and supplemental irrigation system construction; and
- mechanisms for reimbursement.

Special Covenants

The Project Agreement will contain special covenants as follows:

Cost Recovery Plan:

The Grantee will use its best efforts to develop a plan that requires beneficiaries of the Small Dam Program to pay a reasonable percentage, as agreed to by the Parties, of the total costs of constructing the irrigation systems.

Water Users' Associations:

The Grantee acknowledges the importance of beneficiary participation in the operation and maintenance of supplemental irrigation systems to the continued viability and success of the Small Dams Program. Accordingly, the Grantee will exert its best efforts to assist farmers who are

beneficiaries under the project to create water users' associations for i) the management of water distribution, ii) maintenance of the system and iii) the collection of fees or other mechanisms, such as labor exchange, for accomplishing the required maintenance.

(3) Maintenance of Irrigation Systems:

In addition to the requirements stated in paragraph (2) above, the Grantee agrees to take whatever other steps are necessary to ensure that the maintenance requirements for continued operation of the dams, and associated upstream watershed protection and downstream distribution works financed by the Grant are satisfied.

(d) The following waiver to A.I.D. regulations is hereby approved:

1. A waiver of source/origin from A.I.D. Geographic Code 000 to Code 935 in amount not to exceed $30,000 to permit the purchase of one, passenger motor vehicle.

Charles W. Johnson, Director

August 19, 1988
Date

Clearances:
ACONT:PCallen
ADO:REhrich
RLA:KTurner
PROG:KSchofield

Waiver Control No.

ACTION MEMORANDUM FOR USAID/MOROCCO DIRECTOR
(SOURCE/ORIGIN WAIVER)

DATE: August 18, 1988

FROM: Kenneth Schofield, Acting Deputy Director

SUBJECT: Supplemental Irrigation Project No. 608-0197 Procurement Source/Origin Waiver

PROBLEM

The implementation of the Supplemental Irrigation System requires procurement of a non-U.S. manufactured four-wheel drive passenger vehicle.

General information:

a)	Cooperating Country:	Morocco
b)	Authorizing Document:	ProAg 608-0197
c)	Project:	Supplemental Irrigation
d)	Nature of Funding:	Grant
e)	Description of Commodity:	Four-wheel drive passenger vehicle
f)	Approximate Value:	$30,000
g)	Probable Source:	Morocco
h)	Probable Origin:	Morocco

DISCUSSION

The project involves providing technical assistance to enhance the ability of the Government of Morocco to analyze, select and develop potential Supplemental Irrigation sites (SI) and the construction of ten SI systems, in each case in the Settat Command area. The Settat Command Area is isolated and the road conditions there are difficult.

The expatriate long-term advisor under the project will be responsible for providing assistance and training to the ministries involved in implementing the project in addition to visiting proposed SI sites to assist in site analysis and development. He/she will also need to transport equipment which will be used in the analyses at the site. Accordingly, it is proposed that a four-wheel drive vehicle, assembled in Morocco from parts or subassemblies shipped from England, would be purchased with project funds to enable the long-term technical assistance advisor to travel to remote locations in the Settat Command area to inspect SI sites and provide advice to GOM officials.

Justification

Handbook 1B, Section 4C2d permits waiver of the requirement that motor vehicles procured for AID financed project be manufactured in the United States, in circumstances which include where there is a present or projected lack of adequate service facilities and supply of spare parts for U.S. manufactured vehicles.

For the Supplemental Irrigation Project, a four-wheel drive vehicle assembled in Morocco from parts or subassemblies shipped from England is justified for the following reasons:

1. The proposed vehicle will be used under the project by the long-term technical advisor for frequent travel to a remote area of Morocco. He or she will need a reliable vehicle that can stand up to difficult road conditions and which can be serviced and maintained locally so that project implementation can proceed without undue delay due to the unavailability of a project vehicle. At the present time, the representatives in Morocco of U.S. motor vehicle manufacturers do not stock U.S. manufactured four-wheel drive vehicles or related spare parts; therefore, even if a U.S. manufactured vehicle were imported from the U.S., the lack of adequate spare parts or service personnel means that proper maintenance of the vehicle would be difficult, if not impossible.

2. Four-wheel drive vehicles are assembled in Morocco from parts and subassemblies shipped from England. For these vehicles, there are available locally adequate spare parts and servicing personnel to service and maintain the vehicles. The proposed vehicle is a sturdy one which will be durable enough to stand up to the rough use it is expected to receive and will have the type of specifications which will enable the long-term technical assistance advisor to reach remote areas in the Settat command area.

AUTHORITY

Under Delegation of Authority (DOA) No. 654, para 7(b), you have the authority to waive the permissable geographic source/origin from A.I.D. Geographic Code 000 to Code 935 for the procurement of motor vehicles in amount not to exceed $50,000 per transaction (exclusive of transportation costs).

RECOMMENDATION

That, in accordance with the authority granted to you in DOA No. 654, you, by your signature below:

1. approve this waiver of permissable source/origin from Code 000 to Code 935 to permit the purchase of one four-wheel drive passenger vehicle in an amount not to exceed $30,000 from countries included in Code 935; and

2. certify that "exclusion of procurement from free world countries other than the cooperating country and countries included in Code 941 would seriously impede attainment of U.S. Foreign Policy objectives and objectives of the Foreign Assistance Program".

APPROVED: Charles Johnson DATE August 19, 1982 DISAPPROVED: _____

Clearances:
CONT:PCallen
RLA:KTurner
ADO:REhrich

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LIST OF PROJECT AND MISSION REVIEW COMMITTEE MEMBERS

USAID Project Committee

Rollo Ehrich	Agricultural Development Officer, Chairman
Daniel Kohler	Program Economist
Eric Loken	Project Officer, Energy and Natural Resources Division
Paul Novick	Project Officer, ANE/TR/ARD
M'Hamed Hanafi	Program Specialist, Agricultural Division
Driss Meski	Agricultural Economist
Aleksandra Braginski	Project Development Officer

Mission Review Committee

Charles Johnson	Director
Kenneth Schofield	Supervisory Program Officer
Ronald Stryker	Deputy Agricultural Development Officer
Stephen Klein	Chief, Energy and Natural Resources Division
Pamela Callen	Acting Controller

GLOSSARY OF ACRONYMS AND DEFINITIONS

CBC	Unit for Small Dams
DA	Development Assistance (Funds)
DAH	Directorate for Hydraulic Development and Imporvement (MPW)
DAR	Department of Rural Affairs
DCL	Directorate for Local Collectivities (MOI)
DER	Directorate for Rural Development (MARA)
DPA	Provincial Directorate for Rainfed Agriculture
DPE	Provincial Directorate of Infrastructure
DPPN	Provincial Delegate of the Promotion Nationale
DRPE	Directorate for Research and Water Planning (MKPW)
EF	Water and Forest Service (MARA)
FY	Fiscal Year
GDP	Gross Domestic Product
GOM	Government of Morocco
IAV	Institut Agronomique et Vétérinaire, Hassan II
IBRD	International Bank for Reconstruction and Development (World Bank)
IC	Interministerial Committee
IFAD	International Fund for Agricultural Development
LOP	Life of Project
IMF	International Monetary Fund
MARA	Ministry of Agriculture and Agrarian Reform
MOI	Ministry of Interior
MPW	Ministry of Public Works
O&M	Operation and Maintenance
ORMVA	Regional Office of Agricultural Development (MARA)
PIL	Project Implementation Letter
PN	Promotion Nationale (MOI)
PROAG	Project Agreement
RIA	Rapid Initial Assessment
SDP	Small Dams Program
SI	Supplemental Irrigation
SPMH	Small and Medium Irrigation Service (MPW)
USAID	United States Agency for International Development
WFP	World Food Program

Weights and Measures

Dh	dirham
FU	forage units (the nutritional equivalent of 1 kg of barley)
ha	hectare
kg	kilogram
MT	metric ton
qx	quintal (100 kilograms)
m^3	cubic meter

I. SUMMARY AND RECOMMENDATIONS

1.0 Summary of Project Background

Periodic drought and highly variable seasonal rainfall coupled with a range of inappropriate public policies have contributed to a decline in per capita production of cereals over the last decade. The GOM is addressing the policy issues in a constructive way by liberating markets, adjusting prices, and shifting investment to rainfed areas which have a comparative advantage in grain production.

Assuring sufficient water supplies is a much more difficult problem. The problem can be addressed in part by developing drought resistant varieties and cultivation practices which conserve water. Another promising avenue is supplemental irrigation. Application of as little as 100 mm of water per year at critical times during a plants growth cycle can result in as much as a four-fold increase in yields. Construction of small dams to provide supplemental irrigation has been successfully carried out in various regions of Morocco and promises to be an economically efficient means of supplying water to small perimeters (200-400 hectares).

1.1 Summary of Project Rationale

USAID's overall strategy, concentrating on the rainfed sector, is to increase food supplies and small-farmer incomes through training agricultural scientists, funding agricultural research, improving public policy, and developing institutions to carry out these activities. Funding the construction of small dams for supplemental irrigation in these disadvantaged rainfed areas adds an important dimension to the overall rainfed agricultural strategy. Risk of drought will be reduced, cropping possibilities will be increased, labor use will be intensified, and crop production increased.

The GOM, in response to the crisis in grain production, has stepped up rural development efforts. Within that broad shift in strategy, small- and medium-scale water resource development schemes make up an increasing share of the GOM budget, rising from 1.6 percent of total investment in 1981-83 to 3.0 percent projected for the 1988-92 period. However, under the new IMF Stand-By Agreement and its imperative to reduce the budget deficit, there would be no conceivable way to expand small dam construction using domestic resources. External concessional assistance such as that proposed under this project is the only means of increasing program size.

1.2 Summary of the Project Description

1.2.1 Project Goal, Purpose, and Outputs

- The goal of the proposed project is to increase farm incomes and the overall standard of living among rural households in the semi-arid regions of the country.

- The project purpose is to improve the selection, design, implementation and management of approximately 10 supplemental irrigation systems, consisting of a small dam, associated up-stream watershed protection measures, and the downstream works necessary to provide supplemental irrigation, and improving the functioning of these systems.

- Project Outputs

  - Approximately 10 supplemental irrigation systems constructed.

  - Upgraded skills of GOM staff at national and provincial levels.

  - Sound economic, technical, social and environmental criteria established.

  - Project designs completed based on site-specific analyses.

  - A monitoring and evaluation system in place.

  - Viable water user associations established.

  - A water pricing and cost recovery system in place.

  - Farmer beneficiaries effectively trained in methods of supplementary irrigation.

1.2.2 Nature and Scope of Project Activities

1) Site selection and system design

- Rapid Initial Assessment

Sites warranting further feasibility analysis will be selected, based on their likely suitability for supplemental irrigation systems, from the pool of approximately 200 small dam sites already identified in the Settat region.

- Feasibility Analyses

The small dam sites showing promise for supplemental irrigation systems will be the object of more detailed feasibility studies. Either on its own, or through contractors, the GOM will produce hydrological, engineering, environmental, social and economic feasibility studies. Criteria for these studies are elaborated in the body of the project paper.

2) Constructing Supplemental Irrigation Sites

Approximately 10 supplemental irrigation systems benefiting primarily small farmers in the Settat command area will be constructed over the life of the project.

3) Farmer Operation and Maintenance of Systems

Operating and maintaining the supplemental irrigation system will be the responsibility of farmers. The project will assist in organizing water user's associations for this purpose.

4) Developing and Transferring Supplemental Irrigation Technology

Farmer beneficiaries will receive technical assistance so that they may realize the highest level of benefits possible from the supplemental irrigation opportunities offered by this project. A monitoring system at the level of MARA-DER will assure that experience gained in the field increases the knowledge base of the GOM agencies responsible for designing future supplemental irrigation systems. The research component of this project is designed to adapt and improve basic SI technology for Moroccan conditions.

1.3 Summary of Project Inputs and Financial Plan

1.3.1 Project Inputs

1) Funding for construction of approximately 10 supplementary irrigation systems at an average cost of $1.2 million per system ($12,000,000)

2) Long-term technical assistance ($400,000)

An agricultural economist will assist the MARA-DER for three years.

3) Short-term technical assistance ($360,000)

The project will provide five Moroccan experts consisting of an Agricultural Economist, Irrigation Engineer, Agronomist/Soil Scientist, Environmental Analyst and Social Scientist and up to 4 person-months (pm) of expatriate assistance. These short-term Moroccan experts will advise and train MARA-DER and their field units (DPA). Expatriate advisors in disciplines to be identified will provide assistance to other units in the Interministerial Committee as required.

4) Participant training ($120,000)

MS-level training in applied economics for one to two MARA-DER technicians will be financed. Additional short-term participant training will be provided as needed.

5) Commodities ($100,000)

6) Funding for feasibility studies ($600,000)

7) Research on the technology of supplemental irrigation ($100,000)

8) Audits and Evaluations ($200,000)

1.3.2. Financial Plan

Summary of Financial Plan

($'000)

Cost Category	USAID	GOM	Farmer Beneficiaries 1)	Total
Technical Assistance	760	890 2)	--	1,650
Training	120	110 3)	--	230
Commodities	100	30 4)	--	130
Feasibility Studies	600	350 5)	--	950
Dam Construction	12,000	2,300	1,000 6)	15,300
Research	100	--	--	100
Audit & Evaluation	200	--	--	200
Contingency	1,120	320		1,440
Totals	15,000	4,000	1,000	20,000

NB:
1) Farmers benefiting from the Project.
2) Includes: 5 full-time equivalent counterparts, secretarial services, and logistic support.
3) Salaries, and international airfare for training participants.
4) Surveying and other equipment necessary for rapid initial assessments and feasibility studies carried out by GOM.
5) Includes all costs of feasibility studies carried out be GOM employees.
6) Costs of on-farm water distribution systems.

1.4 Recommendations

The USAID Project Design Committee has determined that the proposed activities are technically, administratively, and financially feasible and recommends the approval of this Project Paper.

The ANPAC review of the PID raised several concerns, grouped as follows: project purpose, criteria establishment, policy emphasis, measurement of progress, environmental assessments, and resource allocation. These issues have been dealt with in the Project Paper in the following way:

1) Project purpose: A rigorous process of project site selection is the heart of the project and will be transferred into the GOM's system through technical assistance and demonstration of the process by application to the construction of supplemental irrigation systems. Cost and engineering criteria are an integral part of the program. Economic, social, and environmental criteria are much more rigorous under the proposed site selection process than heretofore practiced by the GOM.

2) Criteria establishment: Criteria for site selection, in addition to a cost/benefit analysis, environmental impact analysis, and maintenance sustainability through farmer management, include a thorough analysis of social factors affecting project feasibility. The potential of the farmers to manage and maintain the system and apply irrigation water efficiently will be considered during feasibility analysis.

3) Policy emphasis: In addition to application of rigorous economic efficiency and environmental impact standards, the project agreement requires the GOM to make every feasible effort to apply a rational system of water charges to improve the efficiency of water use.

4) Measurement of progress: The project will generate baseline technical, social, economic, and environmental data through feasibility studies. An internal monitoring system will develop the data for analysis of implementation efficiency and impact on beneficiaries.

5) Environmental impact assessment: An environmental impact assessment will be produced for each supplemental irrigation system. The GOM will be provided technical assistance to carrying out the analysis dictated by the environmental criteria included in the project site selection process.

6) Resource allocation: The GOM and farmer beneficiaries will assume over 25 percent of the total costs of the program. The GOM will finance 15 percent of each system built with USAID funding and supply 5 technicians and logistical support. Farmers will construct on-farm irrigation works at the 10 SI sites valued at approximately $1 million.

II. PROJECT BACKGROUND AND RATIONALE

2.0. Problem Statement

A number of factors have contributed to the decline in cereals production and ballooning imports over the course of the past decade. Drought from 1981-1985 reduced average grain yields from a long-term average of 1.0 mt/ha (1969-1980) to 0.8 mt/ha. An inappropriate pricing policy, an inefficient marketing system owing to tight government regulation, a skewing of public investment toward the large-scale irrigation subsector, ineffective technology transfer mechanisms, and a lack of research to generate appropriate technology for rainfed agriculture, also played a role.

The GOM is making strides towards correcting those problems which are under its control. Price and marketing issues are being addressed as conditions under the World Bank's Agricultural Structural Adjustment Loan (ASAL II) and USAID's proposed Cereals Marketing Reform Project. A reallocation of public investment in agriculture toward the rainfed sector, first encouraged by USAID, is being supported under ASAL II and the PL 480, Title I program. Generation of appropriate technology for rainfed agricultural production systems is taking place under the USAID-financed Dryland Applied Agricultural Research Project. Improved technology transfer systems are being developed under a World Bank project and at the USAID-financed Aridoculture Center in Settat.

The problem of insufficient water is being addressed in part through improved water conservation practices (land preparation, rotation, fallowing) and development of drought-resistant varieties for the bulk of farmland in the 250-450 mm rainfall zone. Significant progress has in fact been made on the research front. New drought-resistant wheat and barley varieties have been successfully tested and are ready for on-farm trials. A tilling machine (sweep plow) has been tested which shows promise of conserving soil moisture by reducing the disturbance of the soil and leaving a ground cover of crop residue.

One of the most effective means for increasing crop yields in semi-arid zones remains the provision of additional water during critical times of plant growth. This so-called supplemental irrigation can also enhance considerably the benefits obtainable by improved dry-land farming techniques and can allow expansion of those techniques into new, lower rainfall zones. It is thus not surprising that Moroccan interest in supplemental irrigation is very high.

One of the most serious constraints to the further expansion of supplemental irrigation in Morocco is a shortage of water sources in many areas. Groundwater tables are falling in a number of regions (e.g., the Souss Valley) and are seriously strained in others. In some grain producing areas they are too deep to allow economic pumping for any uses besides satisfying human and animal water needs. Only small amounts of land are located near reliable water streams to allow diversion at critical times. In fact, most Moroccan rivers are seasonal and cannot be relied on to provide water at the time needed for supplemental irrigation.

One promising approach to increasing water supply for supplemental irrigation is the construction of small dams. If properly constructed and appropriately located, such dams can slow down the water run-off, thus increasing penetration of water into the groundwater table. This, in turn, will increase the yield of wells from which water for supplemental irrigation can be drawn and generally raises the water table, thus reducing well construction and pumping costs. In addition, such small dams can feed directly into downstream gravity irrigation systems for supplemental irrigation. The small dams constructed so far that provide water for supplemental irrigation vary from three to 25 meters in height and store from 500,000 to 4,000,000 cubic meters of water. Irrigation command areas are typically less than 400 has. Essentially, the dams collect runoff which is stored throughout the cropping season and used to irrigate crops at critical stages in plant development.

The technique of using small dams to provide water for supplemental irrigation is not new in Morocco. In the southern regions it antidates the protectorate. The revival of these techniques came in 1984, when an Interministerial Committee, including the Ministry of Interior, the Ministry of Agriculture and the Ministry of Public Works was formed to implement a small dams program. Thirty-four dams have been constructed under this program to date. Most of them serve several purposes including, drinking water for humans and livestock and recharging ground water. Twenty-three include an irrigation component. Over 3000 has. have thus come under full or supplemental irrigation. The GOM's Small Dams Program is reviewed in detail in Annex B. Especially with respect to the actual construction of dams, this program represents a major achievement. However, a careful analysis by USAID revealed that the potential use of small dams as water sources for supplemental irrigation is not fully realized under the existing program. This project is designed to address this problem and to assist the GOM in making more effective use of its Small Dams Program.

2.1. Relationship to USAID's CDSS

Concentrating on the rainfed sector, USAID's strategy for increasing food supply and incomes of small and medium producers is to 1) increase scientific and technical manpower through programs of institutional technology transfer (such as the project at the Agronomic Institute, 608-0160); 2) develop an applied agronomic research capacity in the most important dryland cereals production area (eight provinces near Settat); and 3) improve pricing and marketing policy through an increased policy analysis capability. The focus on the large, backward, rainfed sector serves three purposes: 1) it addresses the need for greater growth in domestic food production and reduced import expenditures; 2) it addresses income distribution concerns, as the bulk of the rural poor are dependent upon rainfed agriculture; and 3) it responds to the need for increased efficiency in food production which will permit relative food prices to decline, benefiting the urban poor.

The USAID agricultural research program (Dryland Applied Agriculture Research, 608-0136) has identified new farming practices which promise to significantly increase food production and small-farmer incomes in dryland

areas of the country. Research also shows that supplemental water applied at critical stages of plant growth has a dramatic effect on yields. Increases in yields of three to four times over strictly rainfed conditions have been recorded. Furthermore, supplemental irrigation can assure a minimal yield even in years when rainfall is insufficient for any yield at all. Supplementary water can be made available in several ways. Where development of groundwater supplies is technically and economically feasible, center-pivot irrigation systems have been developed. Small dams appear feasible where groundwater supplies are limited and where topographical and geological conditions are conducive to their development. Investment in small-scale, low-cost dams and irrigation works will complement the rainfed strategy, wherever technical and economic conditions so warrant, by reducing the risk of drought, increasing the scope of possible cropping systems, increasing on-farm employment through cultivation of labor-intensive crops such as vegetables, and increasing average crop yields.

2.2. Relationship to the GOM's Development Plans

Five years of drought from 1981-1985 and the subsequent increase in wheat imports from 42 kg per capita during 1971-74 to 87 kg per capita during 1981-87 has led the GOM to greatly step up efforts to promote wheat production, rural development generally, and water resources development in particular. Investments in dryland research, integrated rural development and small-scale irrigation projects have received relatively higher budget allocations in the 1988-1992 plan than in previous years. Small- and medium-scale water resources and supplemental irrigation development schemes, including small dams, make up an increasingly important part of the budget. The share in public investment of the latter type of irrigation development increased from 1.6 percent in 1981-83 to 3.0 percent in the 1988-92 plan.

Major reasons for this shift in relative investment rates toward small, rural-based projects include the GOM's growing concern with increasing the productivity of small farm families that cultivate less than ten hectares under rainfed conditions. This group accounts for about 80 percent of cereals produced in Morocco. Moreover, lack of employment opportunities in rural areas has resulted in a migration to larger cities at rates which exceed the capacity of city-based industry to absorb. Addressing rural unemployment and insufficient food production at the same time, the GOM has mounted a program that uses highly labor-intensive techniques to construct small, multi-purpose dams, most of which include small (50-400 hectares) irrigation perimeters, throughout the drier ecological zones.

This strategy is part of a broader shift in the focus of economic development in Morocco to rural areas, which attempts to affect a better spatial distribution of economic growth. Among the measures employed are: 1) labor intensive infrastructure projects (rural roads, potable water, health facilities, small-scale irrigation, and education facilities), 2) decentralization of development activities, providing tax funds and decision-making authority for rural development projects to local organizations (villages, districts and provincial governments) and 3) encouraging development of small and medium private enterprise in rural areas.

The proposed project will also have a budgetary impact in line with GOM and donor strategy. The contribution of the project to the national program for constructing dams of this kind will result in additional dams constructed, due to the nature of the budget allocation process for this program. There should be no substitution of assistance funds for ordinary GOM budget resources in the case of this project. The reason for this is that the dam construction program receives, unlike other programs, a deposit to an off-budget account in the General Treasury at the beginning of the year. As tranches of construction are completed, USAID funds will be directly deposited to this account which is managed by the Ministry of Interior. In this way, the initial deposit for the existing national program will not be diminished and dams financed by USAID will be in addition to those already planned for the year.

Given the imperative to reduce the GOM budget deficit under a new IMF Stand-By Agreement currently under negotiation, there would be no conceivable means of increasing the current small dam construction program through mobilization of domestic resources. External concessional assistance, such as that proposed under the Supplemental Irrigation project, is the only means of increasing program size.

III. DETAILED PROJECT DESCRIPTION

3.0 Project Goal and Purpose

3.0.1 The goal of the proposed project is to increase farm incomes and the overall standard of living among rural households in the semi-arid regions of the country. This goal will be achieved by strengthening the Government of Morocco's (GOM) Small Dam's Program so that it becomes a more productive and sustainable development tool.

3.0.2 The project purpose is to improve the selection, design, implementation, and management of approximately 10 supplemental irrigation systems. This purpose recognizes the need for incorporating into the present program a more analytical and systematic approach to take into account the unique economic, technical, social, and environmental factors that bring about successful development interventions.

3.0.3 Project Outputs

The project will produce two kinds of outputs. Most of the project resources will be devoted to the construction of viable supplemental irrigation systems in the Settat command area. However, to ensure that these systems conform to the criteria usually employed by USAID, a limited amount of TA and training will also be financed under this project. The institutional support will strengthen the GOM program overall as well as the systems funded under this project.

The project outputs are summarized as follows:

Infrastructure

- Approximately 10 supplemental irrigation systems constructed and operational within the Settat command area, which includes the provinces of Casablanca; El Jadida; Kelaa; Essaouira; Khouribga; Marrakech; Safi; Settat; and portions of Ben Slimane and Beni Mellal.

Institutional

- Upgraded skills of GOM staff at the National and Provincial levels who are charged with developing small dams and irrigation systems. Staff trained and fully capable of conducting substantive economic, technical, social, and environmental analyses required for proper site selection and project design.

- Sound economic, technical, social and environmental criteria established, and appropriate water system sites selected based on these criteria.

- Project designs completed based on site-specific analyses of economic, technical, social, and environmental factors.

- A monitoring and evaluation system in place and providing the necessary information to technical staff and decision-makers for properly designing and implementing supplemental irrigation projects.

- Viable water user associations effectively managing and maintaining community irrigation systems.

- A feasible water pricing and cost recovery system in place.

- Farmer beneficiaries effectively trained in managing and maintaining irrigation systems and in the technology of supplemental irrigation.

3.1 Nature and Scope of Project Activities

3.1.1 Overview

The project consists of a series of interrelated activities all aimed at establishing viable supplemental irrigation systems in Morocco's rainfed agricultural sector. The activities are designed to complement, and not replace, the GOM's own efforts and to lead to supplemental irrigation systems that will be worthy of being replicated.

It is possible to build supplemental irrigation systems in the Settat region area that satisfy the usual economic, social, environmental and technical criteria USAID applies to projects it funds. The current GOM program is not necessarily oriented along the same criteria, and there is no assurance that all dams acceptable to the GOM would also be acceptable to USAID and vice versa. The challenge of this project is to identify sites that in each category meet the more stringent of either USAID's or the GOM's criteria and are thus acceptable to both parties. Only sites that satisfy both sets of criteria will be considered for funding under this project.

Criteria which define a supplemental irrigation site acceptable to USAID are presented below, in Section 3.1.2. Pre-construction interventions, ranging from technical assistance to training to funding for feasibility studies are planned under this project and are intended to assist the GOM in identifying sites that meet these criteria (see section 4.0, below). It is presumed that the GOM will only propose to USAID sites that are acceptable by its own criteria. Therefore all sites funded under this project will satisfy both the GOM's and USAID's criteria.

The second set of project interventions is concerned with the construction of supplemental irrigation sites. Through a negotiated cost reimbursement (NCR) mechanism, USAID will reimburse the GOM for part of the construction costs of approximately 10 sites that meet USAID's criteria of technical, economic, environmental and social feasibility and are located in the Settat area.

The third set of activities is directed at the farmers who are beneficiaries of the supplemental irrigation systems funded under this project. In order to make full use of the opportunities offered by the water provided, farmers will have to be organized and trained in irrigation technology. Finally, a monitoring system will be instituted that will generate data for further improvements in site selection and system design, and that will demonstrate the effectiveness of supplemental irrigation in raising farm yields and incomes.

3.1.2 Site Selection and System Design

The current GOM site selection process consists of four broad stages. First, potential sites are proposed by the local authorities to the Interministerial Committee which then contracts out for technical feasibility studies. Second, limited economic and social analyses are carried out at the time final construction plans are being drawn up. Third, unless a site is clearly unsuited for technical reasons, it is retained and may ultimately be selected for development. Fourth, the final selection of the ten to fifteen dams that make up the annual construction program from all the technically feasible dams includes some political and distributional considerations along with technical ones.

The current site selection process should be refined to better identify systems with high potential for supplemental irrigation. Clearly, economic analyses should be carried out before final decisions are made on site construction. Otherwise, unsuitable sites may remain under consideration for too long. Carrying out economic analyses at a time when all the expensive engineering work has already been completed does not permit the economic data to be fully utilized. Even if a site is unsuitable on economic grounds, it may be too late to stop its construction by the time the final plans are drawn up.

The current site selection process might also benefit from the introduction of expanded social criteria. International experience suggests that irrigation systems can give rise to a host of social problems which, if unchecked, may jeopardize overall project success. For example, the introduction of a new water source can upset traditional property rights and result in social conflict. Likewise, the protection of the dam through upstream conservation works may require controlling access to grazing land and may cause social conflict. The introduction of a system into a tense social environment may undermine farmer participation in system management and maintenance. Experience in other countries has shown that poor management has been the single greatest impediment to irrigation project success and that management "will be more effective by reflecting local needs the closer that management is kept to the user" (A.I.D Evaluation Report No. 8, August 1983). Greater attention should be assigned to potential social ramifications. A detailed discussion of social impacts is presented in Annex E.

More attention also needs to be given to environmental concerns in the site selection process. In addition to controlling erosion and siltation, environmental impacts such as water-borne diseases, increased degradation of grazing lands from increased stocking rates, and water quality problems must be taken into account. The environmental impact analysis required for disbursement of USAID funds for supplemental irrigation sites is described in Annex G.

The project will institute a selection process, aimed at selecting from the pool of small dam sites those that are best suited as sites for supplemental irrigation systems and that are not only technically feasible, but also socially acceptable, environmentally sound, and economically profitable. The process consists of two phases, a rapid initial assessment (RIA) and a detailed feasibility study phase. Each phase is intended to support a specific decision, the RIA whether to fund feasibility studies for specific sites, and the detailed feasibility study, whether to fund and construct a site. The outline of this process is described below.

First Decision Point: Criteria for USAID Funding of Feasibility Studies

From the pool of proposed sites (about 200 are currently identified within the Settat command area), the Interministerial Committee (IC) will select those that after a rapid initial assessment (RIA), show promise as supplemental irrigation (SI) sites which meet USAID criteria. This initial selection will necessarily be rough, based on rules of thumb, and is essentially intended to avoid spending scarce human and financial resources on analyzing sites that show little or no promise.

The GOM, with the assistance of the project-funded, long-term technical advisor, will be responsible for carrying out (RIAs) of potential sites. USAID will consider a site for further analysis only if it satisfies all of the following criteria:

1. Feasible irrigation command area is greater than 200 hectares

   The feasible command area is limited by a number of constraints. At least two of these constraints can be addressed at this point: topography and water availability. First, the topographic constraints which determine the maximum area to which water can be diverted from the dam without any need for expensive lifting systems or land leveling can usually be assessed quickly by looking at a map. This gives a first estimate of the feasible command area.

   Second, an initial estimate of water availability can be obtained by multiplying the watershed area by the annual rainfall and multiplying this result by the runoff coefficient. If the runoff coefficient is not known, an average of 10 percent may be assumed. Dividing this estimate of annual water yield by 3500 m3 results in a second estimate of the maximum number of hectares for which sufficient water would be available for supplemental irrigation. The coefficient (3500 m3) reflects the average amount of water required to supplementally irrigate one hectare, assuming an irrigation efficiency of around 50 percent.

   The maximum feasible command area is the smaller of the above two estimates.

The justification for this criterion is based on the supplemental irrigation emphasis of this project. This project is intended to build small dam systems that can be substantially justified by their supplemental irrigation benefits. Given the average expected net benefit of supplemental irrigation per ha and the average expected construction costs (Annex D) it is unlikely that supplemental irrigation systems based on small dams that irrigate less than 200 has will be justified economically.

2. No obvious technical or environmental constraints

At this preliminary stage of project assessment, critical technical and environmental considerations would include: the general stability and suitability of the existing geology of the impoundment site and immediate surrounding watershed area; the topography of the impoundment area and adjacent watershed areas; type and condition of the soils within the impoundment, adjacent watershed and downstream irrigated perimeter areas; water quantity and quality of the proposed source of supply; and assurance of state control of lands located within the impoundment area and critical surrounding watershed areas.

If a dam appears technically feasible, an engineer will be able to provide an educated guess as to the likely type and size of the dam. Based on historical unit costs it is thus possible to arrive at a first rough cost estimate. Similarly, initial estimates of up-stream and down-stream costs can be calculated and aggregated to a first estimate of systems costs (say "C").

3. Probable economic costs are less than probable economic benefits

The probable economic costs can be approximated by taking 60 percent of C, the financial costs. This approximation is based on the assumption that about 1/2 of the total system costs are wages paid to unskilled labor, and that labor has an economic cost equal to 20 percent of its wage. The economic benefits can be approximated by multiplying the command area by the discounted net benefits per ha (B). Estimates of "B" are given in Annex D.

4. The supplemental irrigation system benefits primarily small farmers

Small farmers are defined as those owning and operating less than 10 ha. "Primarily benefitting" means that at least 70 percent of the beneficiaries are small farmers by the above definition, and that they occupy at least 50 percent of the proposed irrigation perimeter.

A judgment should be made that the land tenure situation does not present an insurmountable obstacle to forming water users associations and efficiently distributing water.

In order to ensure this last criterion is satisfied, the GOM will establish a list of beneficiaries and of their land holdings in the command area, including a map. These two documents, the list and the map, are an integral part of the submission of a funding request to USAID, and will be required later on for the detailed social feasibility study.

The criteria of the RIA should be evaluated in the order given. The first criterion can usually be evaluated without any site visits being required. If the watershed is too small to yield sufficient water, the site can be dropped from consideration for this project right at the outset. The second criterion requires a site visit and also produces some information that is needed to evaluate the third criterion. Only if the third criterion is satisfied will contacting potential beneficiaries and undertaking all the work required to satisfy criterion number four be warranted.

The Interministerial Committee (IC) will review these selections and decide which sites to analyze in more detail, and which sites to propose to USAID for possible funding. Only if all four of the above criteria are met, i.e., answered in the affirmative, will USAID approve the expenditure of project resources on feasibility studies for that site. If USAID agrees with the IC that, based on the RIA, a particular site shows promise, it will reserve funds to reimburse the GOM for the costs of those required social, technical, environmental, and economic analyses that are contracted out. Carrying out the feasibility studies or supervising the contractors in charge of carrying them out, will be the responsibility of the relevant ministry: the MARA-DER for the economic analyses; the Ministry of Public Works, directorate of Hydraulic Works (MPW-DAH) for technical and engineering analyses; the MARA-Directorate of Water and Forests (MARA-E&F) for environmental analyses; and the Ministry of Interior, Directorate of Rural Affairs (MOI-DAR) for social analyses. Cost estimates and terms of reference for the feasibility studies to be contracted out will be submitted to USAID along with the RIA.

The RIA is a rough instrument, and some sites may be excluded even though a more detailed analysis might have found them to be feasible after all. However, the sites that pass the four filters above do have a good chance of being feasible and meeting USAIDs' ultimate criteria for funding. They thus warrant the expenditure of resources for further, more detailed analysis.

Second Decision Point: Criteria For USAID Funding of Supplemental Irrigation Systems

In order to fund a supplemental irrigation system, USAID requires that it be technically and environmentally sound, socially acceptable, and that it show an adequate economic rate of return. In order to establish that these criteria are met the GOM will carry out, or have carried out by a contractor, a set of analyses. These include a hydrological study, and engineering study, a social feasibility study, an environmental impact assessment, and an economic cost/benefit analysis.

Some of these studies (e.g., engineering) are already routinely carried out under the current Small Dams Program. Some (e.g., hydrology) can probably be carried out quickly by the respective GOM offices themselves. The environmental analysis has to be completed to satisfy legal requirements for disbursement of USAID funds for supplemental irrigation sites and the economic analysis boils down to aggregating all system costs accurately to compare with the standard benefit figures given in Annex D.

Hydrology

Two simple criteria can establish the hydrological feasibility of a supplemental irrigation system:

1. Annual inflow minus evaporation losses must be equal to or greater than the total annual supplemental consumptive use of the irrigation perimeter, taking into account irrigation losses.

   In practical terms this means that a reservoir water budget for the site has to be constructed. Ideally such a budget would be based on monthly rainfall patterns for the specific site. But in the absence of detailed information, data from analogous sites or annual data may be used. If required, staff at the MPW may receive specific training in hydrology under the Project so that they may be able to construct such reservoir budgets.

2. The estimated annual sediment load should be small with respect to the reservoir storage volume to assure a physical life longer than the economic life. In particular:

   -- If the annual sediment load is less than 1 percent of the reservoir capacity, the project is acceptable.

   -- If the annual sediment load is greater than 1 percent but less than 2.5 percent of the reservoir capacity, the project may be acceptable subject to some mitigating measures (e.g., maintenance dredging). The costs of these measures are to be added to the operation and maintenance costs borne by the beneficiaries.

   -- If the annual sediment load exceeds 2.5 percent of the reservoir capacity, the project would normally not be acceptable. However, if it can be demonstrated that erosion control can be applied within an acceptable cost limits i.e., the economic rate of return is still 12,5 percent or more, the site may be selected.

Engineering

The GOM is already carrying out detailed engineering feasibility studies for all proposed sites. All of these studies are carried out by certified private Moroccan engineering companies under contract to the MPW. The evaluation of a number of these engineering studies by the

project design team revealed that they are technically adequate and professionally executed (see Annex B). Safety norms are respected and appropriate cost minimizing construction techniques are utilized.

In order to establish the technical feasibility of a particular site, USAID requires that this type of detailed engineering analysis be carried out, that it be extended to include the downstream works, and that it provide a detailed cost estimate by type of costs (labor, equipment, materials etc.) as well as project component (downstream works, dam proper). The cover sheet will contain the following certification, signed by the responsible senior engineer of the Ministry of Public Works:

> "I certify that the supplemental irrigation system designed herein, including the dam, canals, and all other associated works, satisfies all applicable Government of Morocco standards."

This certification and a sufficiently detailed engineering study will satisfy the technical feasibility criteria.

Environmental

As the majority of "critical", yes-or-no environmental criteria would already have been considered to some extent under the initial RIA phase described above, this second phase of site assessment will focus on detailed environmental design considerations and alternatives, and associated mitigative requirements rather than overall site feasibility *per se*. This more intensive environmental analysis work is legally required by USAID to ensure that the proposed site activities have no negative impacts on the environment. The specific information required and issues to be addressed at the site analysis phase are outlined in Tables G-1 and G-2, Annex G. Based upon the project-specific results of this analysis, as documented in an environmental feasibility report, the USAID Environmental Officer will verify that each proposed project site is acceptable for USAID financing.

Social

To establish the social feasibility of a specific SI site, the GOM will provide a social analysis which will include:

- A description of the communities or groups which will receive water and those which will be affected by the new water system.

- A plan for the organization of farmers for 1) the management of water distribution, 2) maintenance of the system and, 3) the collection of fees or other mechanisms such as labor exchange for accomplishing the required maintenance.

This plan will be developed with the participation of farmer beneficiaries. The beneficiaries will express a willingness to accept the system and assume responsibility for its operation and maintenance.

If the above analysis reveals no insurmountable obstacles to introducing a supplemental irrigation system in that site, USAID will consider the proposed system to be socially feasible. More detailed social analyses may be undertaken after final site selection in order to identify site-specific project options, implementation strategies, and a system for monitoring project benefits.

Economic

The requirements for the economic feasibility analysis are simple and straightforward. The first task will involve ascertaining the mean annual rainfall and whether the irrigation system requires any pumping. This will place the perimeter in one of the categories for which discounted net benefits per ha are given in Annex D. Multiplying the discounted net benefits per ha by the total area to be irrigated results in the total benefits generated by the system. Additional benefits should be added only if they are both substantial and quantifiable, e.g., potable water, additional forage and firewood.

The second task consists of aggregating all the system costs. They include the construction costs estimated by the engineering study, the costs of fair compensation for farmers displaced from their land or the value of foregone production from that land, any costs associated with land re-distribution, and the costs of environmental mitigation as far as it is directly connected to correcting environmental damage caused by the supplemental irrigation site. The costs of mitigating environmental damage existing before the project are not included in the calculations.

If additional substantial recurrent costs, not included in usual operation and maintenance costs, are required (e.g., maintenance dredging against siltation, pumping over lifts exceeding 50 meters, environmental monitoring costs), these costs have to be discounted over the life of the project and added to the total system costs.

The cost of non-skilled labor may be adjusted to reflect its true economic opportunity cost. Exact figures are not available, but evidence suggests serious under- and unemployment, especially in rural areas. For example it is normal for jobs on public works projects executed by PN to have to be rationed in some fashion. This indicates that the true economic opportunity cost of labor is substantially lower than the minimum wage paid by PN. Especially during the dry season, when the supplemental irrigation systems will be under construction, rural unemployment can become very acute. Estimating the economic cost of unskilled labor to be 20 percent of its wage therefore seems to be a reasonable assumption.

The economic feasibility criterion is the economic benefit/cost ratio. If a proposed supplemental irrigation system has a ratio of economic benefits to economic costs in excess of 1.2 it will be acceptable to USAID without further analysis. If the economic benefit/cost ratio is less than 1, the supplemental irrigation system will not be acceptable, and if the ratio is between 1 and 1.2 a more thorough economic analysis is required. If such an analysis shows an internal economic rate of return in excess of 12.5 percent, the supplemental irrigation site is acceptable.

MARA-DER will assemble the required analyses into a dossier and present it to the IC. The IC will then accept or reject a site, based on the analyses, and, if the site is accepted, decide whether to propose it to USAID for funding. USAID will review the analyses and ascertain whether the site satisfies the agreed upon criteria for funding.

Note that this system for site selection does not alter any of the decision-making responsibilities within the current GOM program. The proposed changes and improvements affect only the staff work. The analysis of a number of proposed sites during the project design phase has revealed that better staff work in all areas, except possibly engineering, is necessary if the GOM hopes to develop supplemental irrigation sites that USAID can accept for funding. Therefore, initially, the improved site selection process will be focused primarily on developing sites for USAID funding. However, as the new process takes hold, its usefulness to support funding decisions by other donors and by the GOM itself will become clear and the overall GOM Small Dams Program will be improved.

3.1.3 Constructing Supplemental Irrigation Sites

In order to deliver new technology to improve small-farmer incomes, facilitate acceptance of the new site selection and system design methodology, and to demonstrate its feasibility, the project will provide assistance in constructing approximately 10 supplemental irrigation sites over the life of the project. These sites will satisfy the criteria laid out above. The project will provide TA and training inputs to assist the GOM in identifying and analyzing sites that meet these criteria.

The final dossier, consisting of the required technical, environmental, social, and economic analyses will also include cost estimates for all system components. The technical feasibility studies produced by consultants under the current system already include such estimates, and they appear to be quite accurate. Spot checks of the few data points which where available revealed that actual costs were very close to estimated costs.

USAID will agree to reimburse the GOM based on a negotiated cost estimate for each site. The sequence of events will be as follows:

1. The IC submits the complete dossier of the site to be funded to USAID, including the relevant cost estimates. The cost elements will be detailed by type of works (up-stream, down-stream, dam proper) as well as by category (labor, equipment, materials etc.).

2. Based on historical unit costs, the USAID engineer will determine whether the cost proposal is reasonable. Historical unit costs are available from the 30 dams built so far under the GOM Small Dams Program.

3. USAID will reimburse 85 percent of the estimated costs and will provide the GOM with a Project Implementation Letter to that effect.

4. Reimbursement will be made in the manner described in the Financial Plan (Section 4.2.6 below).

3.1.4 Upstream Protection Works and Downstream Irrigation Systems

Under the present GOM system, analysis, selection, and construction of the various components of the complete supplementary irrigation system are carried out by different agencies at different times, with less than full coordination of studies and construction activities. It is the aim of the present project to integrate the entire process toward

1) selecting economically, socially, environmentally and technically sound projects, and

2) carrying out construction in a cost-effective, fully-integrated manner. To this end, upstream erosion control and the feasibility of irrigation will become an integral part of SI site selection. Further, construction activities for all three components will be carried out simultaneously. This will insure that the dam is protected against siltation and the farmers begin to benefit from irrigation water as soon as possible.

The dossier submitted to USAID for financing will therefore be an integrated schedule of total construction activities.

Construction of supplemental irrigation systems pose some particular technical problems requiring assistance from outside the Ministry of Agriculture Units (DER and DPA) charged with implementing this phase of the activity. There are several alternative choices of physical structure and lay-out. Cropping choices and optimal water requirements of different crops dictate in part the ideal type of canal construction. Operation and maintenance requirements and the ability of farmers to manage the use and maintenance of the system also impact on the design of the canal system.

To insure that lowest-cost, farmer usable systems are constructed, the project will fund technical advisors drawn from Moroccan institutions and composed of:

1) An Irrigation Engineer;

2) An Agronomist or Soil Scientist;

3) An Agricultural Economist;

4) A Social Scientist, and

5) An Environmental Analyst.

These skills have been identified as critical to sound design of supplemental irrigation systems, and are skill areas needing enhancement in the MARA-DER and DPA structure. Short-term assistance will be provided as required (see Section 4.0.2.) over a four-year period. The required skills will be transfered to existing MARA staff by the time the first three or four dams are selected, designed, and built, enabling all technical assistance to phase out, except the research, evaluation and monitoring program discussed below.

These Moroccan experts will advise the DER and DPA in all aspects of site selection, design, construction and monitoring of irrigation works. They will also develop a practical research program, develop improved technology of irrigation, agronomy and water use management, advise the DPA on formation of water users associations and develop training programs for farmers.

3.1.5 Organization of Water User's Associations and Technical Training of Farmer Beneficiaries

Farmers in the target region have had little or no experience in irrigation or in cooperative management of jointly-held resources. Moreover, management of water for supplemental irrigation is particularly complex in that distribution of water at just the right time and in precise quantities governed by the needs of a particular plant, at various stages of growth, is necessary to maximize the benefits of this extremely scarce resource. Consequently, a critical component of this project must be assistance in organizing farmers, and training farmers in this demanding new technology.

Based on the social analysis carried out at the design phase, farmers will be organized with the assistance of the DPA representative who in turn will be advised by the technical assistance advisory team. Organization will depend in part on the social and economic structure of the community of beneficiaries. Beginning simultaneously with the construction phase, the details of the rights and responsibilities of each member of the association will be communicated to the farmers in a series of meetings. Fees, water turns and a system of equitable and efficient water distribution will be developed, culminating in a formal, legal document incorporating the water users association. Follow-up advisory services, on both organization and management of water and technical aspects of irrigation, will be provided by the DPA, with assistance from the technical assistance advisors. Feedback from research and monitoring activities will provide the means for improving the irrigation system in future years.

The legal basis for the creation of the water users associations already exists. It is expected to be promulgated into law shortly. The legal document appears sufficiently flexible to adapt to the particular needs of individual farmer groups.

3.2 Project Participants and Responsibilities

The ultimate success of the project will depend on the degree to which all of the many participants undertake and effectively implement their responsibilities. This is a complex project with many participants and its management will require very close coordination between the USAID project office and its GOM counterparts.

3.2.1 Interministerial Committee

This national-level body is the overall policy and implementation group for the GOM's Small Dams Program (barrages collinaires) which will be the project's main counterpart. Its role is dominant in the program and it represents the coordination point for design and implementation. The three permanent representatives on the Committee are the Ministry of Interior, the Ministry of Agriculture, and the Ministry of Public Works.

Ministry of Interior (MOI) - As with the present Small Dams Program, this ministry is responsible for selecting, with its other two counterparts on the Committee, the actual sites to be developed. The Ministry's Promotion Nationale unit will continue to be responsible for overall coordination of activities and labor recruitment for the construction activities. Priority emphasis will be given to employing labor from the communities in which the sites will be located and in the neighboring areas. In addition, MOI, through the account of Promotion Nationale, will receive the USAID reimbursements for feasibility studies and construction and will be responsible for reimbursing the other ministries in turn.

Ministry of Public Works (MPW) - The second member of the Committee will participate with the other two committee members in conducting the site selection via the process provided for in this project. Its technical offices, Direction des Amenagements Hydrauliques (DAH) and Direction de la Recherche et de la Planification de l'Eau (DRPE) will continue to do the geological studies and hydrological studies, respectively, related to the dam sites. In addition, they will be responsible for applying the technical criteria developed in the Project Paper to the site selection process. In the design phase MPW will oversee contracting with private firms to develop the technical design plans for the dams. It will also be responsible for certifying to USAID that the SI system is properly designed from an engineering point of view. During implementation it will furnish an engineer, as it now does, to oversee and guide the construction.

Ministry of Agriculture and Agrarian Reform (MARA) - The Ministry's Direction de l'Equipement Rurale (DER) will be responsible for the RIA and for assembling the final project dossier, will coordinate the final site selection process to be developed under the Project, will carry out the technical feasibility analysis for the downstream irrigation works, and will coordinate the training and organization of farmers. MARA-E&F will be responsible for the environmental assessment and upstream protection of the dam.

Closely linked with the design and implementation process is the monitoring and evaluation system to be developed in the project. DER (with its technical assistance experts) will have responsibility for designing the system and analyzing the results for incorporation into future water system designs. DER will work with the provincial DPA offices which will do the actual data collection for the system.

3.2.3 Provincial Committee

At the provincial level, a committee comprised of MARA-DPA, MOI-PN, and MPW-DPE will continue its role in overseeing most of the field-level activities. The technical capacity of these offices will be upgraded through technical assistance and training to better undertake project activities. During the pre-design phase, the DPA and DPE will assist in the data collection for the RIA. They will closely coordinate with their national level offices in this exercise and in the subsequent in-depth analyses needed for the actual site designs. MOI-PN will be primarily concerned with the local labor recruitment. MPW-DPE will undertake topographical surveys and data collection related to the dam. MARA-DPA will assist in analyzing agricultural potential but will also become more involved with the social and environmental ramifications of site development. MARA-EF ("Eaux et Forets") will be primarily involved in activities related to upstream watershed protection and will closely coordinate with the DPA-SE (Service d' Elevage) on protection measures and land management related to livestock.

During implementation of this project the roles of the provincial offices will be expanded. For the first two years of operation of each dam, MARA-DPA will assign one agent per site full-time to be the technical support for the water user associations. In those areas where the Regional Office of Agricultural Development (ORMVA) has jurisdiction they will furnish the agent. This is an important requirement since the implementation of new water systems will entail inevitable start-up problems. Agents will have responsibility for assisting farmers in organizing themselves and managing the irrigation system. The agents themselves will be supported by the technical assistance and training components of the project and technical units of the DER.

Monitoring project impacts will be another responsibility of the DPA. It will undertake the bulk of the data collection for the monitoring system under the guidance of the national office of MARA-DER.

3.2.4. Other Moroccan Institutions

Technical experts from a wide range of governmental and private institutions will be accessed through competitive procurement procedures to acquire advisors under the planned technical assistance program. The International Irrigation Center at the Agronomic Institute (IAV, Hassan II), Mohamed V University and a number of private consulting firms are promising sources of the required expertise.

3.2.5 Ministry of Economic Affairs

This is the primary contact for USAID in negotiating the final project agreement and subsequent Amendment. Its role will be one of coordination early on to inform all concerned ministries about their responsibilities within the project.

3.2.6. USAID

A USAID Project Officer, within the Agriculture Division, will be assigned to implement this project. S/he will maintain direct contact with the MARA-DER representative of the technical group that will be the primary counterpart for implementing the project in his capacity as Director of the Secretariate to the IC. The Project Officer will also maintain contact with the MPW and MOI members concerning the implementation of the site selection process, monitoring of construction activities, and formation of water users associations.

At the provincial level, the Project Officer will coordinate with the local DPA representative on the Provincial Committee through the DER chief in regard to monitoring on-site activities.

USAID Morocco will also employ a DH Engineer to provide the needed engineering backstopping. This individual will review and accept (or reject) technical design plans and cost estimates for the infrastructure (dams and irrigation works) that the project will finance. This person will also have responsibility for verifying the GOM certifications. The Environmental Officer will verify that each site accepted for funding meets U.S. environmental requirements.

3.3 Project Beneficiaries

The project is being designed to have positive impacts on a wide spectrum of the population. At both the national and local level, staff who are implementing the GOM's Small Dams Program will receive training and technical assistance to further develop their technical knowledge and capabilities to design, monitor and implement supplemental irrigation systems. The exposure to new methodologies and development approaches and the actual experience of putting these into operation will result in a trained, productive and effective technical unit.

In the semi-arid provinces of the Settat region, where the actual sites are to be developed, poor, rural communities will be the direct recipients of the project's benefits. Dryland farmers who remain at subsistence level due to the vagaries of the weather will now have a source of water to boost production in both good and bad years.

The general order of magnitude of financial benefits to the target rural populations is estimated as follows:

1) up to 17,000 workers will be employed for a period of about six months each, and will earn about $7 million;

2) net additional income to farmers from irrigation is estimated at $1.5 to $1.9 million per year for the estimated total of 1500 farm families benefited by the project.

Additional benefits which are not readily quantifiable but expected to be significant include the availability of drinking water, erosion control, and firewood and forage production upstream of the dams. The site selection process is designed to assure that benefits will be distributed to the most

disadvantaged rural populations. These are farmers owning less than 10 hectares of land whose incomes fall below the national average per capita level of farm income of 1880 DH ($221).

Developing increased participation by farmers in the design and management of the supplementary irrigation systems is an important element of the project. Farmers will be consulted on design factors to ensure that the water delivery system takes into account special circumstances of land ownership and cropping patterns. They will be involved in the process of organizing for operating and managing the system. No system will be built unless the beneficiaries truly want it and are prepared to assume full responsibility for managing and maintaining it. Moreover, following the accumulation of experience and verification of the magnitude of net benefits, farmers will be encouraged to begin sharing in the investment costs. This will help ensure that water is used efficiently and that the maximum number of farmers possible are reached by the project.

IV. COST ESTIMATES, FINANCIAL ARRANGEMENTS, AND PROCUREMENT ARRANGEMENTS

4.0 Project Inputs and Estimated Costs

4.0.1 Long-Term Technical Assistance ($400,000)

The project will provide an Economist experienced in evaluating water resources and irrigation systems to the DER. This long-term advisor will assist the DER in establishing the inventory of potential sites, carrying out the RIAs, assembling the final project dossiers, and carrying out the economic analyses required for the final evaluation of a supplemental irrigation site. S/he will also train DER staff in the relevant analytical techniques, through seminars and workshops as well as "on-the-job", and coordinate the short-term technical assistance group. Finally, in conjunction with the short-term technical assistance team, the long-term advisor will assist DER in instituting the required hydrological, social, environmental and economic monitoring systems and arrange for training of the local agents responsible for data collection.

The project design team has identified economics as one of the analytical capabilities of the GOM agencies responsible for the small dams program that could benefit from reinforcement. It is thus desirable to complement the existing professional capabilities of the DER with an economist, at least until local staff can complete the necessary training to assume this function fully. It is also undeniable that at least initially the analyses required by USAID will place an additional workload on the GOM staff, particularly the DER, at precisely the time when training will also place demands on staff time. After three years it is expected that the long-term advisor can be phased out.

4.0.2 Local Short-Term Technical Assistance ($300,000)

The project will provide up to five Moroccan experts in the fields of agricultural economics, irrigation engineering, agronomy/soil science, environmental analysis and social science. The short-term advisors will advise and train MARA-DER and their field units (DPA) on feasibility analyses, site selection, construction of irrigation systems, formation of water users associations and technical aspects of water management. They will also advise and assist the DER in setting up a monitoring system. The purpose of the system is to monitor environmental and health effects; review agricultural practices and estimate crop yields; and assess the ability of the water user's association to distribute water fairly, collect the necessary charges, assure operation and maintenance, and apply advanced irrigation technology on their farms. Such technical assistance will be provided under USAID direct institutional contracts or direct personal services contracts.

4.0.3 Other Short-Term Technical Assistance ($60,000)

Most technical assistance and training needs can be met by Moroccan institutions. However, certain skill areas may require expatriate advisors in the early stages of the project. Hydrology, environmental science, economics,

and some aspects of irrigation engineering may be enhanced by seeking expatriate advisors on a short-term basis. The skill areas required and specific level of effort will be determined by the GOM in consultation with the long-term advisor and the short-term Moroccan advisors.

4.0.4 Short-Term Training (Cost is included in TA above)

The short-term technical assistance team and the long-term agricultural economics advisor will design and carry out a series of short-term workshops to upgrade skills throughout the three-ministry organization responsible for implementing the project. Specific courses will be developed during the implementation phase. Among the topics for short courses already identified are:

a) social analysis and surveys,
b) water management,
c) economic analysis and surveys,
d) irrigation design,
e) plant and water relationships,
f) organization of water users groups,
g) environmental concerns, and
h) hydrology.

4.0.5 Participant Training ($120,000)

Long-term training in applied economics will be provided for one to two MARA-DER technicians. Short-term training in the U.S. will be provided in areas such as environmental analysis. The purpose of the training is to provide an upgraded technical staff in DER in those disciplines that are critical for carrying out the required analytical work. Technical assistance will be phased out once the long-term trainees return to assume these functions.

4.0.6 Commodities ($100,000)

The project will provide 5 micro computers for upgrading MPW and MARA-DER analytical capacity and equipment for environmental and hydrological monitoring. The project will also provide a 4-wheel drive vehicle for use by the long term technical advisor. This vehicle is required for site visits necessary during the RIA as well as during construction and operation of SI system.

In order to assure the availability of service and spare parts, the vehicle will be procured locally. A waiver authorizing this is provided. Upon final departure of the long-term advisor, the vehicle will be turned over to the grantee.

.0.7 Feasibility Studies ($600,000)

In order to approve approximately 10 supplemental irrigation sites for USAID funding, it is anticipated that approximately 15 sets of detailed feasibility studies will have to be carried out. At least some of these, perhaps including engineering and environmental analysis, hydrology, and

detailed economic analysis will be contracted to private Moroccan firms or institutions. USAID will reimburse the GOM for costs of those studies that are contracted out. When USAID approves the RIA, it will also approve the studies to be contracted out and the costs to be reimbursed.

4.0.8 Funding for Construction of Approximately 10 Supplementary Irrigation Systems at an Average Cost of $1.2 Million Per System ($12,000,000)

Up to 85 percent of the total cost of all construction activities, including upstream watershed protection, the dam, and the downstream irrigation system up to the farmgate, will be funded for each site selected according to the criteria described in section 3.1.2. above.

4.0.9 Research ($100,000).

USAID may finance contracts, or grants to a Moroccan institution to carry out research related to the technology of supplementary irrigation. A series of special studies, building on baseline information gathered at the feasibility study phase of site selection, will be carried out. Among those areas requiring research are timing of water application, soil, water, and plant relationships, efficiency of alternative water delivery systems, crop rotations, irrigation of alternative crops, warm-season irrigation potential, farmer management of irrigation water, alternative erosion protection schemes, and the economics of alternative irrigation technology.

4.0.10 Audit and Evaluation ($200,000)

The first evaluation will be scheduled for the end of the third year of the project. A final evaluation will be conducted at the end of the fifth year. The scope of work for the evaluations will be developed jointly by USAID, the GOM and the technical assistance group. It will be financed directly by USAID.

The evaluations will be based on data generated by the feasibility studies, annual work plans, and the internal monitoring system developed with the assistance of the technical assistance groups.

Since all payments will be made on a reimbursable basis after work has been performed and approved , no particular audit requirement is foreseen. However, an amount sufficient for a local audit firm to perform an audit in country has been set aside to allow for unforeseen events.

4.1 Financial Plan

4.1.1 Disbursement of USAID Funds

The different USAID cost elements and their disbursement over the project life are summarized in Table 4-1.

Table 4-1: USAID Financial Plan

('000 Dollars)

	Project Year 1	2	3	4	5	LOP Total
Long-Term TA	140	120	140			400
Short-Term TA						
Locally provided	100	75	75	50		300
Ex-patriate	40	20				60
Participant Training	60	60				120
Subtotal TA and Training	340	275	215	50		880
Commodities	100					100
Feasibilities Studies	120	160	160	160		600
Construction	1,200	2,400	2,400	2,400	3,600	12,000
Subtotal	1,760	2,835	2,775	2,610	3,600	13,580
Research	20	20	20	20	20	100
Audit & Evaluation			100		100	200
Contingency (8 percent)						1,120
Project Totals	1,780	2,855	2,895	2,630	3,720	15,000

4.1.2 Project Contribution by Source

The distribution of project financing contributions by source is given in Table 4-2. Overall, USAID will cover 75 percent of project costs, the GOM a little under 20 percent, and the direct beneficiaries, i.e. the farmers receiving supplemental irrigation systems under this project, will contribute 5 percent. Detailed information about the components of the USAID contribution are provided in Section 4.0, above. This section describes the contributions by the GOM and the direct beneficiaries in more detail.

The GOM's contribution will include salaries of project counterparts such as the officials assigned to develop the rapid initial assessments for proposed sites, carry out or manage detailed feasibility studies, manage construction, and instruct farmers in supplemental irrigation techniques; salary and international air fares for long-term training participants; secretarial and logistic support of the long-term advisor, including field transportation; and operating expenses (e.g. staff support, training facilities, office space, surveying equipment etc.) by participating GOM agencies.

The GOM contribution to direct construction costs will cover 15 percent of all construction costs of the dam and the upstream works, as well as the primary and secondary downstream works needed to bring water to the irrigation site. Direct construction costs are all costs directly related to the construction of a particular SI system, such as labor, equipment and material used in the construction, salaries of contracted engineers assigned full-time to the construction site, costs of seedlings and other inputs used for biological watershed protection. It does not include the salaries of GOM employees responsible for the overall program and which are counted in the GOM's contribution to the overall project.

The farmer beneficiaries' contribution consists of the on-farm investments necessary to use the water, and of planting and maintenance of fruit tree seedlings received under the watershed protection components of supplemental irrigation sites financed by USAID.

Table 4-2: Financial Plan by Source of Funds

($'000)

Cost Category	USAID	GOM	Farmer 1) Beneficiaries	Total
Technical Assistance	760	890 2)	--	1,650
Training	120	110 3)	--	230
Commodities	100	30 4)	--	130
Feasibility Studies	600	350 5)	--	950
Construction	12,000	2,300	1,000 6)	15,300
Research	100	--	--	100
Audit & Evaluation	200	--	--	200
Contingency	1,120	320	--	1,440
Totals	15,000	4,000	1,000	20,000

Note: 1) Farmers benefitting from the Project.
2) Includes: 5 full-time equivalent counterparts, secretarial services, and logistic support.
3) Salaries, maintenance and international airfare of training participants.
4) Surveying and other equipment necessary for rapid initial assessments and feasibility studies carried out by GOM.
5) Include all costs of feasibility studies carried out be GOM employees.
6) Costs of on-farm water distribution systems.

4.2 Contracting and Funding Arrangements

4.2.1 Long-Term Technical Assistance

USAID will contract directly for the long-term assistance through a personal services contract. The minimum qualifications of the long-term advisor are:

Ph.D. or equivalent experience in agricultural economics,

Extensive experience in evaluating water resources and irrigation systems,

Fluency in French at least at the FS 3/3 level, and

Demonstrated skills in training.

Prior work experience in Francophone North Africa is desirable.

The long-term technical advisor will be attached to the DER and have the director of the DER as his counterpart. DER will provide office space, logistical support (including field transportation), computer and office supplies, and secretarial services.

4.2.2. Short-Term Technical Assistance

Short-term technical assistance will be contracted directly by USAID. The GOM, through MARA-DER and through the Interministerial Committee, will be involved in selecting the Moroccan institution(s) based on a competitive bidding procedure.

The Moroccan short-term advisors will operate from their home institution(s) and will be under the general direction of the Director of MARA-DER. USAID and the DER will approve all training, advisory and research plans.

Other (expatriate) short-term advisors will be procured by USAID under an institutional arrangement between USAID and an American university or private organization. Identification of needs and approval of qualifications and scopes of work will be carried out jointly by USAID and the GOM agency requesting the assistance.

Although it is expected that MARA-DER will have the largest needs for technical assistance, given the supplemental irrigation emphasis of this project, technical assistance is not exclusively reserved for that agency. USAID will consider requests for short-term technical assistance from other GOM agencies. Furthermore the short-term training offered by the TA will involve all agencies connected with this project.

4.2.3 Long-Term Training

Selection of candidates, qualifications and funding of long-term training will follow established USAID procedures.

4.2.4 Commodities

Procurement of commodities will be made in the US using established USAID procurement procedures except for the vehicle which will be procured locally. A waiver authorizing local purchase is provided as part of this project paper.

4.2.5 Feasibility Studies

USAID will reimburse the GOM for the costs of the feasibility studies for sites retained after the RIA, if the GOM has to use outside consultants for executing these studies. The procedure for reimbursement will be a modified FAR procedure. USAID will have to approve the terms of reference fo the feasibility studies, and will have to concur in the reasonableness of the GOMs cost estimate for the studies for which the GOM plans to hire outside consultants. USAID will inform the GOM in writing of its decision. The GOM will contract directly with the consultants and supervise the execution of the feasibility studies. Upon completion and acceptance of the work, USAID will reimburse the GOM the initially agreed upon amount. The detailed reimbursement mechanisms will be further negotiated with the GOM and defined in PIL # 1.

4.2.6 Construction Work

The USAID share of the estimated system's cost will be reimbursed to the GOM, using a modified FAR procedure. Precise procedures will be established during negotiation of the Project Agreement and specified in PIL No. 1. USAID's initial negotiating position is:

50 Percent after completion of the dam

25 Percent after completion of the down-stream works

25 Percent after completion of the up-stream works.

In any case, the last reimbursement will not be made until all work is completed and the system has been turned over to the water user's association for operation and maintenance.

Given the GOM's budget problems, this position will probably be changed to allow an advance and an additional tranche for partial completion of the dam structure.

4.2.7 Research

USAID will contract directly with a Moroccan institution(s) for the research component of this project.

4.2.8 Audit and Evaluation

USAID will contract directly for the required audit and project evaluation services.

V. CONDITIONS AND COVENANTS

5.1 Conditions Precedent to Initial Disbursement

5.1.1 First Disbursement

Prior to the first disbursement under the Grant, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. a statement of the names of the persons holding or acting in the office of the Grantee specified in the Project Agreement and such other additional representatives as may be designated by the Grantee, together with a specimen signature of each person specified in such a statement.

5.1.2 Reimbursement for Feasibility Studies and Construction

Prior to the first disbursement under the Grant for this purpose, or to the issuance of documentation pursuant to which such disbursement will be made, the Parties will agree in writing (except as Parties may otherwise agree in writing) to the:

(a) content of the feasibility studies to be undertaken;

(b) procedures for approving and executing feasibility studies;

(c) procedures for site approval and supplemental irrigation system construction; and

(d) mechanisms for reimbursement.

5.2 Covenants

5.2.1 Cost Recovery Plan

The Grantee will use its best efforts to develop a plan that requires beneficiaries of the Small Dams Program to pay a reasonable percentage, as agreed to by the Parties, of the total costs of constructing the irrigation systems.

5.2.2 Water Users Associations

The Grantee acknowledges the importance of beneficiary participation in the operation and maintenance of supplemental irrigation systems to the continued viability and success of the Small Dams Program. Accordingly, the Grantee will exert its best efforts to assist farmers who are beneficiaries under the project to create water users associations for 1) the management of water distribution, 2) maintenance of the system and 3) the collection of fees or other mechanisms, such as labor exchange, for accomplishing the required maintenance.

5.2.3 Maintenance of Irrigation Systems

In addition to the requirements stated in the Project Agreement, the Grantee agrees to take whatever other steps are necessary to ensure that the maintenance requirements, for continued operation of the dams and associated upstream watershed protection and downstream distribution works financed by the Grant, are satisfied.

5.2.4 Project Evaluation

The Parties agree to establish an evaluation program as part of the Project. Except as the Parties otherwise agree in writing, the program will include, during the implementation of the Project and at its conclusion:

(a) evaluation of progress toward attainment of the objectives of the Project;

(b) identification and evaluation of problem areas or constraints which may inhibit such attainment;

(c) assessment of how such information may be used to help overcome such problems; and

(d) evaluation, to the degree feasible, of the overall development impact of the Project.

5.2.5 Support of Project

The Grantee agrees to pursue policies and procedures which support the general objectives of the Project, and to notify A.I.D. if any other measures are contemplated which will significantly affect the operations of the project.

VI. MONITORING, EVALUATION AND IMPLEMENTATION PLAN

6.1 Implementation Arrangements

The USAID/Morocco Agricultural Division will have primary responsibility for monitoring the project. A USAID Officer within this Office will be assigned as Project Officer. A DH engineer will also provide backstopping assistance to the Project Office, and will be responsible for all of the project's engineering elements, including review and verification of the GOM's certification. The Environmental Officer will verify that each site accepted for funding meets US environmental requirements.

The Ministry of Economic Affairs will be responsible for coordinating negotiations on the Project Agreement and Amendment. The Interministerial Committee composed of the Ministry of Agriculture and Agrarian Reform, the Ministry of Interior, and the Ministry of Public Works, will be responsible for implementing the program. Each Ministry will name an official representative who will be the contact point for all activities involving that particular Ministry. USAID's primary contact for monitoring of the project will be with the Director of Rural Works within MARA-DER, in his capacity as Chairman of the Secretariat of the Interministerial Committee.

Specific responsibilities of each entity are:

- MOI-PN - overall coordination of studies and construction works, and supplying labor.

- MARA-DER and MARA-EF - feasibility studies for irrigation systems and upstream protection works, construction of irrigation works and development of upstream protection works, training and organizing farmer beneficiaries of irrigation works, and developing a monitoring and evaluation system.

- MPW-DAH - feasibility studies for dams, construction of the dams, providing machinery and on-site coordination of construction works.

Technical assistance and training make up substantial elements of the project. A local institution will be contracted through competitive procurement to provide short-term TA and training. A long-term, expatriate advisor will be procured under a personal services contract.

The process of implementation will be straightforward. All construction works and studies will be carried out by the GOM or contracted to private firms by the GOM, using currently operating internal systems. USAID will reimburse the GOM for feasibility studies, in agreed amount for construction progress and upon the GOM's certification that projects are completed. Funds will be deposited into a special account opened for the Small Dams Program and controlled by the Ministry of Interior, Promotion Nationale (PN), which is the institution on the Interministerial Committee that coordinates construction activities. Actual construction activities are carried out by the respective

technical ministries, either directly or through contracts with private Moroccan firms. Funds will be allocated to the relevant ministries to cover construction costs, using the GOM system already in place for effecting such allocations.

Technical assistance, research and training components will be provided under direct USAID contracts. Construction activities will be controlled and monitored by USAID through the process for approving site selection, reviewing feasibility studies, and the system of payment, which reimburses for completed studies and works. Commodities will be procured from US sources directly by USAID. Evaluations and Audits will be carried out under direct USAID contracts.

6.2 Illustrative Implementation Schedule

The life of the project is five years. The following is an estimated implementation schedule:

	Activity	Estimated Date
1.	Project Paper authorized by the Mission	August 1988
2.	Project Agreement signed with GOM	August 1988
3.	PIL No. 1 detailing methods of operation for A.I.D approval of site selection, design plans, and reimbursement procedures sent to GOM	September 1988
4.	Solicitation process started for water resources economist to be contracted directly by USAID under a personal services contract	September 1988
5.	Water Resources Economist arrives and starts work in site selection, design of monitoring system, and development of terms of reference for detailed feasibility studies.	January 1989
6.	Contract for local short-term advisory group competed, negotiated, and signed by USAID	November 1988
7.	Short-term advisory group in place and begins training DER staff on site selection and analytical requirements of site designs	December 1988
8.	Long-term trainees selected	December 1988
9.	DER with advisors designing and starting initial site selection process	December 1988
10.	Interministerial Committee selects the first three sites for development and A.I.D reviews/approves	February 1989

11. First three site designs completed and construction started	Mid-1989
12. Initial Design Phase -- monitoring system	Mid-1989
13. 4th-5th site design phase	Mid-1989
14. Sites 4 & 5 designed/implemented	late 1989
15. Long-term trainees return	1991
16. Sites 6 & 7 designed/implemented	1991
17. Interim evaluation of project	1991
18. Site 8 & 9 designed/implemented	1992
19. Site 10 designed and implemented	1993
20. Project completion date	Aug 1993
21. Final evaluation of project	1993

6.3 Monitoring and Evaluation Plan

6.3.1 Monitoring

Monitoring project activities will be the primary responsibility of the USAID Project Officer within the Agriculture Division and the Civil Engineer. The monitoring function will be supported, as needed, by the USAID Controller, Regional Contract Officer, Regional Legal Advisor, Program Officer, and Environmental Officer.

The development of a monitoring and evaluation system for the Small Dams Program is an integral component of the SI project. The MARA-DER, with TA support, will have responsibility for designing the system and analyzing results for incorporation into future water system designs.

USAID monitoring activities will include the review of GOM monitoring and evaluation methodologies, attendance at Interministerial Committee meetings, on-site field trips, and frequent briefings with GOM implementing organizations. The USAID engineer will verify that costs are reasonable and works are completed and the Environmental Officer will verify that the project is environmentally sound prior to reimbursing funds for feasibility studies and construction costs. Semi-annual progress reports will be prepared by the USAID - contracted water resources economist to be used in monitoring project progress and to be retained for reference during project evaluations.

6.3.2 Evaluations and Audits

The first evaluation will be scheduled at the end of three years. At that point, sufficient data concerning all phases of the program will have been gathered through the monitoring system set up under the Project to justify an

in-depth evaluation by an independent consultant. The purpose of this evaluation is to recommend mid-term corrections in procedures, develop a preliminary assessment of the project's impact on farmers and develop data and analytical proposals to be used in the final impact evaluation. The evaluators will:

1. assess progress toward the achievement of the project goal and purpose;

2. assess progress in establishing water users associations and transmitting new technology to beneficiaries. The analysis should include a sample survey of farmers that are operating completed irrigation systems to ascertain yields, cropping patterns, income, labor use, crop production, and farming practices. Fertilizer use, crop rotations, and water application techniques will be of particular interest. Further, the functioning of the water users associations will be assessed and recommendations made for improving the functioning of these associations. The association, and rules governing its operation, are critical to water use efficiency and economic efficiency of the program;

3. assess construction methods and costs to determine if least-cost alternatives are being followed;

4. assess the institutional arrangements for project implementation and monitoring and recommend adjustments as warranted; and

5. develop a preliminary analysis of the potential impact of the project on GOM institutions and policies. Of particular interest will be a qualitative assessment of the extent to which the economic, social and environmental studies required under the project have affected: (1) site selection; (2) the size and types of systems constructed; (3) the maximization of the supplemental irrigation command area; and (4) the development or protection of the watershed.

A final impact evaluation will be conducted at the end of the project's five-year life. It will assess the efficacy of supplementary irrigation as a technology for improving the livelihood of small, poor farmers in the semi-arid environment of central Morocco. Utilizing the detailed economic, agricultural, environmental and social information generated by the monitoring system built into the project, the evaluators will measure economic benefits and costs, environmental impacts, evaluate the effectiveness of water users association in managing water distribution, and assess the institutional arrangements for continuing the Small Dams Program and their effect on the replicability of project impacts.

The project includes up to $200,000 in project funds to cover the costs of monitoring, evaluation and auditing activities.

VII. SUMMARY OF ANALYSES

7.0 Introduction

The following summaries of analyses and conclusions are based in part on studies carried out by an ISPAN team composed of an engineer, economist, sociologist, and environmentalist. The purpose of the studies was to review the GOM's Small Dams Program, to determine its overall feasibility and to make recommendations for project design. They concluded that the program was basically sound and that the GOM was capable of carrying out the proposed project activities.

7.1 Summary of the Technical Analysis

The GOM has constructed 34 dams in 15 provinces under the Small Dams Program since 1984, of which 23 include an irrigation component. The most common types are earthen dams with a clay core and masonry dams, because they are best suited for Moroccan conditions. The cost of dams varies from 5 to 13 million Dh ($ 1≃8.5 Dh). The design and construction of the dam is a joint effort of the MPW and the MOI. The MARA is responsible for the planning and construction of the downstream irrigation works, which are carried out under the general authority of the DER. Upstream watershed protection is undertaken by the MARA through its department of "Eaux et Forêts" (EF).

7.1.1 Irrigation Technology

Irrigation projects are designed for a proposed cropping pattern which consists mostly of a two-course rotation of cereals (mainly soft and hard wheat in substitution to barley) and legumes. Sometimes a slight increase of the cropping intensity is envisioned by the introduction of maize and a forage crop (berseem or alfalfa). A shift out of cereals into higher-valued vegetable crops is to be expected following improved water availability.

Research findings show that supplemental irrigation greatly increases yields. Experimental work on supplemental irrigation has been carried out since 1975 at the Oulad Gnaou experiment station in Beni-Mellal Province. Average rainfall at this site is about 420 mm. It was found that a small amount of timely, supplemental irrigation -- about 100 mm -- has a large effect on yields of wheat, giving yields from 3.0 to 4.2 t/ha as compared to the national average yield of less than 1.0 Mt/ha. In the 1975-76 season, with 311 mm of rainfall, a supplemental irrigation of 98 mm at the germination stage yielded 4.2 Mt/ha. In 1979-80, with 224 mm of rainfall, supplemental irrigation of 79 mm added at the germination stage gave a wheat yield of 3.5 Mt/ha.

The irrigation works undertaken by the MARA are limited to the off-farm conveyance and distribution systems. A gravity-fed system is adopted whenever suitable soils exist downstream in the low-lying terraces. Otherwise, the water has to be pumped from the reservoir to a main conveyance canal, increasing the capital investment as well as O&M costs.

The irrigation system itself is very simple. It consists of an intake structure and a concrete conveyance canal with single-gated farm turnouts. Canals are usually designed to carry flow rates of 30 l/s to 120 l/s, depending on the size of the command area. In this system water is delivered to the farmers by timed flows according to the area to be irrigated. This principle is found in many traditional irrigation systems in Morocco. Although flexibility is nil, the operation is simple and understandable, and assures equitable distribution of water by enhancing the farmers' sense of right to water. The cost of irrigation works varies between 8,000 and 10,500 DH/ha, depending on the length and dimensions of the canal as influenced by the size and shape of the command area. When the stream is steeply embanked and there is no irrigable land downstream, water is pumped to higher ground, increasing the investment cost to as much as 20,000 DH/ha.

The design of the irrigation systems is somewhat superficial and could be improved. The option taken by DER to do it through its provincial services in the DPAs with the backing of the central service of DER should be encouraged. But this requires setting up a strong, multidisciplinary technical unit capable of supervising and providing guidance and technical assistance to the DPAs for better managing the planning, design, construction, and operation of the irrigation projects to be developed. This unit may be composed of an agricultural engineer, an economist, an agronomist, and a social scientist. The USAID project should provide adequate training and the necessary field equipment.

7.1.2 DAM Design and Construction

The design of the dam, spillway, and outlet works is done competently based on state-of-the-art hydraulic engineering theory and techniques. The quality of engineering is good. The consultants pay particular attention to the safety of the structure and to a design which is labor intensive, uses locally-available materials to the greatest extent possible, and is economical. The role of the consulting firm is very limited and narrowly focused on dam design. The consulting firm's role in project planning and development is minimal. Consulting engineers responsible for the design of the dam are concerned about structural safety and would like to see more extensive site investigations and laboratory tests, especially in the case of larger dams.

The construction of the dam, which is undertaken jointly by the MPW and the MOI, seems in general to be well done and remains within the estimated budget and the allocated time frame. Although construction is labor intensive, labor accounts for 50% to 60% of the total cost, there does not seem to be a deliberate inflation of the labor component.

7.1.3 Hydrology

There is need to devote more time to the analysis of the existing hydrological data base and to refine and upgrade the methodologies for estimating monthly inflows, flood flows, sediment yield and reservoir sedimentation. Time should also be devoted to the evaluation of natural and artificial recharge and to reservoir operation studies in conjunction with

monthly agricultural water demands, fish culture, and environmental requirements. A monitoring system needs to be established. The data base and the analysis of the data to estimate annual inflows, the flood frequency and flood hydrographs should be open to other government agencies, educational institutions, and private consultants.

7.1.4 Upstream Protection Works

While only the minimum amount of work is done around the immediate area of the dam, designed solely to protect the dam from siltation, the general approach is acceptable from a technical point of view. Working in close coordination with MPW and MARA-DER from the outset of the rapid initial appraisal, the MARA-EF should carry out the following, somewhat expanded, analyses to determine the necessary dam protection activities and their costs:

- improved soil, topography, hydrology and geology studies of the surrounding watershed area with emphasis on potential erosion impacts and control measures.

- assessment of the impact of possible increases in grazing on erosion.

- development of a plan, including cost estimates, for anti-siltation measures necessary to reduce siltation to an acceptable level.

- identification of any potential water quality problems which might impede agricultural production objectives.

7.1.5 Summary of Recommendations

The technical evaluation of the GOM's Small Dams Program raised the following issues:

- There should be increased cooperation between the three ministries to coordinate design and construction of the entire system: upstream protection works, the dam and the downstream irrigation system.

- The irrigation system needs improvement and the technology of supplemental irrigation needs to be better understood.

- The capability in hydrology should be strengthened.

- Development of a conceptual framework for planning for supplemental irrigation is recommended.

- The engineering design and construction of the dams is satisfactory.

- The monitoring system for hydrology is inadequate. Monitoring programs should be established for each project.

- Technical assistance and training programs should be provided for all components, but especially for irrigation system design and implementation and upstream protection works.

7.2. Summary of the Economic and Financial Analysis

7.2.1. Background and Rationale

The economic feasibility of this project depends on the economic feasibility of each of the SI systems to be funded. Since no specific sites have been selected, site selection being an integral part of this project's institution building aspect, it is not possible at this time to derive a specific estimate of the project's likely internal rate of return. Nevertheless, building on the parameters established in the rigorous site selection criteria established for the project, minimum values for the internal rate of return for the project can be calculated, which are sufficient to establish the economic feasibility of the project.

The criteria for site selection established in this Project Paper guarantee that no site funded under this project will have an economic rate of return of less than 12.5 percent. If all sites funded under this project are exactly at this margin, the internal rate of return on the funds expended for construction is also 12.5 percent. In fact it is unlikely that all sites will be that marginal, and it is probable that the overall economic rate of return will be substantially above this minimum. The cost side of the equation of course does not include indirect costs such as technical assistance and other expenses aimed at institution building.

Those project costs aimed at improving the technical capacity of the GOM's overall project should not be compared to the direct benefits that will accrue from the systems funded under this project. The benefits of these institution building activities are more of a long-run nature and will affect the overall GOM program. If only one technically feasible, but economically questionable dam were dropped from the construction program each year, due to better staff work made possible by technical assistance and training provided under this project, the costs of this project component would be offset many times over.

For the bulk of the project, however, economic feasibility depends crucially on whether economically viable sites can indeed be found in the project's target area. The project feasibility studies have established that this is indeed the case.

7.2.2. Economic Benefits and Costs

An analysis of construction costs showed that a typical small dam costs about eight Million DH, downstream works around four Thousand DH per hectare, not counting tertiary canals and on-farm water distribution systems, and upstream works cost around one to two Million DH per site. Typical costs for a site providing supplemental irrigation (gravity fed) to 300 hectares would thus be around 11 to 12 Million DH. Assuming a labor component of 50 percent for the overall system, this represents economic costs of about 7 Million DH, or about 23 Thousand DH per hectare.

Estimates of the discounted net economic benefits that can be expected from supplemental irrigation are given in Annex D. For gravity fed systems the figure ranges from 36 Thousand to 40 Thousand DH per hectare, depending on

the average natural annual rainfall in the area. The ratio of discounted economic benefits to economic costs is thus between 1.6 and 1.7, comfortably above the threshold of 1.2.which is the economic selection criteria for supplemental irrigation systems under this project. In fact, in the low rainfall zone (below 350 mm per year) a 300-hectare gravity fed supplemental irrigation system will be economically feasible, as long as its economic costs do not exceed 10 Million DH. Typically this figure would correspond to financial cost of around 16 to 17 Million DH.

A supplemental irrigation system might even be economically feasible at an economic cost of up to 12 Million DH (financial cost approximately equal to 20 Million DH). However, a detailed economic feasibility study would have to be carried out to ascertain feasibility in this case as the benefit cost ratio is less than 1.2.

In conclusion, it is possible to find sites that satisfy the economic criteria set out for this project. Since only these sites will be funded, it can be argued that the overall project satisfies the same criteria. The project is thus economically viable.

7.2.3. Beneficiaries' Financial Analysis

The primary beneficiaries of this project are the small farmer who will receive supplemental irrigation. Farm budget studies indicate that the net benefit accruing to these farmers will be between 4.8 and 5.7 Thousand DH per hectare in gravity fed systems and about 900 DH less in systems requiring pumping (see Annex D). This net benefit takes into account increased costs for fertilizer and other farm inputs.

According to the GOM's current policy, the only investment costs farmers have to bear is the cost of the on-farm water distribution system. These costs are estimated at 2,000 DH per hectare, or 560 DH per year if annualized over the five-year life of these installations. In either case, the expected financial benefits to the farmer will exceed his economic costs by a factor of about 8 to 10, making participation in this project highly profitable. Farmer beneficiaries should therefore have considerable incentive to participate in the project.

Estimated net returns to farmers are high, suggesting that there is considerable scope for requiring farmers to pay for at least part of the investment costs of the project. This would be economically quite rational. However, political and social considerations dictate caution since farmers are not accustomed to paying high water charges. This is a subject for long-term policy dialogue, backed by real data generated from completed irrigation systems under the project.

7.3 Social Soundness Analysis

7.3.1 Socio-Cultural Context

The "Small Dams" program is motivated largely by social concerns. Rural unemployment and a desire to stem the tide of rural-urban migration is the primary force behind public construction works in general and small dams

construction in particular. The unemployment rate in the rural areas is estimated at 10.9%. The rate of outmigration has averaged over 100,000 people (one percent) per year since 1975. The income level of rural dwellers averages about 60 percent of that of urban workers. Given a population growth rate of 2.6 percent per year, creation of jobs, especially in the rural areas, is the GOM's number one development concern.

7.3.2 Beneficiaries

Rural unemployed will benefit in three ways: short-term employment (6 months) while dams are being constructed, growth in on-farm employment owing to increased intensity of cropping under irrigated systems, and off-farm employment stimulated by increased agricultural output.

Small farmers will be the primary beneficiaries. Ample scope exists for insuring that benefits do indeed go to the smaller, poorer farmers. The GOM has expressed willingness to accept this criteria. Further, 67.8 percent of all farmers nationwide farm less than 10 hectares of land, accounting for 45.1 percent of the land area and only 0.1 percent of the farmers have over 100 ha of land, accounting for about 10 percent of the land area. Over 72 percent of farms are owner operated, with the remainder distributed among collectives, church lands and other. In the province of Settat, 83.4 percent of the farms are less than 10 hectares, accounting for 36.8 percent of the land, while 2.6 percent own more than 50 hectares and account for 30 percent of the land.

7.3.3 Participation

At present, potential local beneficiaries are not involved in decision-making in a systematic way in the site selection process. No attempt is made to probe deeply into such issues as willingness to pay for water resources and proposed systems for maintenance of infrastructure. Project benefits could be significantly increased by up-front participation and understanding on the part of farmers that are to receive the benefits of irrigation.

7.3.4. Socio-Cultural Feasibility

On balance there are no major, insurmountable social obstacles to implementation of the program. However, certain actions will be attempted in the project to ameliorate five potential social obstacles to project success:

First, farmers will be trained to overcome the general lack of technical experience, with application of supplementary water to cereals and forage crops.

Second, farmers will be organized into water users associations and trained to manage systems maintenance.

Third, water-use efficiency would improve if a system of pricing or rationing were established. If farmers treat water as a free good, benefits of the project will not be maximized.

Fourth, efforts will be made to control grazing upstream from the dams to prevent detrimental environmental effects.

Fifth, an improved system for compensating farmers for inundated land or land restricted for grazing should be instituted.

7.3.5. Proposed Approach to Assessing Social Impact of Individual Dam Subprojects

The social feasibility and social impact of each proposed subproject will be tested. The study will focus on farmer's interest in participating in the program and ensuring that potential beneficiaries understand their responsibilities during implementation, including the formation of water users' associations.

7.3.6. Socio-Economic Impact

If technical, social and economic criteria laid out in the project are followed, it is expected that quantifiable benefits of the following magnitudes will be forthcoming:

a) 17,000 workers employed for an average of six months per person and earning approximately $7 million,

b) Quadrupling yields of wheat and forage on 2500 has, which will provide a net increase in farm income per year of between $1.5 and $1.9 million for 1500 farmers.

Other possible benefits, which are not readily quantifiable, include reduced erosion, firewood production, pasture, and increased drinking water.

7.4. Institutional Analysis

7.4.1. Organizational Structure

The GOM Small Dam Program (SDP) is administered by an Interministerial Committee composed of the Ministries of Interior (MOI), Agriculture and Agrarian Reform (MARA) and Public Works (MPW). In February 1986, two years after the inception of the Small Dams Program, a formal agreement was signed among the three ministries outlining their respective responsibilities in the execution of the Program. While decisions concerning the overall thrust of the program and the final selection of sites rest with executive-level decision-makers in the ministries, the technical implementation of the SDP is delegated to the technical staffs within each Ministry.

7.4.2. Ministry Responsibilities

The MOI coordinates SDP activities through the provincial Governors and the Promotion Nationale Program. With the recent GOM decentralization and regionalization program, this coordinative function has been strengthened. It should also be noted that Governors are powerful actors in the GOM development process. They propose potential projects to His Majesty the King and have direct responsibility for project implementation.

The Promotion Nationale (PN) is a national program charged with the critical task of generating minimum-wage employment for skilled and unskilled labor in urban and rural areas. It does so by recruiting and training unemployed labor for execution of infrastructure and reforestation projects throughout Morocco. In the context of the SDP, the PN has been assigned primary responsibility for project implementation and coordination of all ministries' activities at both the national and provincial levels. PN also provides "small materials" such as fuel and lubricants for large equipment as well as construction materials such as cement and iron bars.

The PN is successfully carrying out its responsibilities under the existing Small Dams Program and it is capable of carrying out the additional responsibilities associated with this project. Under the Supplemental Irrigation Project its role will remain unchanged. However, its role in organizing farmers and conducting social analyses will need to be enhanced through training and technical assistance.

The Ministry of Public Works (MPW) is a key player in the preparation of pre-feasibility and feasibility studies and dam construction. It also provides heavy machinery and coordinates technical tasks, although responsibility for the overall coordination of construction activities remains with the MOI.

The MPW Department of Provincial Equipment is sufficiently staffed to carry out its role in dam construction at a high level of competence. However, it does not have the capability to design actual engineering plans, and therefore contracts for the work with private engineering firms. In general the quality of these plans is first rate. While the MPW is fully competent and staffed to support the USAID financed SI project, short-term training should be provided under the project to up-grade skills in small dam hydrology so as to ensure continued high level performance.

The MARA, through its Department of Rural Equipment (DER), is in charge of irrigation and animal water supply components of the SDP, and, through its Water and Forest Department it carries out protection works for the watershed areas. In addition, it assures the technical viability of basin protection and the utilization of water for irrigation. MARA is also responsible for managing construction of irrigation canals, organizing water users associations, training farmers in irrigation technology, and providing technical oversight for the upstream protection works. In addition, it provides materials such as cement, iron bars, and water pumps. At the provincial level, MARA-DER works through the Direction Provincial de l'Agriculture (DPA) which is responsible for the technology transfer and farmer organization activities related to the SDP.

In evaluating the various organizations involved in the SDP, it became apparent that MARA-DER is the best candidate for assuming the lead under the USAID Supplemental Irrigation Project. This is primarily an agricultural project which naturally falls under the mandate of MARA and the DER services as the Secretariat of the Interministerial Committee. Additionally, DER is already engaged in activities which are similar to those forseen in the USAID project. Finally, DER has the staff in place and the technical capabilities

to assume many of the new responsibilities of the project. The introduction of the USAID project will therefore not entail a radical restructuring of DER's mode of operation. Rather, the aim will be to improve and expand the scope of MARA activities. At the provincial level, however, the DPAs' technical capabilities and staffing vary considerably from province to province and on the whole tend to be weak. A focal aspect of the project will therefore be the upgrading of skills at the DPA provincial level.

7.4.3. How the System Functions

The existing process of site selection and design for supplemental irrigation systems begins at the provincial level. Communes (administrative subdivision of a province) submit requests for small dam sites to the Provincial Committee of Small Dams, which consists of provincial representatives of the three Ministries, and which is headed by the Governor. Following a meeting held by the Governor with local beneficiaries, in which it is determined that the project is needed and that farmer beneficiaries agree to form a water users association and accept responsibility for managing the project, a rough feasibility study is prepared. If the project is approved at the provincial level by the Governor, it is then submitted by the Governor through the MOI to the national Interministerial Committee.

After the most promising sites are identified by the Interministerial Committee, the Ministry of Public Works initiates pre-feasibility and feasibility studies for the dam sites. Later, the Ministry of Agriculture undertakes studies regarding the up-stream and down-stream sites. Based on the final feasibility studies, a prioritized list of sites is submitted to the Interministerial Committee for final selection.

Political decisions certainly enter into the selection process. However, it does appear that the technical and economic considerations play a role in deciding which dam sites are chosen for the development of irrigation systems.

In the final phase of the selection/design process, the MPW contracts with private engineering firms to develop detailed design plans for the dam sites and MARA develops plans for the upstream and downstream works.

The implementation of the project is a joint effort of the three Ministries, with overall supervision and coordination provided by the MOI-Promotion Nationale. MARA-DER and the DPA are responsible for the construction of the downstream irrigation works, MARA-Water and Forest Department completes upstream watershed protection and the MPW is in charge of all hydraulic engineering works. It should be noted that in cases where a dam site falls within an area designated as a water development region, all functions otherwise completed by the MARA-DER-DPA are assumed by another office, the Regional Office of Agricultural Development (ORMVA).

The basic system works fairly well but should be modified to ensure selection of sites with high potential for supplemental irrigation and to ensure completion of upstream watershed protection works, the dam and irrigation system in a coordinated and timely fashion.

7.5 Summary of Environmental Analysis

Section 216.2(d) of A.I.D. Environmental Procedures stipulates that an Environmental Assessment or Impact Statement is required for all irrigation or water management projects of this nature. However, Section 216.2(C)2(XV) of said Procedures provides some degree of flexibility in meeting this requirement for those instances which involve the application of A.I.D-approved environmental design criteria or standards. In accordance with this latter provision, the Mission has developed an appropriate set of environmental criteria and guidelines to be followed during the various stages of assessment and implementation of each small dam construction activity financed under the project.

Due to the generally degraded existing condition of most of the lands within the project target region and the relatively small scale of the proposed irrigation systems, it is not anticipated that the land development activities contemplated under the project would result in significant long-term negative environmental impacts. The primary area of environmental concern is, therefore, any adverse impacts which might occur following, and as a result of, the completion of individual system construction activities. Within this latter area, the Mission has identified the following potential impacts to be of priority environmental concern:

- adverse changes in water quality and/or quantity within a project development area and any neighboring downstream areas;

- increased incidence of waterborne or water-related diseases within the same areas; and

- increased soil erosion in the surrounding watershed areas resulting from changed numbers and/or patterns of use of local livestock populations.

As specific local conditions warrant, each of these environmental issues will be properly assessed and addressed by skilled project staff or concerned local government personnel for each activity to be implemented under the project. All assessment findings and recommendations will be reviewed and verified by the Mission Environmental Officer prior to final USAID approval to proceed. No sub-project activity will be approved for A.I.D financing without prior written evidence that all significant environmental issues will be properly dealt with to the greatest extent feasible through explicit environmental design, operations, maintenance or monitoring mitigative recommendations and requirements. Accordingly, it is concluded that this project will be implemented in an environmentally acceptable manner which satisfies all salient Agency regulations and requirements.

SUPPLEMENTAL IRRIGATION

(608-0197)

PROJECT PAPER

USAID/MOROCCO

August 19, 1988

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ANNEX A

LOGICAL FRAMEWORK

ANNEX A

LOGICAL FRAMEWORK

	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
PROJECT TITLE AND NUMBER:	Supplemental Irrigation (608-0197)		
NARRATIVE SUMMARY			
Program or Sector Goal: Goal one: To increase farm incomes and overall standard of living among rural households in the semi-arid regions of Morocco.	1. Farm household income for direct beneficiaries of the project at least doubles. 2. Total area under supplemental irrigation reaches at least 2000 hectares. 3. Yield and production of cereals on irrigated lands benefited by the project doubles.	1. Direct measures through baseline surveys. 2. Follow-up monitoring studies. 3. End of project evaluation	1. GOM fully adopts the new methodologies for site selection and continues to devote adequate budget allocations to constructing supplementary irrigation systems. 2. New supplementary irrigation technology is readily managed by small-farmer water user's associations.
Goal two: To strengthen the GOM Small Dams Program so that it becomes a more productive and sustainable development tool.	1. The improved feasibility criteria generated by the project is adopted by GOM for the entire Small Dams Program 2. Supplemental irrigation systems built under improved standards approaches 100% of the total built.	1. Analysis of the scope and quality of feasibility analysis used throughout the the GOM Small Dams Program. 2. Evaluation of the GOM system of site selection. 3. End-of-project evaluation.	
Project Purpose: To improve the selection, design, implementation and management of approximately ten supplemental irrigation systems.	1. GOM adopts improved criteria for site selection, upgrades skills of staff and applies improved feasibility analyses to selecting, designing and constructing supplementary irrigation systems. 2. Farmers become full participants in designing systems, organize to manage the system, and adopt improved technology of irrigation.	1. Analysis of the scope and quality of feasibility studies submitted to USAID. 2. Monitoring of the process for designing and constructing supplemental irrigation systems. 3. Monitoring farmers'role in selectingsites. 4. Midterm and end-of-project evaluation.	1. GOM continues to place high priority on supplemental irrigation systems. 2. The political climate will enable a shift to technical criteria for site selection.

Project Outputs			
Infrastructure			
Approximately, 10 supplemental irrigation systems constructed and operating within the Settat Command area.	To 5I systems completed and turned over to farmers in 1989, three in 1990, three in 1991 and two in 1992.	1. Engineering and environmental certifications. 2. Monitoring of construction progress. 3. Verification of costs. 4. Monitoring of farmer organization and practices. 5. Mid-term and end of project evaluation.	1. GOM budget situation will not worsen. 2. Budget priorities do not shift radically. 3. Suitable sites are in fact available.
Institutional			
Upgraded skills of GOM Staff within the Small Dams Program trained and capable of conducting economic, technical, social and environmental analyses for site selection and project design.	1. Candidates selected for long-term training. Return by 1991. 2. Short-term training courses designed and carried out: - national level technicians - provincial level technicians 3. Improved quality of feasibility analysis.	1. Workplans 2. Monitoring visits by Project Officier 3. Review of course material. 4. Evaluation of feasibility analyses. 5. Mid-term and end-of-project evaluation.	1. GOM provides personnel and resources for training programs. 2. GOM policy remains constant vis a vis selection criteria.
- **Sites ranked and selected** based on sound economic, technical, social and environmental criteria.	1. The Interministerial Committee carries out the RIA and feasibility analyses, and selects sites for funding based on the rigorous criteria established by the project.	1. Monitoring of selection process. 2. Evaluation of studies 3. Project evaluations.	1. GOM provides sufficient personnel. 2. GOM policy does not change.

- Site-specific analyses of economic, technical, social, and environmental criteria used for project designs.	Acceptable designs submitted to USAID for funding.	1. Evaluation of designs. 2. Mid-term and end of project evaluation.	1. GOM provides sufficient personel. 2. GOM policy does not change.
- Monitoring and evaluation system in place and providing necessary information to technical staff and decision-makers for properly designing and implementing irrigation projects.	1. High-quality Baseline data generated from feasibility analyses. 2. Monitoring system in place. 3. Feed back to adjusting criteria and level of analysis begins to occur in third year of project as irrigation systems produce results.	1. Review of baseline studies. 2. Review of monitoring reports. 3. Monitoring of information plans. 4. Project evaluations.	High-level officials on Interministerial Committee are truly interested in improving the social and economic viability of SI systems.
- Viable water user associations effectively managing and maintaining community irrigation systems.	1. Charter established, officers elected and management rules adopted, 2. Maintenance is being carried out.	1. Field reviews of completed sites. Review of organization documents. 2. Monitoring studies. 3. Project evaluations.	The financial rewards of supplemental irrigation are sufficient to induce major changes in farmers way of doing business.
- A water pricing and cost recovery system in place.	1. Monitoring information verifies that financial flows are positive. 2. GOM devises plan for water pricing. 3. Farmers accept pricing plan.	1. Monitoring system generates baseline on income and changes in income. 2. Policy dialogue. 3. Evaluations.	GOM amenable to this major policy change.
- Farmer beneficiaries effectively trained in methods of supplementary irrigation.	1. Workshops in essential skills and methods carried out for farmers. 2. Farmers adopt new practices. 3. Water use efficiency increases by at least 50 percent.	1. Field review of provincial data systems. 2. Field monitoring and opinions of TA team. 3. Farm-level sample surveys. 4. Project evaluations.	1. Provincial staff are given the time and resources to carry out training. 2. GOM price and marketing policies continue to be conducive to adoption of new technology by farmers.

Project Inputs

USAID

1. Funding for constructing approximately 10 supplementary irrigation systems ($12,000,000). Long-term technical assistance ($400,000). 3. Local short-term technical assistance ($300,000). 4. Other short-term technical assistance ($60,000). 5. Participant Training ($120,000). 6. Commodities ($50,000). 7. Funding for feasibility studies ($600,000). 8. Funding for Research ($100,000). 9. Audit and evaluation ($200,000).	1. Reimbursement rate equal to or greater than financial projections. 2. Contracts let. Productive advisory relationship established. 3. Contracts let. Institution begins providing training and advice on studies. 4. GOM selects acceptable candidates. 5. Needs verified and deliveries made. 6. Quality of feasibility studies meets standards set out in PP and PIL's. 7. Contract let. Yield increasing and water saving technologies discovered. 8. Contract let. Team fielded. Report produced.	1. Review of expenditure records. 2. Agreement on selection criteria, and candidate. Reviews and evaluation of performance for contracting activities 3. Procurement records. 4. Review of progress on developing feasibility studies and quality of studies. 5. Evaluations	1. USAID appropriations continue at historical levels. 2. French speaking persons meeting demanding skill requirements are available. 3. There are no unforeseen problems that would prohibit the timely con-tracting of a local institution. 4. PROAG is signed in August.

GOM

1. Farmers' contribution to on-farm irrigation works ($1,000,000).	1. Farmers organize and build required on-farm irrigation works.	1. Field monitoring.	1. Farmers are motivated to contribute to their own future welfare.
2. Five full-time technicians and logistical support ($800,000).	2. GOM provides these technicians for the SI project.	2. Monitoring.	2. GOM does not divert resources to other programs.
3. Salaries airfare for participants ($330,000).	3. Participants selected and suc-cessfufully complete MS-level degree.	3. Monitoring.	3. GOM budget levels remain adequate.
4. Feasibility studies ($330,000).	4. Studies produced are high quality and timely.	4. Evaluations.	
5. 15 percent of construction costs ($2,300,000).	5. GOM matches USAID funding in timely manner.	5. Verification of accounting records.	

ANNEX B

TECHNICAL ANALYSIS

ANNEX B

Technical Analysis

1. Description of the Program

Since 1984, the GOM has constructed 34 dams in 15 provinces under the Small Dams Program of which 23 include an irrigation component. The most common types are earthen dams with a clay core and masonry dams, because they are best suited for Moroccan conditions. The cost of the dams built varies from 5 to 13 million DH. The design and construction of the dam is a joint effort of the MPW and the MOI, while the MARA is responsible for the planning and construction of the downstream irrigation works, which are carried out under the general authority of the DER. Upstream watershed protection is undertaken by the MARA through its Water and Forest Service "Eaux et Forêts" (EF).

The Department of Hydrology "Administration de l'Hydraulique" in the MPW is in charge of all hydraulic engineering works, and in particular for the technical studies of the Small Dams Program. The "Administration de l'Hydraulique" has two branches: the Directorate for Hydraulic Development and Improvement "Direction des Aménagements Hydrauliques", (DAH), which does the geological studies and the Directorate for Research and Water Planning "Direction de la Recherche et de la Planification de l'Eau" (DRPE), which prepares the hydrological studies. If these preliminary studies indicate that it is possible to build a dam at the site, a private engineering consulting firm is engaged to do a pre-feasibility study--including a cost estimate--based on the hydrological and geological information supplied by the "Administration de l'Hydraulique." At the same time, the same information is supplied to the Ministry of Agriculture in order that they may determine whether a satisfactory area is available for irrigation, and to develop a cropping pattern. This information is given to the DER and DPA to design a simple irrigation canal system including a cost estimate for labor and material. The budgets for dam, irrigation works and upstream soil conservation measures are submitted to the Interministerial Committee for final selection and inclusion in the GOM's budget for the following year. Once the budget is approved, the final design study is contracted out to a private consulting firm.

Both during the pre-feasibility study and the detailed study phase, the consulting firms discuss various options for dam design with the administration which used to have a strong input into the engineering study. More recently, the consulting firms have insisted that the dam design be based solely on technical and economical considerations.

Once the final design documents are submitted to the Ministry of Public Works, the consulting firm has no more input into the dam construction phase, which is entirely in the hands of the government.

2. Agriculture and Irrigation

- Cropping systems

Irrigation projects are designed for a proposed cropping pattern which consists mostly of a two-course rotation of cereals (mainly soft and durum wheat in substitution for barley) and legumes. Sometimes a slight increase of the cropping intensity is envisioned by the introduction of maize and a forage crop (berseem or alfalfa). A shift out of cereals into higher-valued vegetable crops is to be expected following improved water availability. This would reflect expected gains in yields per hectare of cereals and the opportunity for farmers to obtain higher incomes from intensified and diversified crop production. The area put under supplementary irrigation downstream of a small dam varies from 25 to 400 ha, depending upon the net annual inflow into the reservoir and the availability of suitable soils. Except in the mountainous areas, where precipitation may be 800 mm or more, most other areas in Morocco lie between the 200-600 mm annual isohyets. The yield from the watersheds varies depending on soils, vegetation, geology, and slope. The runoff coefficient can vary between 0.05 and 0.15. For projects developed until now, the size of the irrigated perimeter has been computed by dividing the average yearly inflow by the seasonal water requirements per hectare of the crops foreseen in the crop rotation.

- Experience with supplemental irrigation

Research findings show that supplemental irrigation greatly increases yields. Experimental work on supplemental irrigation has been carried out since 1975 at the Oulad Gnaou experiment station in Beni-Mellal Province. Average rainfall at this site is about 420 mm. It was found that a small amount of timely supplemental irrigation -- about 100 mm -- has a large effect on yields of wheat, giving yields from 3.0 to 4.2 Mt/ha as compared to the national average yield of less than one Mt/ha. In the 1975-76 season, with 311 mm of rainfall, a supplemental irrigation of 98 mm at the germination stage yielded 4.2 Mt/ha. In 1979-80, with 224 mm of rainfall, supplementary irrigation of 79 mm added at the germination stage gave a wheat yield of 3.5 Mt/ha.

Other experimental work on the effects of supplemental irrigation on the yield of field crops is being carried out at the Aridoculture Center in Settat. The objective of these studies is to compare the yield response of different cereal genotypes grown under different water deficits and to establish a simulation model for wheat growth under different water deficits and cropping techniques. In 1985 and 1986, wheat under rainfed conditions generated a yield of 2.2. MT/ha., 75 mm of supplemental water produced 3.2. Mt/ha, and 150 mm of water produced 4.5. Mt/ha.

Wheat yields in the region in which this project will be implemented average about 0.8 MT/has under rainfed conditions. Thus, applying as little water as the equivalent of 100 mm of rainfall at precise times in the growth cycle of the crop can quadruple yields. Similar magnitudes of yield increases should be possible for forages. Adding improved cultivation practices, hessian fly-resistant varieties and fertilizer should significantly expand

yield possibilities. Fertilizer will have an assured impact on yields because risk owing to variability of rainfall is the main factor causing farmers to apply very low levels of fertilizer under rainfed conditions.

Experimental results also show that adding water in excess of the optimal level of about 100 mm per year has little effect on yield. Thus, there is excellent scope for increasing returns through improving water management. For example, reducing the rate of application from 200 mm to 100 mm would, of course, double the area served by a given amount of stored water, virtually doubling the benefits of a given reservoir.

The above facts suggest two very important project design elements. First, technical assistance to farmers should have a high pay off. Second, applying a system of water charges or introducing a strict rationing system will likely be necessary to induce farmers to improve their management of the water. The latter is a sensitive policy issue which can only be addressed as evidence of benefits are accumulated during project implementation. At present, the GOM intends that farmers pay only the operating and maintenance costs of this system. It is likely, however, that water charges covering at least part of the investment costs will be necessary to induce farmers to use water efficiently. Water charges would benefit society as a whole in two ways. First, production per dollar of investment in dams would increase. Second, excess "rents" accruing to farmers over and above returns necessary to gain a given level of production could be captured as public revenues, which in turn could be used to expand public investment in water resources.

- Irrigation work

The irrigation works undertaken by the MARA are limited to the off-farm conveyance and distribution systems. A gravity-fed system is adopted whenever suitable soils exist downstream in the low-lying terraces. Otherwise, the water has to be pumped from the reservoir to a main conveyance canal, increasing the capital investment as well as O&M costs.

The irrigation system itself is very simple. It consists of an intake structure and a concrete conveyance canal with single-gated farm turnouts. Canals are usually designed to carry flowrates of 30 liters per second to 120 liters per second, depending on the size of the command area. In this system, water is delivered to the farmers by timed flows according to the area to be irrigated. This principle is found in many traditional irrigation systems in Morocco. Although the flexibility is nil, the operation is simple and understandable, and assures equitable division of water by enhancing the farmers' sense of right to water. The cost of irrigation works varies between 8,000 and 10,500 DH/ha depending on the length and dimensions of the canal as influenced by the size and shape of the command area. When the stream is steeply embanked and there is no irrigable land downstream, water is pumped to higher ground, increasing the investment cost to as much as 20,000 DH/ha.

- Upstream protection of the dam

Some revegetation and soil work such as terracing and check dams is done in the upper watershed in connection with each project to prevent soil erosion and reservoir siltation. Usually 1% to 10% of the upper watershed is subject to treatment and revegatation at an average cost of 6,000 DH/ha.

3. Description of Proposed Dam Sites in the Settat Command Area

- Physical setting

The "Settat Command" area includes all or part of three very distinct geographic regions in Morocco: the low Atlantic plains, the Hercynien highlands, and the Interior steppes and plateaus. At the moment, almost all the proposed small water projects are located in the last two regions. These two large divisions have been subdivided into seven distinct geographic areas: Haouz de Marrakech plateau, Jbilete-Mouissate, Bahira plain, Tadla plain, the Phosphate Plateau, Rehamna massif, and the Essaouira-Chicaoua syncline. Geology, soils, rainfall, surface aquifer and surface drainage have differing characteristics that affect the analysis of each small dam site.

- Geology

Four geological formations have importance to this program:

o Alluvial and lacustrine formations with good surface aquifer recharge are widespread in the Bahira/Tadla plains and the Haouz.

o Calcareous formations are widespread in the Essaouira basin, Jbilete, Rehamna, Bahira plains, Phospate plateau, and the vicinity of Beni Mellal. The formations influence the pH of the water and shallow aquifer recharge. Some eroded calcareous formations cannot be biologically restored and remain sources of siltation.

o Sedimentary formations derived from red clays from shallow seas and lagoons can be found in approximately the same areas as the calcareous formations. They are barely permeable. Some are highly erodable and contain saline layers that can affect the water quality and cause siltation.

o Ancient igneous and metamorphic formations in Jbilete and Rehamna have shallow soils and extensive rock outcrops and are impermeable.

- Soils

The soils of the command area require special attention from the engineering, environmental, and agricultural viewpoints. Soils will determine vegetative and structural soil conservation measures. Along with storm intensity and slope, soils have the major influence on sheetwash, channel erosion, reservoir embankment stability, location of borrow pits, foundation excavation, on-farm irrigation management, and cropping patterns.

- Climate

The Moroccan climate is summer dry/winter wet. The command area's rainfall varies with latitude, altitude, distance from the ocean, and exposure of the watershed to the Atlantic storms. The area is located south of the Casablanca-Tadla line. Below this line, the annual rainfall rarely exceeds 400 mm. The west border of the Haouz has about 200 mm of rain. Equal in importance to the amount of rain is the timing of the storms in relation to

crop water demands. The start of the winter rains (October-November) and the amount of rainfall in March-April are the two crucial times in the Settat command area. Rainfall has a coefficient of variation of 30% to 40%, which is typical of semi-arid areas.

The temperatures vary between 15° and 25°C near the coast and 25° 35°C in more continental areas. The coldest months are December, January, and February. Humidity varies from 45% in July to 77% in January. Evaporation is about 1500 ± 150 mm.

- Surface runoff

Surface runoff occurs in response to the rainfall and depends--in addition to watershed characteristics--on the intensity of the storm. Thus, it is not unusual to encounter a wide variation of runoff coefficients between storm events on the same watershed as well as between different watersheds. Most of the projects are situated in watersheds without basic hydrologic data. The determination of runoff from watersheds without rainfall and runoff stations is a difficult task. Estimation of mean monthly or annual inflow rates and flood hydrograph peaks and volumes can easily be subject to ± 50% error. The same can be said about the estimation of flood frequencies and flood hydrographs. The heterogeneity of the climate, soils, and vegetation in Morocco does not lend itself to the development of a generic method of runoff determination. Each site is a particular case to be studied as a small watershed within a hydrologic region.

- Sediment load

Sedimentation of storage reservoirs is a serious problem affecting the physical life and cost of the project. The estimation of sediment yield from watersheds and the amount of deposition in the reservoirs is very difficult and can be subject to ± 100% error.

- Groundwater

The Jbilete and Rehamna areas have no shallow aquifers. The Haouz, Bahira, and Tadla areas have fluvio-lacustrine sediments that contain shallow aquifers. The crataceous formation in the Tadla plains has a deep aquifer, the other areas do not.

- Plants and vegetation

The project area is now predominantly agro-pastoralist. The largest area is planted to seasonal barley and bread wheat followed by a fallow period. Much smaller areas are planted to legumes. The cropping pattern changes each year depending on the timing and amount of rainfall. In the Bahira plains and parts of Haouz, wintertime cereals are planted with floodplain irrigation. In the Tadla plains, huge irrigation projects have recently been developed with three to six crop rotations each year. The Haouz plateau, a much older center of irrigated agriculture, grows a wide mix of garden crops, cereals, and alfalfa. Orchards of olives, almonds, and figs are encountered in Tadla and Haouz. The only large-scale forests are the plantations along major roads. Because of the long history of cultivation, there does not appear to be any reserve for the original plantlife.

- Animals

About 40 species of mammals and about 100 species of birds are known within the project area. Endangered or threatened mammalian species have long since disappeared except for the Sidi Chiker reserve. The domestic livestock include goats, sheep, cows, and a few camels. They graze on land too steep for cultivation, on fallow land and post-harvest fields. There are few pastures with improved forage.

- Health and waterborne diseases

In Morocco, the major waterborne and water-related diseases are malaria, coliform bacterial intestinal disorders, amoebic dysentery, and urinal bilharzia, all of which have been reported in the Settat command area.

4. Evaluation of the Technical Aspects of the Program

- Irrigation

At present, in most of the Small Dams Program's irrigation perimeters, water requirements of crops are estimated on the basis of full irrigation requirements. In the context of supplemental irrigation, the command areas can be substantially expanded by spreading existing supplies over a larger area. With supplemental irrigation, the timing of irrigation becomes more important than the quantity of water applied. Typically, supplemental irrigation on cereals and forages will guarantee a yield of 3.0 to 4.5 Mt/ha in farming areas receiving 300 mm or more of rainfall with an amount of irrigation water of 75 to 200 mm, depending on the local seasonal rainfall and its distribution.

Pumping the water to higher ground increases the capital and O&M costs. During the planning stage, unnecessary pumping should be avoided as much as possible by considering development of irrigation projects further downstream. When pumping cannot be avoided, more efficient pressurized systems such as center pivots might become economically competitive. Despite their high investment costs of about 30,000 DH/ha, the operational costs might be substantially reduced because of their high efficiencies, which may be as high as 80 percent. However, these systems would require appropriate farmer organizations and technical assistance.

Cooperation and interaction among the three ministries involved should be increased in order to improve the planning process so that the development of each dam project can be brought into harmony with social, environmental, and production goals. A radical shift out of the existing institutional framework as defined by the Interministerial agreement cannot be envisioned in the short-term. More reasonably, one might envision as a first step, enhancing the capability of each institution involved to adequately fulfill its obligations. This would increase cooperation among them by making them more sensitive to the implications of their actions and to the value of the information they can provide. For instance, an in-depth analysis of hydrological inflows is not only crucial for the design of the dam, but is essential for the design and operation of the irrigation system, particularly for supplemental irrigation. Training may be an essential first step toward this goal.

The design of the irrigation systems is somewhat superficial and should be improved. The option taken by DER to design syutems through its provincial services in the DPA's with the backing of the central service of DER should be encouraged. However, this option requires that guidance and technical assistance be provided to the DPA's for better managing the planning, design, implementation, and management of the irrigation projects to be developed. The contribution of the USAID project to encourage this could be in providing adequate training and the necessary field equipment.

A conceptual model for planning, designing, and management of supplemental irrigation systems should be developed. The development of this model may proceed along the following stages:

o Estimating a functional relationship describing the water use of the crop as determined by soil moisture fluctuations caused by water use, rainfall, and irrigation;

o Determining the soil moisture fluctuations caused by crop use, rainfall, and irrigation;

o Establishing a response function relating plant yield to an integrated value of soil moisture throughout the growing season;

o Analyzing (by economic criteria) the long-term probability of success or failure of any particular irrigation schedule at the location.

Such a model could be used to extend the conclusions drawn from the experiments carried out by the Dryland Applied Agricultural Research to the entire Settat command area. It would assist in formulating a clear policy for planning the allocation of water, determining the optimal size of the irrigation project and the optimal operating rules of the dams.

- Hydrology

The hydraulic design of the storage reservoir, the spillway, and the outlet works is done on the basis of hydrologic information supplied by the government. The design engineers, as well as the government hydrologists, are aware of the shortcomings of the hydrologic data base and the methods for making runoff estimates. However, one cannot wait 20 years to collect more data before undertaking a development project; the worth of five more years of data has been shown to be economically insignificant in many projects. Yet, as more sites are developed, more hydrological information is collected and more experience is gained, the predictions and the planning will become more reliable. In the meantime, there is a need to devote more time to the analysis of the existing data base, to refining and upgrading the methodologies for estimating monthly inflows, flood flows, sediment yield and reservoir sedimentation. Time should also be devoted to the evaluation of natural and artificial recharge and to reservoir operation studies in conjunction with monthly agricultural water demands, fish culture, and various environmental requirements. A monitoring system should be established. The data base and the analysis of the data to estimate annual inflows, and flood frequency and flood hydrographs should be available to other government agencies, educational institutions, and private consultants.

- Dam Design

The design of the dam, spillway, and outlet works is done competently based on state-of-the-art hydraulic engineering theory and techniques. The quality of engineering is good. The consultants pay particular attention to the safety of the structure and to a design which is labor-intensive, uses locally available materials to the greatest extent possible, and is economical. The role of the consulting firm is very limited and narrowly focused on dam design. However, many times the objectives of the project are not clearly articulated to the consultant and she/he is not given the opportunity to search for safe and least-cost alternatives. The consulting firm's role in project planning and development is minimal. Consulting engineers responsible for the design of the dam and concerned about structural safety would like to see more extensive site investigations and laboratory tests, especially in the case of larger dams.

The role of the consulting firm is finished once the final design report and drawings are submitted to the "Administration de l'Hydraulique." The construction is carried out by the MPW and the MOI. Some design engineers feel that it would be preferable--particularly in the case of larger dams--to have the designer collaborate with the government during the construction process as adviser and change or adapt the design to the unusual conditions that might be encountered in the field. There are a number of consulting firms in Rabat and Casablanca which would be competent to provide dam design and realistic estimates of construction costs.

- Dam Construction

The construction of the dam, which is undertaken jointly by the MPW and the MOI, seems in general to be well done and remains within the estimated budget and the allocated time frame. Although construction is labor-intensive, labor accounts for 50% to 60% of the total cost, there does not seem to be a deliberate inflation of the labor component.

- Upstream Protection Works

While only the minimum amount of work is done, to protect the dam, the general approach is acceptable from a technical point of view. The MARA-EF has good technical resources for carrying out the necessary works. It is recommended that coordination between MARA-EF and agencies responsible for other components be improved. In particular, the EF engineers should work with the other agencies from the very outset to plan a protection scheme, provide cost estimates, and contribute to the analysis of siltation problems and the means to alleviate such problems. This inter-agency collaboration should continue throughout the scheme design and implementation process to ensure that all works are properly completed in a timely, coordinated fashion.

An expanded analysis required for protection of the irrigation system should include:

- improved geological, soil and topographical studies of the surrounding watershed area, with emphasis on potential erosion impacts and control measures;

- examination of existing land use practices (e.g., livestock grazing) in the surrounding watershed area in relation to potential erosion impacts and control measures (if necessary);

- assessment of the technical and financial efficacy of varying degrees and types of anti-siltation measures such as structural and vegetative erosion control works, bank stabilization works, livestock management/control mechanisms and improved farm land and water management practices; and

- identification of any potential water quality problems (e.g., salinity, alkalinity) which might seriously impede the attainment of agricultural production objectives.

5. Summary of Recommendations

The technical evaluation of the GOM's Small Dams Program raised the following issues:

There is a need for increased cooperation between the three ministries to coordinate design and construction of the entire system: upstream protection works, the dam, and the downstream irrigation system.

- The downstream irrigation works need improvement and the technology of supplementary irrigation needs to be better understood by the extension service.

- The capability in hydrology needs to be strengthened: hydrological monitoring programs should be established for each project.

- There is a need to develop a conceptual framework for planning for supplemental irrigation.

- The engineering design and construction of the dam are satisfactory

- Technical assistance and training programs have to be provided for all components, but especially for irrigation system design and implementation and upstream protection works.

ANNEX C

EVALUATION OF THE FEASIBILITY OF THREE PROPOSED SITES

ANNEX C

Evaluation of The Feasibility of Three Proposed Sites

1. Overview of Information Availability

The purpose of this evaluation is to assess the GOM's current system of site selection and to recommend improvements. To this end, expanded feasibility criteria were applied to three supplementary irrigation sites being proposed by the GOM to ascertain whether or not they would be acceptable and whether or not the proposed feasibility analyses would be adequate for site selection.

Three proposed supplemental irrigation projects were evaluated in light of the criteria and guidelines established by the SI project. The sites visited were Sidi Salah in the province of Beni Mellal, Aricha in the province of Settat, and Biadna in the province of El Kelaa.

Only a rudimentary economic analysis was available for each site.

Engineering and irrigation information was relatively complete for each site. In only one of the sites visited was information on significant social aspects provided (Biadna), and even here the information was very limited. An effort was made to discover more about the social aspects and implications of the dams in its discussions with local officials, experts, and farmers.

The analysis related to watershed protection requirements appeared weak compared to the engineering standards applied. The soils studied were in the impoundment area but engineering standards--not agro-pastoral standards were used. There was no range status assessment available for any of the sites. Erosion data had been extrapolated from very large river basins which were not necessarily comparable to these smaller watersheds. In most cases, the watershed improvement and protection program was completed for the area immediately around the dam, ranging from 1% to 10% of the total watershed. Little effort was made to assess the relationship between erosion and conditions in the upper watershed.

Watershed improvement actions were limited and not always appropriate to the heavily grazed and cropped watersheds of the plateaus and plains. At some dam sites, there is an overemphasis on terracing, check dams, and eucalyptus. What is needed is more attention to vegetative soil control methods (e.g. strip cropping), livestock access, season-of-use and limit agreements. There is a need to influence existing nurseries to grow some of the more difficult natives species, provide shrubs, perennial and annual grass seeds rather than just trees.

Environmental health concerns had not been addressed at the time of site visits. No extra funding had been put aside for special monitoring.

2. Feasibility Analysis of Specific Sites

a. SIDI SALAH

- Hydrological Analysis

There was sufficient water for supplemental irrigation, but the annual sediment load was far too large compared to the reservoir capacity. The reservoir may silt up in six to ten years.

- Environmental Analysis

The proposed dam site at Sidi Salah had too litte information available on the watershed. It was the largest watershed (162 km^2). The upper watershed sits in two provinces--which could complicate any administrative coordination for upper watershed improvements and erosion control. In the impoundment area farmers will be losing significant acreage. Small dams with supplementary irrigation in the floodplain area have not been considered adequately. In addition, karst problems (a dissolving limestone) and embankment collapse are possible severe constraints.

USAID should consider whether it wants to tackle the task of coordinating work in the 162 km^2 area on livestock, dryland cereal production, and erosion control. The topography and geology also appear the most difficult of the three sites visited.

- Social Analysis

(A) Water Uses Planned

1) Irrigation for 150 hectares, affecting 50 families

2) Water provisions for approximately 30,000 livestock.

(B) Delineation of Affected Population - Characteristics of Beneficiaries

1) Status: The dam site is located in a relatively poor region; farmers say that villages have experienced substantial out-migration.

No information was available about other affected communities; nor about characteristics of land in irrigated perimeter.

Problems have existed in getting farmers to accept equal quantity of land elsewhere in compensation for land needed for dam site. This issue appears to be handled by local authorities in what may be an authoritarian manner, but information was too sketchy to draw firm conclusions.

Farmers have no prior irrigation experience.

2) Conclusion: Further information is required before a judgement can be made.

(C) Participation

1) Status: Farmers have had no prior irrigation experience. The government's communication with farmers is limited. Farmers do not know what water-users association would look like nor that they might be required to pay fees.

2) Conclusion: Communication and participation efforts are deficient. More emphasis to these aspects might increase chances of project success.

(D) Feasibility

There is no prima facie case as to why this project would not succeed from a social point of view.

(E) Impact

Impact cannot be reliably assessed owing to lack of information.

(F) Conclusions and Recommendations

While no prima facie reason exists to reject this site, serious gaps in information exist and would have to be filled before definitive support for this site should be committed.

- Economic Analysis

The rudimentary economic analysis performed indicated a low probability of economic feasibility.

b. ARICHA

- Hydrological Analysis

There is sufficient water for supplemental irrigation. In fact, because the reservoir capacity is very large, the cultivated area can be doubled from the estimated 200 has to 400 ha if suitable lands are available. The sediment load is large, but is just at the limit of the criterion. If mitigating measures such as maintenance dredging, upper watershed soil conservation practices and occasional sluicing of the finer sediments are practiced, the project may be acceptable.

- Environmental Analysis

This site had the least information. The impoundment area had the worst erosive conditions of any of the three sites with deep gulleying, rills, and badland-type slopes. Livestock data had been collected only for the irrigated perimeter. It was not clear that erosion protection was possible at any reasonable cost.

Erosion control would appear to be a very high cost item and require a lengthy time period for preparation (soil/slope investigation, nurseries, land management agreements).

- Social Analysis

(A) Water Uses Planned

1) Provision of drinking water for neighboring villages (220 families in a 10 km radius, with a projected population of 327 families after 20 years).

2) Provision of water for livestock (currently 1,400 animals, with a projected 1,700 animals after 20 years).

3) Irrigation for approximately 200 hectares.

B) Delineation of Affected Populations - Characteristics of Beneficiaries

1) Status: The dam site is located in a relatively poor region. The 200 hectares to be irrigated include the property of approximately 80 families, or 800 people, according to the official document provided. However, informal comments on the site suggested that the projected irrigation perimeter contains only plots of large landowners, each owning more than 10 hectares.

No information was available about other affected communities other than general assertions that their interests were being taken into account. Nor was official information on land distribution available. Land needed for the dam site was said by officials to have been freely given and compensation was said to present no problem.

2) Conclusion: Questions remain about size of landholdings to be irrigated and relative wealth of these beneficiaries.

C) Participation

1) Status: Farmers have had no cooperative irrigation experience (although they had some individual irrigation experience), they live in a dispersed residence pattern, and do not carry out harvest tasks jointly. Farmers appear to have relatively little experience in cooperative activities. Government agents' communication with farmers has been limited. Farmers do not appear to know much about what a water-users association might look like, nor do they appear aware of what will be required of them in terms of payment.

Officials voiced assurances that establishing water-users associations would pose no serious problems, and that extension services would furnish necessary knowledge for success in water utilization.

2) Conclusion: Communication and participation are deficient at this point, but not so deficient as to lead to rejection of the project. However, much more effort in consulting with and enlisting participation of the affected communities would be required to assure project success.

D) Feasibility

There are no prima facie reasons why this site would not succeed from a social point of view. However, the lack of prior joint irrigation experience and poor communication up until now between the government and local communities may occasion unexpected problems.

E) Impact

Impact cannot be reliably assessed because of lack of information.

F) Conclusion and Recommendation

Skewed land distribution in the irrigated perimeter suggests that the project may not meet the small farm criteria. Furthermore, serious gaps in relevant information exist.

- Economic Analysis

The rudimentary economic analysis available indicated that the site was only marginally acceptable.

c. BIADNA

- Hydrological Analysis

There is sufficient water for supplemental irrigation of about 80 ha. The sediment load is light. In general, the site is acceptable from an hydrological viewpoint.

- Environmental Analysis

Biadna has a small upper watershed (10 km^2) in a schist geology that should cause few problems. The upperwatershed falls within one administrative unit. A gravity-fed irrigation system is proposed which greatly simplifies operations and maintenance. The "Eaux et Forêts" representative was sensitive to the needs for hillslope erosion control and increases in productivity. However, his activity was limited to 10 percent of the watershed in the immediate dam area. The proposed USAID assessment method requires additional work on downstream water supply; erosion control, and land losses in the irrigated perimeter in order to accommodate distribution system and windbreaks and livestock management. These are all serious and significant environmental concerns. But, given its scale and location, Biadna appears to be the best of the three sites visited.

- **Social Analysis**

(A) Water Uses Planned

1) Irrigation for approximately 80 hectares of a possible 160 hectares (documents provided show that 23 families own 140 hectares, with the size varying between one and ten hectares).

2) Water provisions for livestock (2000 sheep).

3) Household water: Not mentioned in documentation provided, but cited in discussions with officials.

(B) Delineation of Affected Populations - Characteristics of Beneficiaries

1) Status: The dam site is located in a relatively poor region, where there has been no cooperative irrigation experience. Barley and barbary figs are the main agricultural crops, and livestock constitute an important economic activity.

Land in the irrigated perimeter is owned by families from a number of neighboring villages as well as the village closest to it. Land distribution, according to documentation provided, is somewhat skewed (two owners control 70 of the 140 hectares), but officials said that, in the 80-hectare area that would be the first segment irrigated, this distribution would be much less unequal.

2) Conclusion: No concrete reason exists to reject this site on above grounds.

(C) Participation

1) Status: Farmers cultivate private lands and do not appear to have much experience in cooperative economic activities.

Government communication with farmers appears to be limited, and farmers were not aware of what the water-user association would look like, nor what would be required of them for maintenance and operation of the water system.

Some farmers expressed discontent that their land would be by-passed by the irrigation system; others complained that their access to pasture land would be cut off by the dam and flooded area. Officials present assured the farmers that these problems would be resolved.

2) Conclusion: Communication and participation efforts are deficient. More emphasis to these aspects would increase chances of project success.

(D) Feasibility

No prima facie reasons exist why this project would not succeed from a social point of view. However, the lack of prior cooperative irrigation experience and poor communications up until now between government workers and local communities may occasion unexpected problems.

(E) Impact

Impact cannot be reliably assessed due to lack of information.

(F) Conclusions and Recommendations

Preliminary information suggests that this is a site which has good potential for success. However, serious gaps in relevant information exist.

It is recommended that these gaps be filled and that USAID take into account the results of that analysis in reaching a decision on providing support for this dam.

Economic Analysis

The financial and economic analysis indicates that this project has a FIRR of 38% and and EIRR of 5%, i.e., it is profitable for the farmer, but not for society. The reason for this is essentially that the available annual inflow allows the supplemental irrigation of no more than 80 ha. Given the estimated cost of the dam, insufficient benefits are generated to satisfy the economic feasibility criteria.

ANNEX D

ECONOMIC AND FINANCIAL ANALYSIS

ANNEX D

Economic and Financial Analysis

1. Irrigation and Land Use in Morocco

Total cultivable area in Morocco is about 7.72 million ha (11.2 percent of the total geographic area). Of this, 800,000 ha are under irrigation and the balance, of 6.92 million ha, is under rainfed cultivation. About 30 percent of the cultivable area is left fallow, giving a cropping intensity of about 70 percent. Cereals (mainly wheat and barley) occupy 60 percent of the cultivated land. At present, some cereals and a large proportion of sugar and fodder crops are cultivated in fully irrigated areas, largely in the northern part of the country.

A promising alternative to full irrigation is supplemental irrigation (SI), defined as irrigation under the situation where a given crop can be economically grown under normal rainfall alone but additional water will stabilize and improve the quantity and or quality of yields. Typically, conditions conducive to SI are found in agro-ecological zones characterized by annual precipitation ranging from 250 to 600mm. Other than certain large-scale irrigation schemes (e.g. the Tadla and Doukala schemes), where winter crops are supplementarily irrigated, the following three agro-ecological zones within Morocco fall into this category:

i. Plains and valleys at the foot of the Middle and High Atlas mountains. The major part of irrigation water is surface supplied from water sources, floods and snow melt, but wells also exist. Such areas are represented by Ain Taoujdate district in Meknes Province and Ait Outir district in Marrakech Province. Vegetables, forages, cereals and fruit trees are being irrigated. The number of irrigations ranges from 2 to 4 per crop season, depending on the local rainfall.

ii. The Atlantic plains and the plateaus of eastern Morocco. Berrechid district in Settat Province and Taourirt district in Oujda Province are representative of these zones. The annual rainfall is about 400 mm in the first zone and 250 mm in the second. Most irrigation water is pumped from groundwater. Individual farmers use their own pumping equipment to irrigate vegetables, cereals and forages in Berrechid district while forages, cereals and olive trees are irrigated in Taourirt district.

iii. In Had Kourt district, Kenitra Province. In these areas farmers usually cultivate sugar beets under rainfed conditions. During the last year of drougth some farmers began to supplementally irrigate this crop on an area of about 430 ha. The water is pumped from the Sebou and Rdate Wadis with 1 to 4 irrigations per crop season.

Most of the agricultural land included in the Settat command area falls into category i. or ii., above. Given its dryland agricultural focus and it's sparse rainfall (typically less than 400 mm per year) it is in many ways an

ideal region for promoting supplemental irrigation. We know that in this region the lack of water available to the growing plant is the single most important factor limiting yields. Thus, the potential impact from the agricultural research program funded by USAID at the Aridoculture Center in Settat may be somewhat limited due to lack of water. This applies particularly in those regions where average annual rainfall is less than 300 mm (El Kalaa province for example), where the problem is often compounded by poor distribution of this water throughout the growing season. By increasing water available for supplemental irrigation this project will not only have a direct impact on agricultural production, but also indirectly enhance the potential benefits of the agricultural research center at Settat.

2. Benefits of Supplemental Irrigation

Research findings show that supplementary irrigation greatly increases yields. Experimental work on supplementary irrigation has been carried out since 1975 at the Oulad Gnaou experiment station in Beni-Mellal Province. Average rainfall at this site is about 420 mm. It was found that a small amount of timely supplemental irrigation -- about 100 mm -- has a large effect on grain yield of wheat, giving yields from 3.0 to 4.2 Mt/ha as compared to the national average yield of less than one Mt/ha. In the 1975-76 season, with 311 mm of rainfall, a supplementary irrigation of 98 mm applied at the germination stage yielded 4.2 Mt/ha. In 1979-80, with 224 mm of rainfall, supplementary irrigation of 79 mm added at the germination stage gave a wheat yield of 3.5 Mt/ha.

Other experimental work on the effects of supplementary irrigation on the yield of field crops is being carried out at the Aridoculture Center at Settat. The objective of these studies is to compare the yield response of different cereal genotypes grown under different water deficits and to establish a simulation model for wheat growth under different water deficits and cropping techniques. In 1985 and 1986, wheat under rainfed conditions yielded 2.2 MT/ha., 75 mm of supplemental water produced 3.2 Mt/ha, and 150 mm of water yielded 4.5 Mt/ha.

Yield increases in the areas where SI is already practiced have also been encouraging. In Meknes province and in Ait Outin yields have typically doubled or tripled. In the Settat region (near Berrechid) yields of 4 Mt/ha for wheat were obtained, four times the yield under rainfed conditions. It is likely that these yields will increase even further, as farmers become more familiar with SI practices.

In addition to increasing yields, SI also helps stabilize them. Year to year fluctuations in grain yield in the Settat command area are extremely large. To guard against the ill effects of these fluctuations, farmers in the Settat command area tend to devote a substantial portion of their land to the more drought resistant barley, rather than growing higher yielding and higher valued grains such as wheat. The assured availability of water that the irrigation systems introduced under this project offer will thus have the additional benefit of inducing farmers to adjust their production program away from barley towards wheat.

A third benefit will come from the intensification of animal husbandry that SI will make possible. Straw from grain crops is the major cattle feed used in Morocco. SI will not only increase grain production, but straw production as well, albeit to a lesser degree, and the overall increase in available water will permit better watering of the livestock. In some areas, where the system yields sufficient water, farmers might also introduce dedicated fodder crops, in addition to grains, to concentrate more on livestock raising.

Finally, farmers may also decide to devote part of their land to growing vegetables, or grow vegetables after the main cereal crop has been harvested. The viability of second crops is very site specific, and may vary from year to year as a result of available rainfall. For example in years of extremely good rainfall, very little water will be required for supplemental irrigation and the bulk of the reservoirs' capacity could be devoted to irrigating a second crop. On the same site in years of poor rainfall, virtually all the water will be required for supplemental irrigation and a second crop will not be feasible.

Net SI Benefits per Hectare

Farm budgets were constructed to evaluate the benefit of providing SI to a hectare of agricultural land in the Settat command area. The question asked was: If an SI system providing water to a hectare of land is installed, how much more can be produced from this land and what is the additional production worth? The sum of the value of this additional production, less annual recurrent costs, discounted to the present, gives the additional value that the SI system imparts to the land. Adding this over all the hectares that benefit from a specific SI system results in a measure of the "worth" of the whole SI system. The economic decision criterion is then simply that the economic costs of the entire SI system, including dam, up-stream works, and down-stream works, must not exceed what it is worth.

The additional output due to SI is calculated using the following assumptions:

1. Only additional output from the first crop, assumed to be grain, and from associated livestock holdings is counted as benefits. Potential benefits from a second harvest, though probably possible in good years, are not certain enough to warrant inclusion at this time. Second harvests would also be based on the application of full irrigation, not supplemental irrigation which is the emphasis of this project.

2. At least 350 mm of water per hectare are provided for supplemental irrigation. Assuming typical losses from evaporation and irrigation efficiency of around 50 percent, this will allow 100 to 200 mm of water to reach the crop. This is sufficient to virtually guarantee grain yields of around 3.5 Mt/ha, assuming low to normal rainfall and appropriate agricultural techniques (fertilizer etc..).

3. Yields are assumed to be only about 60 percent of potential initially, but as farmers learn to use the water provided more efficiently and modify their agricultural practices, they are expected to reach their potential of 3.5 Mt/ha within five years. The potential of 3.5 Mt/ha is in the lower range of results obtained so far (see above). Three-year averages of yields in the Settat command area for the dry zone (less than 350 mm of rain) and the intermediate zone (greater than 350 mm of rain) were used to compare to expected yields under supplemental irrigation. These yield estimates are 0.66 and 1.06 Mt/ha respectively.

4. Livestock holdings are assumed to increase by the equivalent of one head of cattle per ha. Milk production is estimated to be 860 liters per year, a figure that takes into account the typical age and sex distribution of Morocco's cattle herd. Anualized meat production is estimated to be 42 kg/ha.

5. Before the SI system becomes operational, farmers are assumed to devote 75 percent of their land to barley production and 25 percent to durum wheat (blé dur) production. With the SI system, drought risks are reduced and farmers will respond by planting only 20 percent of their acreage with barley, the remainder split evenly between bread wheat (blé tendre) and durum wheat.

6. Additional production costs were assumed to consist of 12 man-days of labor, valued at the economic opportunity cost of 4.5 DH/day (20 percent of the minimum wage), 150 kg of fertilizer valued at .8 DH/kg, and the farmers' share in the systems O&M costs estimated at 500 DH/ha for gravity fed systems (2 to 3 percent of the system costs). For systems involving pumping, an additional cost of .25 DH/m3 of water was added to reflect the running costs of the pumps.

7. Five year averages of import parity prices were taken as the economic value of production. The calculations are given in Table D-1.

The annual additional net benefits per hectare due to SI were discounted over the assume system life of 20 years using a 12 percent discount rate. The resulting estimates of net worth of SI per ha, labelled "B", for the four combinations of rainfall zone and pumping requirement are given in Table D-2. Table D-3 gives more detail on the calculation of B for the intermediate rainfall zone as an example.

As can be seen the values of B range from about 30 thousand DH/ha to about 40 thousand DH/ha. This implies that a hectare of land with access to water for SI should be worth between 30 and 40 thousand DH more than comparable land without any access to irrigation. USAID/Rabat has some anecdotal evidence on differences in land prices between comparable land with and without access to water for irrigation and has reported on that to Washington in cable form (Rabat 5224). The differences reported range from about 50 thousand DH/ha to 70 thousand DH/ha. These values, however, refer to land with access to more water than will usually be provided in the types of SI systems funded under this project. This anecdotal evidence thus supports the order of magnitude of the estimates arrived at analytically and tends to reinforce confidence in the economic viability of the project.

Table D-1

Import Parity Prices for Grains
(per metric ton)

Cost Item	Barley (Orge)	Durum Wheat (Ble dur)	Soft Wheat (Ble tendre)
FOB Gulf ($)	90	161	136
Sea Transport	20	20	20
CIF Casablanca	110	181	156
in DH(1$=8.3DH)	913	1502	1295
Port Charges	108	108	108
Local Transport	98	98	98
Local Parity Price	1119	1720	1501
Rounded in DH/q	112	172	150

Table D-2
Estimated Net Worth (B) of SI per ha
('000 DH/ha)

Type of SI	Mean Annual Rainfall Zone: less than 350 mm	Mean Annual Rainfall Zone: greater than 350 mm
Gravity fed	40.4	36.7
Pumping needed	33.9	30.2

Table D-3

Calculating the Net Benefit (B) per ha

Production Schedule	w/o SI	with SI	Prices
Grain Production			
Grain Yield	10.6	35.0 q/ha	
Crop Rotation			
Barley (orge)	75.00%	20.00%	112.0 DH/q
Durum Wheat (ble dur)	25.00%	40.00%	172.0 DH/q
Soft Wheat (ble tendre)		40.00%	150.0 DH/q
Livestock Production			
Milk	--	860 l	2.0 DH/l
Meat	--	42 kg	18.0 DH/kg
==>Total Value of Output	1,346	7,768 DH/ha	
Production Costs			
Labor	--	12 md	4.5 DH/md
Fertilizer	--	150 kg	0.8 DH/kg
Share of O&M	--	500 DH/ha	
Pumping Costs		875 DH/ha	
==>Total Production Costs			
Gravity fed SI		674 DH/ha	
Pumped SI		1,549 DH/ha	

Economic Net Benefit Flows

	Year 1	2	3	4	5 through 20
gravity SI	2641	3418	4194	4971	5748
pumped SI	1766	2543	3319	4096	4873

Net Present Value ("worth" of SI) at 12 percent over 20 years

gravity fed SI systems	36703 DH/ha
SI systems requiring pumping	30167 DH/ha

Sensitivity Analysis

The above estimate of discounted net benefits (B) are sensitive to changes in the underlying assumptions. Three are of particular importance and reflect management of project resources, extension and farmer management of irrigation, and upstream protection against erosion. The results of the sensitivity analyses were as follows:

a. Lagged implementation of the project. If irrigation systems are not built at the same time as the dam, or sufficiently soon that the second year of the project can be exploited by farmers, the economic benefit of the project will fall. If for any reason the construction of the dam itself is drawn out, a similar effect will be registered. If, for example, the construction of the canals were postponed for one year, the discounted net benefit per hectare would be reduced by about 10 percent.

b. Slow rate of mastery of the irrigation system. If, for any reason, farmers are slow to accept the new technology, because extension services are unable to do their job, or the water user's associations are slow to develop, benefits will be reduced. If it takes 7 instead of 5 years for farmers to master the SI technology, benefits will be reduced by 10 percent.

c. A third test was made to see the effect of a longer system life on B. If the SI system has a life of 30 years, instead of the assumed 20 years, B will be increased by 10 percent. Good watershed management to prevent erosion is an effective way of extending system life.

3. Costs of SI Systems and Benefit/Cost Comparisons

It is more difficult to arrive at expected costs per hectare figures, than is the case for benefits. This is principally due to the fact that costs are much more site specific than benefits and therefore subject to much more variation. This variation has essentially two sources, the variation in unit costs (e.g. the costs per cubic meter of fill, the costs per linear meter of canal) and variation in the size of the structure required in different locations.

By disagregating costs into three categories, upstream, dam proper and downstream, it is possible to get somewhat of a handle on that variation. By far the largest variation is in the estimates of upstream watershed protection works. As a rule of thumb about 10 percent of the watershed require treatment to slow erosion, and on average the biological treatments used cost around 6000 DH per hectare, according to information provided by the GOM. The size of watersheds varies roughly from a few hundred hectares up to 30 square kilometers. Most of the very small watersheds, however, will not provide sufficient water for supplemental irrigation on perimeters of the size considered here. The typical watershed of a site suitable for supplemental irrigation will be between 15 and 30 square kilometers. Accordingly, for the systems considered here, up-stream protection works would have to be applied to 150 to 300 hectares at a cost from .9 to 1.8 million DH per site.

More accurate data exists on average dam costs, since a fairly large sample of dams has already been built. Construction cost data was available for 23 of them, 16 earth dams and 7 masonry dams. Table D-4 summarizes the results:

Table D-4: Analysis of Construction Costs

		Minimum	Maximum	Mean
Earthen Dams:	Volume ('000 m3)	42.0	220.0	107.5
	Cost ('000 DH)	3,710	17,845	8,736
	Unit Cost (DH/m3)	64.9	156.0	88.6
Masonry Dams:	Volume ('000 m3)	4.0	30.0	15.5
	Cost ('000 DH)	3,088	12,450	7,429
	Unit Cost (DH/m3)	381.8	771.9	552.8

A number of points are worth noting in this table. First, on a per cubic meter cost basis, masonry dams are roughly six times as expensive as earthen dams. However, masonry dams usually require only ten to fifteen percent of the volume of an earthen dam to retain the same amount of water. In the final calculation, masonry dams thus actually wind up about ten percent less expensive than earthen dams, in financial terms. Furthermore, since masonry dams require more unskilled labor, the economic cost of which is only about 20 percent of the wages paid, their cost advantage in economic terms is even greater. Second, The variation in cost per cubic meter is much less than the variation in total dam costs. Nevertheless, the variation in total dam costs is less than the sum of the variation in unit costs and size of the dam. This is because typically larger dams have lower unit costs and vice versa. Accordingly, the variations in size and unit costs tend to offset each other. Finally, one notes that the average cost per dam is just about 8 million DH (one million Dollars), albeit with a substantial variation.

Given the typical profiles of small dams it is possible to calculate the volume of the dam required for a given hight and site specific values for the slope of the banks. In the target area the typical values for the slopes vary between 4 and 6 meters per meter increase in hight. The volume of a twenty meter high earthen dam can thus be calculated to be between 80 and 110 cubic meters. Multiplied by the average cost 88 DH per cubic meter one can arrive at an estimated average cost for a twenty meter dam of between 7.2 and 9.6 million DH (.85 to 1.15 million Dollars).

Unit costs for down-stream works also vary greatly. The estimated costs of eight gravity fed systems, which had perimeters over 200 hectares and for which data were available, varied between 820 and 14,710 DH per hectare with a mean of 3,770 DH/hectare. Using 4,000 DH/hectare as a planning figure for an

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average downstream gravity fed system thus seems reasonable. For systems requiring pumping, costs per hectare are substantially higher. There were not sufficient data available to arrive at an estimate for down-stream costs per hectare for systems requiring pumping.

In sum, therefore, the financial cost of a supplemental irrigation system consisting of a 20 meter dam (DH 8.4 million), a 300 hectare supplemental irrigation perimeter (gravity fed, DH 1.2 million), and a 25 square kilometer watershed of which ten percent need treatment against erosion (DH 1.5 million) will be between 11 and 12 million DH (1.4 million Dollars).

In aggregating the economic costs it is proper to discount the non-skilled labor component by up to 80 percent. Unemployment is quite high in Morocco, estimated currently at about 15.5 percent in the cities. In the rural areas unemployment, particularly seasonal unemployment, is probably significantly higher, as evidenced by the continued rural to urban migration. Promotion Nationale employed almost 12 million man-days of unskilled labor in 1987, primarily in labor intensive infrastructure projects in the rural areas. The fact that these employment opportunities have to be rationed is further evidence of the pervasive un- and under-employment in rural areas of Morocco. It is therefore a reasonable estimate to assume that non-skilled labor has a true economic cost approximately equal to 20 percent of the minimum wage.

It is one of the goals of the Government of Morocco's Small Dams Program to have as high a proportion of the cost as possible to go for unskilled labor. The explicit target is 60 to 70 percent. However, experience has shown that this target is rarely reached for completed systems. Some activities, such as planting for biological watershed protection, are quite labor intensive, and the targets may be reached for these system components. Overall, however, labor costs rarely account for more than 50 percent of system costs.

This proportion has been increasing lately, as the Government of Morocco has adjusted its construction techniques and some overhead costs, such as equipment rental, have fallen. For the purpose of the rough estimates used here, assuming a non-skilled labor component of 50 percent seems appropriate.

Applying the economic costs of labor to the system costs, rather than the financial costs gives an estimate of the system's overall economic costs. Economic costs consist of 20 percent of labor costs (assumed to be half of financial costs), and the full amount of all other costs (i.e. .5x.2+.5=.6). In practical terms this simply amounts to reducing financial costs by 40 percent to arrive at economic costs.

Economic costs of a typical system with a 300 hectare perimeter costing between 11 and 12 million DH are thus around 7 million DH, or 23 thousand DH/hectare. This estimate is comfortably below the estimate for economic benefits given in Table D-2. The benefit cost ratio is between 1.6 and 1.7 implying that such a typical system would easily satisfy the economic criteria established for funding of supplemental irrigation systems under this project.

4. Beneficiaries' Financial Analysis

The national average per capita income of farmers was approximately 1884 DH in 1984. A family of six farming 10 has under rainfed conditions can generate a net income of about 10100 DH or 1683 DH per person according to data generated by the project feasibility studies. This approximates the national average per capita farm income. Adding supplemental irrigation, total net income (not accounting for capital improvements costs such as land leveling, tertiary canals, etc..) is estimated at approximately 50,000 DH for ten hectares, or 8,300 DH per person. Net farm income, before amortization of farmer provided investments, would increase almost five-fold under this project.

Actual benefits per farmer will probably be substantially lower. Given the parcelization of land holdings in Morocco, it is very unlikely that any one small farmer will have his entire 10 hectares within the SI perimeter. It is more likely that a small farmer has one to two hectares within the perimeter, the remainder located elsewhere. But even in this case farm income would almost double.

Capital improvements paid for by the farmer beneficiaries are estimated around 2,000 Dh per ha, or amortized over five years, these capital improvement costs amount to approximately 560 DH/ha per year, about 10 percent of annual net benefits per ha (see Table D-3). Other costs such as operation and maintenance costs and production cost increases that the farmer must bear are already included in the annual net benefit calculation (see Table D-3). Clearly, assuming these orders of magnitude, farmers should be willing to adopt a system of supplementary irrigation. Moreover, they should be able to pay substantial water charges and still realize significant gains in net family income.

ANNEX E

SOCIAL SOUNDNESS ANALYSIS

ANNEX E

Social Soundness Analysis

1. Socio-Cultural Context

The Barrages Collinaires (Small Dams) Program of the GOM is motivated largely by social concerns. Rural unemployment and a desire to stem the tide of rural-urban migration are the primary motives behind public construction works in general and small dams construction in particular. The unemployment rate in the rural areas is estimated at 10.9 percent. The rate of outmigration has averaged over 100,000 people (one percent) per year since 1975. The income level of rural dwellers averages about 60 percent of that of urban workers. Given a population growth rate of 2.6 percent per year, creation of jobs, especially in the rural areas, is the GOM's number one development concern.

The small dams program will effect employment in three basic ways: short-term employment (6 months) while dams are being constructed, growth in on-farm employment owing to increased intensity of cropping under irrigated systems, and off-farm employment stimulated by increased agricultural output.

It is evident, however, that employment effects will be largely temporary and inconsequential given the magnitude of the problem and the limited scope of the project. Dams should therefore be justified on other grounds, including increased small-farmer income, increased food production, erosion control, and increased potable water availability.

2. Beneficiaries

Review of social conditions for dams already constructed revealed wide diversity in farm size and income among projects. Conditions ranged from one or two large-scale farmers to many small-holders. In order to maximize the equitable distribution of benefits measurable social criteria should be established for selecting sites to be financed under the project.

There is good evidence that scope exists for limiting beneficiaries to small farmers. Further, the GOM has expressed willingness to accept a small-farmer focus. Nationwide, 67.8 percent of all farmers farm less than 10 hectares of land, accounting for 45.1 percent of the land area, and only 0.1 percent of the farmers have over 100 ha of land, accounting for about 10 percent of the land area. Over 72 percent of farms are owner operated, with the remainder distributed among collectives, religious lands and other forms of tenure. In the province of Settat, 83.4 percent of the farms are less than 10 hectares, accounting for 36.8 percent of the land, while 2.6 percent own more than 50 hectares and account for 30 percent of the land.

Among the five completed sites reviewed, only one served a few large farmers. In the remaining sites, the distribution of land closely reflected national and provincial averages. In the most extreme case observed, two farmers owned 60 percent of the land to be improved by the irrigation project. In the remaining four cases, land was fairly evenly distributed, with over eighty percent of the farmers holding less than ten hectares.

Melk (private ownership) is by far the most common tenure situation, accounting for 72 percent of farms nationwide. Private ownership would be the simplest tenure system to deal with. Tenancy arrangements may cause difficulties in allocating benefits of irrigation (and costs of irrigation water) among land owners and tenant farmers. For example, traditional tenancy arrangements will certainly be disrupted by the introduction of a major new resource, irrigation water. Farm labor requirements increase, production per hectare will increase, and cost-sharing arrangements for maintenance of the irrigation structures would have to be worked out.

Maximizing total benefits and assuring maximum equity in their distribution can be accomplished in three ways. First, criteria can be set for site selection which will insure that smaller, poorer farmers are included as beneficiaries. Second, farmers may be assisted in organizing themselves to manage water resources and trained to use the water most efficiently. Third, laws governing water use and land tenure situations may be fashioned to favor equitable distribution of benefits. In short, insuring maximum project benefits may require inputs in terms of social analysis, and farmer training. Social analysis and selection criteria should to developed at the planning stage, and public resources should be expended on technical training for farmers.

In terms of short-term employment benefits for communities affected by the dam projects, the system already in place appears quite reasonable. Recruiting labor is done on a first come, first serve basis. As wages are fixed at the average rural wage level for unskilled farm labor, it is to be expected that benefits will be fairly evenly distributed. Attempting to refine the employment selection process, say by establishing income criteria, would be cumbersome and probably would not significantly improve the social distribution of project impact.

Two kinds of possible negative impacts should be considered and systems of compensation developed to offset these impacts. Protection of the dam through upstream conservation works usually requires controlling access to grazing on land traditionally open for free grazing. Most likely, a system of communally controlled rotation would have to be developed. In most cases, improved total biomass production may well result if a system of communal range management were to be installed. The second negative factor is inundation of productive land by the reservoir. At present the GOM arranges for trading similar land in another location. However, this system may have to be refined to account for spatial dislocation, land quality differences and land tenure disruption. Social analysis should be expanded to take these negative factors into account and to devise equitable systems for compensating affected farmers and herders.

3. Participation

At present, potential local beneficiaries are not involved in decision-making in a systematic way in the site selection process. In a few cases, a questionnaire was carried out which provided data on potential beneficiaries, and determined in very broad terms whether the community desired irrigation water. No attempt was made to probe deeply into such issues as farmer experience with group economic activities, the existence of

social structures which could cause difficulties in water management, willingness to pay for water resources, proposed systems for maintenance of infrastructure, and suggested means for compensating neighbors affected negatively by the reservoir or upstream conservation works. Clearly, project benefits could be significantly increased by up-front participation and understanding on the part of farmers that are to receive the benefits of irrigation, or on the part of those that may be negatively affected by the project.

An expanded social analysis is recommended which would:

1) Assess communication channels between affected communities and between communities and officials. Improved communication will uncover possible sources of social conflict, gain insights regarding farmer organization possibilities, define workable compensation schemes, and help define technical assistance needs in so far as water management is concerned;

2) Assess the competence of agricultural extension services and compare this to the technical training required for farmers. This should be done early to prepare farmers technically and to establish the water users organization necessary to manage the irrigation water;

3) Identify and analyze possible negative social impacts (such as restricted grazing) and develop recommendations for community solutions; and

4) Explore ways of applying a uniform water law for water users associations. An effective water law should:

a) establish the farmers' financial responsibility toward increasing efficiency of use of water resources,

b) clearly delineate the farmers' responsibility and responsibility of governmental organizations,

c) establish communication channels for handling problems,

d) establish a workable and equitable system for allocating water, and

e) establish a fee system or labor sharing scheme for allocating maintenance costs among members of the water users association.

Another problem that could arise from the program is the potential negative impact on downstream groups. Examples of such negative impacts include reduced groundwater reserves and reduced stock water. The difficulty arises from the fact that these communities would normally not participate in benefits and would have no voice in the design of the project. Surveys of downstream impacts and development of schemes for compensating these communities should therefore become a part of the social feasibility analysis for each subproject.

4. Socio-cultural feasibility

On balance there are no major, insurmountable social obstacles to implementation of the program. Communities inevitably expressed a desire to obtain irrigation water and expressed willingness to assume major responsibilities in management of the irrigation systems. However, in the absence of experience and an in depth social analysis, certain actions should be built into the project. First, training of farmers can overcome the general lack of experience, technically, with application of supplementary water to cereals and forage crops. Experiment station results are available and direct experience with center pivot systems in the region will provide useful basic data. Theoretical models of gravity-fed supplemental irrigation systems have been developed and are being tested by the Institute Agronomique et Vétérinaire and will begin to produce extendable recommendations. Training of extension agents and appointment of an agent to work with farmers on perfecting the new irrigation technology appears to be necessary, at least during the first several years of the program.

Second, farmers should be organized into water users associations and trained to manage systems maintenance and distribution of water. A system of fees or allocation of labor for maintenance of canals should be put into place. A new water law has been developed but not yet promulgated. Using the law as a guide, extension agents should assist the farmers in establishing an association, electing leaders, and implementing the system.

Third, there is a major policy issue which awaits the GOM's attention. At present, farmers are to be responsible for only maintenance and operating costs. No capital costs are to be recovered through levying water charges. This policy could cause difficulties by contributing to less than efficient use of water and reducing the overall budget for irrigation development. If incomes rise significantly as a result of irrigation, recovering some proportion of this for future investment in additional sites would increase the aggregate benefits of the program at no additional investment cost. It is proposed that social and economic benefits be monitored closely and recommendations for increasing farmer participation in cost recovery be considered at a future date.

Fourth, restricting the use of upstream rangelands to control soil erosion may be a source of social conflict. The GOM's approach to this problem thus far has been to apply restrictions from the "top down". Participation of the community in establishing rational use of the protected lands would be preferable. Thus, part of the social analysis conducted for each dam site will be to explore alternative management schemes and query the affected populations regarding their preferences.

The GOM's approach to social issues itself may be an obstacle to effective realization of program benefits. Top down executive methods are used whereas a more participatory style seems desirable. Extension services do not currently have the capacity to organize water user's associations and train farmers in the technical aspects of supplement irrigation. The new law governing water user's associations has not been tested on local populations nor was it developed with the participation of users. Finally, despite the fact that the overriding motivating force behind the Small Dams Program is social in nature (employment, benefits for small farmers, etc.) virtually no in-depth social analysis is currently being carried out.

Thus, to insure that social conflict is minimized and that economic benefits to small farmers are maximized, USAID intervention in the program should provide for social analysis and improvement of the capacity of the extension service to train farmers in organization and technical aspects of irrigation.

5. Proposed approach to assessing social impact of individual subprojects

The social feasibility and social impact of each proposed subproject should be tested following the broad outline presented below. The study should be carried out in four steps: 1) determination of whether there are absolute social barriers to subproject success, such as insurmountable conflict over compensation for inundated lands or refusal to manage the irrigation system, 2) a social feasibility analysis to determine impact on beneficiaries, 3) implementation aspects, including organization of construction labor and formation of water users associations, and 4) setting up a monitoring and evaluation study to provide measures of project impact and social assessments useful as input into future subprojects.

Pre-feasibility assessment

This assessment should delineate affected populations, develop a list of farmers, indicate the size of holdings, and provide a map of the proposed irrigation perimeter. In addition it should determine the communities or individuals likely to be displaced by the reservoir and upstream protection works, ascertain if a system for compensation for displacement exists and determine whether the level of compensation is acceptable to the affected population. It should ascertain whether farmers want the system and whether the project will primarily benefit small farmers.

Social feasibility study

This analysis should answer the following questions:

- What are the communities which will receive water and those which will be affected by the new water system?

- What is the nature and quality of communication channels within the beneficiary community, and among affected communities?

- Is the capacity of the local extension service sufficient to assist farmers in organizing water user's associations and training them in irrigation technology?

- Further, the analysis should develop a detailed plan for organizing farmers for 1) management of the water distribution, 2) maintenance of the system, and 3) the collection of fees or other mechanisms for accomplishing the required maintenance.

The analysis required to answer these key questions should accomplish the following:

- Describe communities receiving water, those affected by the program but not benefiting from irrigation, and those providing construction labor. Determine their attitudes toward the program, and the status of communication systems.

- Determine the social history of the affected communities, attempting to understand the relationships between groups within the affected region and the history of conflict and cooperation.

- Develop a baseline survey of farmers to be included in the irrigation perimeter and groups affected by inundation and control of upstream erosion for dam protection. The survey should determine land holdings, crop production, labor use, income, including non-farm income, and family size.

- Assess social issues and problems that may arise during the construction phase of the project. These should include: an estimation of the pool of unemployed labor; willingness of farmers to supply some of the labor needed for construction of the irrigation canals; an estimation of the appropriate compensation rates in each case; and an assessment of the optimal timing of construction, given seasonal farm labor requirements.

- Determine the nature and quality of communication channels within the communities and between the communities and officials. This will include an analysis of leadership structures, cooperative organizations, history of the community with respect to local authority post development programs, and the like. In short, the analysis will develop a recommendation as to the feasibility of farming water users associations and delivering new irrigation technology to farmers. The analysis would recommend alternative mechanisms for organizing farmers and delivering technology.

Monitoring and evaluation

A study of the social impact of the dam on the affected communities should be carried out, utilizing the baseline information collected in the above feasibility analysis. This should involve periodic surveys and intermittent field work over a period of time -- say, the first 2 years of the life of the irrigation perimeter.

The monitoring and evaluation study should attempt to trace the evolution, over time, of those social parameters analyzed and measured in the above feasibility analysis.

6. Assessment of Moroccan Sociological Expertise

In order to assess the availability of sufficiently well-trained Moroccan sociologists and anthropologists, a preliminary evaluation was made, both in qualitative and quantitative terms. The general international reputation of the Moroccan sociological community is well established, and it ranks high among third-world countries as well as in the Arab world. A number of Moroccan sociologists and anthropologists are figures of international stature. University degrees in sociology are awarded at the Faculté des Lettres of the universities of Rabat and Fès. The numbers of the sociology faculty at Rabat and Fès are roughly comparable; however, the university of Fès only recently began to offer degrees at the level of the "masters degree". The sociology faculty at Rabat offers degrees at all levels.

For all of Morocco (including degrees awarded abroad), there are currently:

- 4000 holders of a "licence" in sociology
- 200 holders of the "doctorat de troisième cycle"
- 40 holders of the "doctorat d'état"

In all of Morocco in sociology, there are approximately:

- 15 "professeurs d'enseignement superieur"
- 20 to 25 "maîtres de conférence"
- 25 "maître - assistant"
- 15 "assistants"

The following institutions would potentially be able to provide sociologists for field research and analytic purposes, as well as to provide further detailed information as to human resource capability:

- Association marocaine de sociologie.
- Faculté de sociologie, psychologie et philosophie at the University of Rabat.
- Faculté de sociologie, psychologie et philosophie at the University of Fès.
- Institut Agronomique et Vétérinaire Hassan II, Rabat.
- Institut National d'aménagement et d'urbanisme, its Centre d'études et de recherches, Rabat.

There are an estimated 50 consulting groups (bureaux d'études) which would be able to provide some assistance in social analysis.

In conclusion, there are sufficiently qualified human resources in sociology and anthropology available in Morocco to carry out a sustained program of social analysis within the framework of the supplementary irrigation program, and along the lines of the studies suggested above.

In the medium and long-term, it would be possible and reasonable for the relevant ministries (Interior, Agriculture) to increase their own sociological capabilities, and to be able to provide the sociological expertise to oversee, if not actually implement, the appropriate social analysis. In the short run, the necessary studies could be commissioned from competent sociologists within the university/institute communities, or from experienced consulting firms.

7. Impact

The small dam project is motivated by the desire to provide economic benefits of irrigation to small farmers. If technical, social and economic criteria laid out in this project are followed, it is expected that quantifiable benefits will be a quadrupling of yields of wheat and forage on 2500 has, providing net increase in farm income per year of $1.5 to $1.9 million for 1500 farmers and 17,000 workers will be employed for six months each and earn approximately $7 million.

Other possible benefits, which are not readily quantifiable, include reduced erosion, firewood production, pasture, and increased drinking water.

The distribution of benefits will be equitable, as beneficiaries will be chosen according to their status as small farmers. Irrigation benefits will be proportional to land holdings, and strict upper limits on the size of farm will be imposed. Approximately 1500 families, totalling 9000 individuals will be directly benefited by the irrigation program. Further, a modest impact on migration to larger cities is expected. Increased employment on farmers owing to intensification of cultivation under irrigation, secondary employment generated by increased agricultural production and temporary construction employment will tend to slow outmigration.

8. Issues

Four questions arise from the social analysis which should be dealt with during the implementation phase of the project:

- To what degree should farmers pay the costs of operation and investment?

- Are farmers capable of organizing to manage maintenance and water distribution, given their lack of experience?

- Will the GOM be able to develop appropriate systems of compensation for inundated land?

- Is it possible to develop effective systems of control over grazing of upstream lands?

While individual instances of each of the above issues were noted in the review of social factors associated with past dam construction, in no case did the issue seem insurmountable. A social analysis is built into the site selection process which will define possible problems before each site is selected. A combination of policy dialogue with the GOM, in-depth social feasibility analysis, and farmers training should be sufficient to alleviate these potential problems.

ANNEX F

INSTITUTIONAL ANALYSIS

ANNEX F

Institutional Analysis

1. Organizational Structure

At the national level, the GOM Small Dams Program is implemented by an Interministerial Committee composed of the Ministries of Interior (MOI), Public Works (MPW), and Agriculture (MARA). The Committee was formed in 1984 and in February 1986 a formal agreement was signed among the three ministries to implement the Small Dams Program. The agreement outlines program objectives and delineates the responsibilities of the respective Ministries. While decisions concerning the overall thrust of the program and the final selection of sites rest with executive level decision-makers, the technical implementation of the program is delegated to the technical staffs within each Ministry (see Attachment I: Ministry Personnel Furnished for Execution of the Small Dams Program).

The national-level technical departments represented on the Interministerial Committee are as follows: Directorate for Rural Development, (DER) within the Ministry of Agriculture; the Directorate for Hydraulic Development and Improvement (DAH) within the Ministry of Public Works; and the National Promotion Program (PN) within the Ministry of Interior. These departments undertake feasibility and technical studies, make recommendations on final site selection, and design and carry out infrastructure and upstream protection works.

The Water and Forest Service in the Ministry of Agriculture is also associated with the Interministerial Committee and is responsible for developing a watershed management program for all sites. The Ministry of Finance is responsible for managing the financial aspects of the program. Under the proposed USAID project, the Ministry of Economic Affairs (Ministère des Affaires Economiques) will also be involved and will coordinate the USAID project on behalf of the GOM. Project coordination will entail: (1) signing the Project Agreement with USAID, (2) coordinating GOM-USAID policy dialogue concerning the project, and (3) facilitating discussions among participants as implementation issues arise.

At the provincial level, the decision-making body is the Provincial Committee for Small Dams, which is chaired by the Governor. The Governor is the direct representative of His Majesty the King and he relates to the National-level Interministerial Committee through the Ministry of Interior. The provincial Committee consists of provincial representatives of the three technical ministry offices found at the national level. These are: the Provincial Directorate for Rainfed Agriculture ("Direction Provincial de l'Agriculture") (DPA) representing MARA-DER; the Provincial Directorate of Infrastructure ("Direction Provincial d'Equipment") (DPE), from MPW-DAH; and the Provincial Delegate of the Promotion Nationale ("Delegue Provincial de la Promotion Nationale") (DPPN) representing PN.

2. Ministry Responsibilities within the GOM Small Dam Program

Ministry of Interior (MOI): The Ministry of Interior's mandate is highly diverse. MOI coordinates all GOM activities at the provincial level. With the recent GOM decentralization and regionalization program, this coordinative function has been enhanced. In the context of the GOM Small Dams Program, the MOI coordinates activities through provincial Governors and the Promotion Nationale Program.

- Promotion Nationale (PN)

The PN is a national program created in 1961 by Royal Decree, and charged with the critical task of generating minimum-wage employment for skilled and unskilled labor in urban and rural areas. In 1981, the PN was strengthened and is now responsible for the development of projects throughout Morocco. PN activities are largely directed towards infrastructure and reforestration development which include the training of unskilled labor and other activities supporting large infrastructure projects. In the early 1980's, the PN Program was placed within the Ministry of Interior. Because employment generation represents a key GOM objective, the PN is considered a priority program and it receives its annual budget directly from the Ministry of Finance rather than through the MOI.

The PN has a special account (T.G. 30-00) at the Treasury. This special account is divided into budget line items such as equipment, construction, and material. No money can be moved from one budget line item to another. Each budget line item is subdivided into sub-line items, with some flexibility to move money from one sub-line item to another. For the proposed USAID project, a new budget line item could be added to the special account (T.G.30-00) to cover the Supplementary Irrigation Project financed by USAID.

Within the MOI, PN is linked to two departments: (1) the Department of Rural Affairs ("Direction des Affaires Rurales") (DAR) and (2) the Directorate for Local Collectivities ("Direction des Collectivités Locales") (DCL). PN is headed by a military officer. The Small Dams Program is managed by an office attached directly to the Director of PN, the unit for Small Dams "Cellule des Barrages Collinaires" (CBC).

The CBC provides national level coordination for all activities dealing with dam construction. Through the Director of PN, the CBC works on a daily basis with provincial offices which are under the direct supervision of the provincial PN representative (DPPN), who is also a military officer appointed by Royal Decision. The PN also includes an Administrative Division consisting of two branches, the Service for Budget and Accounting, and the Service for Personnel and Procurement of Material and Equipment. In addition, a Technical Division consisting of three services (Programming, Planning, and On-Site Follow-up) provides administrative services to the Small Dams Program.

In the context of the Small Dams Program, the MOI-PN has been assigned primary responsibility for project implementation and coordination of all activities at the provincial level. Through its provincial offices, PN hires unemployed labor from local communities and provides labor supervision during the construction phase. It is also responsible for the coordination of activities carried out by MARA-DPA and MPW-DPE, and the provision of light

materials (fuel, lubricants, etc.) and construction materials (cement, iron bars, etc).

The PN is well equipped to carry out its assigned role under the present program. Under the USAID-funded project, its role will remain unchanged. Since the project is but a component of the present program, the introduction of the new project can be adequately supported within the present institutional structure. However, its role in farmer organization and social analysis needs to be enhanced through training and technical assistance.

- The Governor

Governors are powerful actors in the GOM development process. They propose potential projects to the national government and have direct responsibility for project implementation. In the Small Dams program, the Governor makes initial decisions as to which sites are submitted for consideration by the Interministerial Committee, and is a key player in the implementation process, once final decisions on site selection and the down-stream and up-stream works have been made at the national level.

Ministry of Public Works (MPW): The Ministry of Public Works is a key player in the preparation of pre-feasibility and feasibility studies and dam construction. It carries out all hydrology and engineering studies related to site selection, produces the necessary engineering design plans, and oversees the technical aspects of dam construction in consultation with the PN. The Ministry is also responsible for preparing a memorandum of execution for the dams which includes precise specifications for: sources of material; description of construction works; lists of personnel needs; characteristics of material; method of execution and detailed execution plans; and supervision of the technical aspects of dam construction. In addition, the MPW provides heavy machinery and coordinates technical tasks, although responsibility for the overall construction of dams remains within the MOI-PN.

In October 1987, a Division for the Small Dams Program was created within the Ministry and placed under the (DAH). The Division of Small Dams is divided into three services: The Service for General Studies, the Service for Technical Studies, and the Service for Project Implementation.

The MPW-Provincial Directorate of Infrastructure (DPE) is sufficiently staffed to carry out its role at a high level of competence. However, it does not have the capability to design the actual engineering plans, so it contracts out the work to private engineering firms. In general the quality of these plans is first rate. The analysis of the MPW-DPE indicates that its staff would be able to absorb a new project in its portfolio without the need for additional employees. Moreover, the USAID-funded project is not likely to require major changes in the present scale of operations because the project will become a part of the existing Small Dams Program, which has already been programmed into MPW staffing and work plans. While the MPW-DHA is fully competent and staffed to participate in the project, selected short-term training should be provided under the USAID project to up-grade skills in small dam hydrology.

Ministry of Agriculture and Agrarian Reform (MARA): The Ministry of Agriculture and Agrarian Reform is responsible by law for developing the

agricultural sector. It defines appropriate water-use strategies for the agricultural sector and implements agricultural strategies approved by the GOM and Parliament. These agricultural strategies are implemented by ten (10) principal technical departments, plus thirty-four rainfed department agencies (DPA), nine (9) regional development offices (ORMVA) and ten (10) autonomous agricultural institutions.

MARA is in charge of irrigation and animal water supply components of the small dams program as well as watershed management. It assures the technical viability of basin protection and the utilization of water for irrigation. MARA is also responsible for managing construction of irrigation canals, organizing water user associations, training farmers in irrigation technology, and providing technical oversight for the upstream protection works. In addition it provides materials, such as cement, iron bars, water pumps, etc. In the context of the Small Dams Program, there are two key departments within MARA. A description of each follows:

- The Directorate for Rural Development (DER) is in charge of the supplemental irrigation program and is one of the top technical departments within MARA in terms of budget size, quality of personnel and role in water policy formulation.

The DER implements programs dealing with water distribution, land consolidation, rural roads and extensive storage facilities at the village level. This department approves the designs and drafts blueprints of facilities needed by other departments within the Ministry of Agriculture. It also monitors the implementation and construction of these projects.

Prior to 1980, DER was primarily designing and building the water distribution systems in the irrigated perimeters (ORMVAs). With the shift in GOM priorities from an almost exclusive focus on irrigation to the rainfed sector, the directorate became directly involved in the formulation of policy on the utilization of water within the agricultural sector.

Since 1986, the DER program has focused on the completion of irrigation infrastructure for dams built during the period 1985-1987. During this period, twenty one (21) dams for agricultural use were built, of which 16 will be used to irrigate approximately 3,000 hectares. The remaining five will be used to collect water for animals. The sixteen irrigation projects were largely to rehabilitate already existing systems.

The department is composed of two divisions:

1. The Water Resources Development and Land Tenure Management Division, composed of two services:

   - service for large irrigation perimeters.

   - service for research on water resources development.

2. The Rural Development Infrastructure Division, composed of three services:

   - service for small and medium irrigation, including the Small Dams Program.

- service for water infrastructure work for villages.

- service for supervising, constructing and equipping MARA facilities.

Two other services, which are independent of the above divisions, are linked directly to the Director General of the DER. These are the administrative and the general studies services.

DER has a staff of 12 engineers, several of whom hold the equivalent of an MS degree in engineering. The DER staff is composed of people with a variety of skills in agricultural engineering, economics and planning. Of this group, three engineers are assigned full-time to the Small Dams Program. This staff is primarily responsible for conducting all of the feasibility studies and final design plans for the irrigation systems that are constructed under the Small Dams Program. Their analysis focuses on irrigation technology potential of prospective sites, although they apply some economic, social and environmental criteria to the selection process. While the latter are not studied in depth, they are roughly analyzed and enter into final feasibility decisions.

The DER human resource capacity has two key strengths. First, it has a sound level of technical competence in a wide variety of disciplines, and has a design system already in place for evaluating and taking into account a range of parameters other than the purely technical. Second, it has ample manpower available. DER can adjust relatively easily to changes in portfolio workload. For example, during peak activity periods, Small Dams Program staff have the flexibility to call on other DER staff for support in meeting work requirements as needed. This is consistent with the prominent political profile of the Small Dams Program within the GOM.

In evaluating the various organizations in the Small Dams Program, it becomes apparent that the DER is the obvious candidate for assuming a lead role under the USAID-financed Supplemental Irrigation Project. This is primarily an agricultural project which naturally falls under the mandate of MARA. Additionally, DER is already engaged in activities which are similar to those foreseen in the USAID project. Finally, DER has the staff in place and the technical capabilities to immediately assume many of the new responsibilitis of the project. The introduction of the USAID project will therefore not entail a radical restructuring of DER's mode of operation. Instead, the aim will be to improve the analytical processes and expand its scope.

The USAID project will require at a minimum four engineers from the present DER staff to undertake the project's major activities: application of criteria to site selection; conduct of the economic, technical, social, and environmental analyses; site designs; and design and implementation of the monitoring system. Since there is sufficient capacity in the organization, additional new staff will probably not have to be employed. However, present staff do not have the required level of competence in the economic, social and environmental skill areas to effectively undertake the new methodologies and analytical tasks that will be the hallmark of the new project. Skills will therefore have to be upgraded through training and technical assistance.

- Provincial Directorate for Rainfed Agriculture (DPA): At the provincial level, the DER is represented by a chief working under the supervision of the Director of the DPA. The Director of the DPA is the provincial representative of the Minister of MARA. He is responsible for supervising and coordinating provincial level technical services for ten MARA directorates, including those of the DER and the DE&F.

DPA is responsible for technology transfer to farmers and organizing water user's associations under the Small Dams Program. Technical capabilities and staffing vary considerably among the different provincial offices so it is impossible to fully analyze this entity without knowing the specific sites that will be developed under the project. A typical DPA office has one or two MS-level engineers but the majority have a BS degree equivalent or less. Provincial DPA staff is usually composed of an engineer who serves as Chief of Service, 3 to 4 engineers charged with undertaking studies and project implementation; 1 to 2 engineers specialized in Topography; and up to 20 middle and lower-level technicians and support staff.

The DPAs work under the close guidance of their central office (DEP) which furnishes technical assistance and training when needed. While the DPAs provide a basic level of support services to farmers, the requirements of the project will most likely require a higher level of technical support than is currently provided.

The project will introduce the concept of supplemental irrigation which is a relatively new technique in Morocco. It is doubtful that DPA agents are sufficiently skilled in the technology to effectively advise farmers. The project also requires the development of water users associations in areas where farmers have had little or no experience with irrigation. The process of farmer organization will be relatively delicate, as historically it has had a mixed level of success in Moroccan agriculture. DPA capacity in this area is not strong and will have to be supplemented with TA and training if agents are to be effective catalysts for organizing farmers. Training will be provided for provincial staff and staff of local centers.

Another area in which the DPAs will have to operate is the protection of the upper watershed. While MARA-"Eaux et Forets" will have primary responsibility for reforestation activities, a far greater concern will be the management of pasture land. The introduction of new water sources could attract large numbers of livestock. If unmanaged there could be severe land degradation that could eventually compromise the viability of the irrigation works. The DPAs have the responsibility for advising farmers on livestock management. However, this is a complex activity that will require strong technical support that is lacking in many DPAs. This issue should be addressed in the project through technical assistance and training.

In summary, the DER is highly qualified to assume the lead role under the USAID project. However, its provincial and local offices require considerable investment in human resource development. The project should place particular emphasis on the provision of appropriate TA and training at the level of the DPAs.

As explained below, Section 3. in cases where a dam site falls within an irrigated perimeter, it is the Regional Office of Agricultural Development (ORMVA) which assumes all functions otherwise performed by DER/DPA. The ORMVAs are provincial entities charged with furnishing agriculatural services to farmers in the irrigated perimeters. In general, the ORMVAs have larger and more technically qualified staff than the DPAs. Nevertheless, the technical concerns mentioned in the discussion of the DPAs also apply to this organization. Supplemental irrigation, farmer organization and livestock management are complex and not well understood. While the ORMVAs that might be involved in the USAID project are probably better organized and technically equipped than the DPAs, they too will require some infusion of technical assistance and training to effectively implement project field activities.

The Water and Forest Service has responsibility for developing a watershed management program for each site. This service manages forested lands, the great majority of which are owned by the State. It is responsible for the management of forests and production of lumber and other products, and managing water, forage, recreation and wildlife. Given the serious deforestation and desertification problems facing Morocco, the department concentrated most of its effort, during recent years, on reforestation and watershed management programs. Within the Small Dams Program, this service is charged with the preparation of studies related to up-stream protection of the dams, the supply of seedlings for erosion control planting, and the monitoring of up-stream work. The ability of this unit to carry out the required environmental assessments will be strengthened through technical assistance programmed for the MARA.

3. How the System Functions

Site Selection and Design: At the provincial level, "communes" (administrative subdivision of a province) submit requests for small dam sites to the provincial committee for small dams, composed of MARA, MPW, and MOI provincial representatives and chaired by the Governor. The Committee is responsible for supervising all activities connected with small dams within the province. Following a meeting held by the Governor with local beneficiaries, in which it is determined that the project is needed and that farmers who are to be the primary beneficiaries agree to form a water users association and accept responsibility for managing the project, a rough feasibility study is conducted by the provincial technical staffs of the three Ministries. The analysis focuses primarily on topographical surveys with lesser attention to economic, environmental and social issues. Assuming that the project is approved at the provincial level by the Governor, it is then submitted by the Governor through the MOI to the Interministerial Committee.

The most promising sites are selected at the national level by the Interministerial Committee. Following the first selection, the Ministry of Public Works initiates pre-feasibility and feasibility studies for the dam sites. Later, the Ministry of Agriculture undertakes studies regarding the up-stream and the down-stream sites. Note that in most cases, the Ministry of Public Works uses private engineering firms to implement the feasibility studies while MARA relies upon its own staff.

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Based on the final feasibility studies, a technical decisions is made on dam sites and on the complementary upstream and downstream infrastructures. A prioritized list of proposed sites is then submitted to the Interministerial Comittee for a final selection.

Political decisions certainly enter into the selection process. However, it appears that the technical and economic considerations play a role in deciding what dam sites are chosen for the development of irrigation systems. It should also be noted that decisions as to how much water will be used for irrigation, versus potable or industrial use, are influenced by the provincial level office of the MPW through a dialogue with MARA.

In the final phase of the selection and design process, the MPW contracts with private engineering firms to develop detailed design plans for the dam sites and MARA-DER develops plans for the upstream and downstream works.

Implementation: The implementation of the project is a joint effort of the three Ministries, with overall supervision and coordination being provided by the MOI-PN. MARA-DER-DPA is responsible for the construction of the downstream irrigation works; MARA-Eaux et Forets completes upstream watershed protection; MPW is in charge of all hydraulic engineering works; and the MOI-PN provides labor and supervises construction activities under the management of a MPW technician. The latter ensures that technical design plans are being followed.

It is important to note that in cases where a dam site falls within an ORMVA irrigation perimeter, all functions otherwise completed by DER/DPA are assumed by ORMVA. This division of roles is not stated in the present Interministerial agreement. However, it is anticipated that the charter will be revised to include greater technical detail and that the division of responsibilities between ORMVAs and the DER will be clarified.

Under the present system, for the implementation of down-stream works, MARA generally only becomes seriously involved in the process after the dams are built. In only two cases, MARA developed down-stream and up-stream activities simultaneously with dam construction (Tlat Boubker perimeter, near Nador, and Sidi lamyari perimeter, near Beni Mellal). One aim of the project should be to foster greater integration of activities related to the three components of the system at both the feasibility and construction phases.

4. Other donors

The Italian Government is assisting the GOM in the construction of five small dams in the Province of Tangier. Three dams, Boughalef I, II, and III, located near the Tangier airport, are already under construction. The collected water from these three small dams will be used to irrigate 300 hectares for vegetable production. Water from two more dams to be financed by the Italians, Oued Saboun and Oued Seghir, will also be used for irrigation.

A World Food Program project will complement the employment generation efforts of the PN and will entail food distribution to workers involved in the construction of mini dams. The life of the project is 5 years (1989-93) with funding of $13.9 million. These funds will be used to annually purchase the following commodities:

Wheat:	9,750 MT
Oil :	585 MT
Sugar:	390 MT

The commodities will be given as compensation to workers involved in dam construction. A total of 10,400,000 work days of employment will therefore be generated in rural areas. The project will cover 65 sites throughout Morocco.

Attachment I:

Ministry Personnel Furnished
for
Execution of the GOM Small Dams Program

Interior:

1) An officer from Promotion Nationale to administer employment of unskilled labor,

2) An assistant responsible for material procurement and management,

3) Paymaster for unskilled labor,

4) Administrative assistant, and

5) Specialized labor (masons, electricians, machine operators, etc.)

Public Works:

1) An engineer with overall responsibility for execution of the dam construction,

2) A manager for acquisition of equipment and major materials,

3) Various technicians (labor foreman, engineers, etc.) according to specific requirements (detailed in the Memorandum of execution for each dam),

4) Administrative personnel, and

5) Machine operators.

Agriculture:

1) Forestry specialist,

2) Agronomist and Irrigation engineer, and;

3) Topography engineer.

Each Ministry furnishes offices, storage space, and lodging related to its specific responsibilities. Furthermore, each ministry is responsible for the provision of materials, as follows:

Interior: Administrative vehicles, minor materials, fuel and lubricants for large equipment, and construction materials such as cement and iron bars.

Public Works: Major materials (listed in the memorandum of Execution of the dam), including compacting machinary, loaders, trucks, tractors, pumps, electrical generators, air compressors, fuel tanks, etc.

Agriculture: Administrative vehicles for its own personnel, materials for canal construction, and seedlings for erosion control planting.

Four key individuals are responsible "on site" for the execution of the works:

1) Officer of Promotion Nationale (Interior).

2) Chief of Operations (Public Works).

3) Materials Manager (Public Works).

4) Forestry and Agronomy engineers (Agriculture).

ANNEX G

ENVIRONMENTAL ANALYSIS

ANNEX G

Environmental Analysis

1. Introduction

The project proposes to increase farm incomes and the overall standard of living among rural households in semi-arid regions of Morocco by strengthening the GOM's capability to select, design, implement and manage small dam projects for supplemental irrigation. This will be accomplished through a combination of technical assistance, training, miscellaneous studies and limited commodities support, and funds for the construction of approximately ten (10) small dams utilizing an improved set of economic, technical, social and environmental site selection and design criteria, and analytical and monitoring procedures.

If not properly assessed and implemented, the proposed dam construction activities could result in significant negative environmental impacts in addition to a reduced overall economic performance. In recognition of this fact, Section 216.2(d)(1)(ii) of the Agency Environmental Procedures stipulates that "an Environmental Assessment or Environmental Impact Statement, as appropriate, will be required for all irrigation or water management projects, including dams and impoundments". However, Section 216.2(c)(2)(xv) of said Procedures provides some degree of flexibility in meeting these requirements in stating that this formal environmental assessment process may be waived for "those activities which involve the application of design criteria or standards developed and approved by AID".

This alternative approach to meeting Agency environmental requirements has been adopted for use in the design and implementation of this project. In accordance with this "design standards" approach, project development has focused on: (1) an assessment of existing environmental conditions within the proposed project target area, and current GOM program environmental design practices and technical capabilities; and (2) development of appropriate environmental design criteria and guidelines to be followed during the course of project implementation. The results of this work are presented in the following sections of this analysis.

2. Existing Situation

A. General Environmental Profile of the Project Area

Introduction:

The proposed project will focus on the "Settat command area" which is located primarily in the semi-arid steppe region of the Atlantic Basin of Morocco. The project has been further refined to areas of between 200 and 400 mm of rainfall in order to target dryland farmers (vs. the more water-rich farmers of the Atlas areas), in agreement with the current approved Mission program strategy.

Geography:

The Settat command area includes all or part of three very distinct geographic regions of Morocco: the low Atlantic plains, the Hercynien highlands and the Interior stepper and plateaus. At the moment, almost all of the proposed small water projects can be located in the latter two regions. These two large divisions have been subdivided into seven distinct geographic areas (see Figure G-1): Haouz de Marrakech plateau, Jbilete-Mouissate, Bahira plain, Tadla plain, the Phosphate plateau, Rehamna massif, and the Essaouira-Chicaoua syncline. This report cannot detail all the differences between these locations; however, some of the more significant environmental characteristics of this region are reviewed briefly in the following sections of this analysis.

Geology:

Several geological formations have environmental significance for this project (see Figure G-2):

-- Alluvial and lacrustrine formations (mostly Quaternary/Neogene) with good surface aquifer recharge are widespread in the Bahira/Tadla plains and the Haouz.

-- Calcareous formations(Precambrian, Jurassic, Cretaceous and Eocene) are widespread in the Essaouira basin, Jbilete, Rehamna, Bahira plains, Phosphate plateau and the vicinity of Beni Mellal. These formations influence the pH of the water and shallow aquifer recharge.

-- Sedimentary formations derived from red clays from shallow seas and lagoons (Jurrasic, Cretaceous, and Permo/Triassic) can be found in approximately the same areas as the calcareous formations. They are impermeable or barely permeable.

-- There are very ancient Precambrian and Cambrian igneous and metamorphic formations concentrated in the Jbilete and Rehamna areas that are impermeable to water.

Rainfall:

The project area's rainfall (Figure G-3) varies with latitude, altitude, distance from the ocean, and exposure of the watershed to Atlantic storms. In general, the higher the latitude, the higher the altitude, the closer to the ocean, the more exposed to Atlantic storms (north-to-northwest orientation); the greater the rainfall. The project area is located south of the Casablanca-Tadla line. Below this line, rainfall rarely exceeds 400 mm, and varies between 30 to 50 days with rainfall and 7 to 10 months without rain. Snow is very rare. The west border of the Haouz has exceptionally low precipitation (200 mm). Equal in importance to the amount of rain are the timing of the storms, storm intervals, and year-to-year variability of rainfall. The start of the winter rains(October-November) and the amount of rainfall in March-April are the two crucial timing events in the Settat

command area. Late rains or low March-April rainfall frequently cause crop failures or decreased yields. The dry season essentially lasts from May to September. Rainfall has a coefficient of variation of 30 to 40% which is typical of semi-arid areas. While its variation is not nearly as high as the Sahara or parts of the Sahel, the rainfall cannot be relied on for safe dryland agriculture in all years. Devastating droughts can come in a series of two or three years as has just occurred in the early 1980s. A major goal of these projects will be to reduce the negative effects of inter-storm drought and year-to-year rainfall variability.

Surface Waters:

The project area has three major hydrological areas: the Tensift, the Oum-Er-Rbia and two closed basins with no outlet (see Figure G-4). The Tensift basically drains the Haouz de Marrakech and marginally concentrates flows from Essaouira and Jbilete. The Oum-Er-Rbia has tributaries in the Tadla plain, the Phosphate plateau, Rehamna and, marginally, the Haouz, Bahira and Doukalas. All of the proposed projects appear to be located within these two river basins.

Given the size of the proposed water projects, the impact on the total river basins will be negligible. Any significant impact will be immediately downstream of the dammed watershed and will be felt within the tributary, not the main channel. These tributary impacts can include loss of productive land by reducing natural flood irrigation, loss of groundwater recharge downstream from a project, and complex impacts from reducing sediment inflows and scouring power of the stream in downstream reaches. This report will not address the cumulative impacts of all the dams proposed for the Tensift and Oum-Er-Rbia basins on each other and the environment.

Groundwater:

The projects may effect shallow aquifers by either replenishing them at the dam site or lowering them further downstream. The Jbilete and Rehamna areas have no shallow aquifers. See Figure G-5. The Haouz, Bahira and Tadla areas have fluvio-lacustrine sediments that contain shallow aquifers. In addition, a more erratic shallow water table (derived Secondary and Tertiary sediments) can be found in Essaouira, Bahira, and the Phosphate plateau. In the areas with shallow aquifers (especially along river channels), a feasibility study and a monitoring study should be required to determine possible positive or negative effects of USAID-sponsored water projects.

The Cretaceous formation in the Tadla plains has a deep aquifer. Other areas do not have signifcant deep groundwater. The proposed water projects will not have a significant effect on the deep aquifers and will not be addressed in the criteria and guidelines.

Plants and Vegetation:

Most of the area was originally semi-arid steppes (grassland) with a shrub formation of Jujube, Atlas pistachio and gum acacia (Zizyphus lotus, Pistachia

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atlantica, Acacia gummifera). The project area is now predominantly agro-pastoralist. The largest area grows seasonal barley and bread wheat followed by a fallow period. Much smaller areas grow legumes (fava beans, lentils, chickpeas, peas).

The cropping pattern changes each year depending on the timing and amount of rainfall. In the Bahira plains and parts of the Haouz, wintertime cereals are planted with floodplain irrigation that incorporates clay or cement ditches. In the Tadla plains, huge irrigation projects have recently been developed with three to six crop rotations each year (sugar beets, cereals, legumes, forage crops). The Haouz plateau, a much older center of irrigated agriculture, grows a wide mix of garden crops, cereals and alfalfa. Where possible, orchards of olives, almonds and figs are planted (Tadla, Haouz). Grapes are grown in Rehamna and Haouz. The only large-scale forests are the plantations along major roads with pockets of Thuya, chene vert, and degraded groves.

Because of the long history of cultivation, there does not appear to be any reserve for the orginal plantlife. The only natural reserve within the program area, the royal hunting reserve of Sidi Chiker, contains some plants of the orginal steppe grassland. Because of the highly degraded and altered nature of the terrain, the water projects will, in all likelihood, never encounter a species of concern.

Animals:

About 40 species of mammals and about 100 species of birds are known within the project area. Endangered or threatened mammalian species have long since disappeared except for the Sidi Chiker reserve. The golden eagle winters in the program area. The White Stork and the Red-necked nightjar (both listed as endangered by IUCN) can be found in the area. It is hard to conceive how these projects will further impact wildlife except for the possible increase in habitat for some water-dependent birds and amphibians, such as sandgrouse or the Morrocan toad. Small losses of hunting area may occur, but should be adequately mitigated by the revegetation program. No populations, positively or negatively affected, are endangered or will significantly be altered by the dam projects. For this reason, there will be no sections in the criteria and guidelines dealing with wildlife.

The domestic livestock include goats, sheep, cows and a few camels. They graze on lands too steep for cultivation (above 20% slopes; too dry to plow; too rocky). They graze on fallow land and post-harvest fields which are privately controlled. Some livestock food also comes from weeds picked from the cereal fields. There are a few pastures with improved forage. Where they exist, the forage is fed to confined livestock. The most stressful period is the late summer. When total stocking units are compared to annual carrying capacity (in animal units per month), the Marrakech area has 3.5 times the animal units than the land can support. The Settat area "overgrazing" ratio is 3.8.

It cannot be stressed enough that these water projects are for agro-pastoralists. The amount of grazing in the surrounding watershed will

impact the amount of erosion and siltation and eutrophication of the reservoir. The location of watering points (including the reservoir) can concentrate livestock within the upper watershed greatly intensifying overgrazing and erosion. The increased straw and stubble from supplemental irrigation can either lead to fatter livestock or more livestock. The contact of humans and animals at the reservoir can increase transmission of certain waterborne diseases (see below). These secondary impacts may be the most difficult to mitigate because of the traditional and legal difficulties of limiting livestock numbers, access to the upper watershed and periods of use.

Health and Waterborne Diseases:

Extensive thought has been given to the health consequences of large dams in Morocco but very little work has been done to establish baseline health conditions and changes after dam construction for smaller dams. Dams can improve human health by improving nutrition (greater yields and better health and weight gain in livestock) and by providing water for improved sanitary conditions (treated drinking water and more water for washing). On the other hand, the increased presence of waterborne diseases can harm human health by reducing the body's ability to process food (dysentery) and weakening humans to the point that they cannot work.

In Morocco, the major waterborne and water-related diseases are malaria, gastro-intestinal disorders, dysenteries and urinal bilharzia. There is evidence to indicate that all of these maladies are currently found within the Settat command area. Bilharzia appears to be spreading both by human and possibly bird carriers. Both malaria and bilharzia are associated, in part, with vegetation along edges of reservoirs, irrigation works and elevated water tables causing marsh-like waterlogging or recharge basins for shallow aquifers. Eutrophication, bacterial intestinal disorders, and amoebic dysentery are frequent when there are human settlements and/or livestock in the upper watershed. The health risks greatly increase if the reservoir or irrigation water is also used for drinking. The mitigation of waterborne and water-realted diseases will be a major focus of the criteria and guidelines. From the point of view of human behavior and values, it is not an easy problem to mitigate.

Upstream fungicides or pesticides as well as industrial toxins will not be considered in this report. No upper watershed investigated had any of these upstream inputs. Fertilizers which can increase health hazards indirectly by stimulating grasses and microbial growth will be addressed.

B. Current Program Environmental Design Practices and Capabilities

A review of the GOM small dams program to date indicates that while program staff are aware of the necessity for addressing environmental concerns in the planning and design of individual projects, serious shortcomings exist in the manner in which these concerns are dealt with under current program operations. The general impression is that "environmental concerns" are pursued only to the minimum extent necessary to safeguard immediate downstream engineering investments. Thus, investigations of existing program sites

indicate that little or no attention has been paid to such issues as changes in water quantity and quality, public health and livestock-induced erosion in the surrounding watershed - all critically important topics of environmental concern for projects of this nature.

This same "engineering bias" was also evident in the team composition tasked with establishing appropriate environmental design requirements for program activities. Generally, these determinations are made through limited consultations and site visits by project engineers and key program and local representatives of MARA's Water and Forests Division. There appears to be no environmental design collaboration with MARA's Animal Husbandry Division, or any other agencies involved in range and livestock management concerns and no Ministry of Public Health staff appear to be involved in assessing and mitigating the serious potential negative impacts associated with waterborne and water-related diseases.

3. Recommendations for AID-Assisted Program Operations

A. Environmental Analysis Procedures

Introduction:

The preceding discussion demonstrates the need for improved procedures to systematically assess and address environmental concerns as an integral part of the overall small dams program design and implementation process. Towards this end, the project's environmental design has focused on the development of appropriate environmental analysis procedures to be followed in assessing and designing individual dam sub-projects to be implemented under the project. These procedures are described briefly in the following section of this Annex.

It must be stressed at the outset that these procedures have been tailored to local, project-specific conditions. Hence, they do not attempt to encompass either the breadth or the depth of comparative US environmental assessment requirements. This would not be cost-effective, desirable, or probably even possible given local conditions, information constraints and technical capabilities.

Similarly, these procedures have been designed specifically for the project target region of Morocco, with its own unique set of climatic, physical, biological and socio-economic characterisitics. Thus, the guidelines include no questions on endangered species, air pollution, noise, in-stream fish or other aquatic organisms, pesticides or other human-introduced toxics, loss of natural vegetation, ecological diversity, and traffic. All these generic topics of environmental analysis are not considered to be significant in the Settat command area. Other aspects receive very short attention, such as energy, aesthetics, river basin impact, historic/archaeological sites, etc., because they will only be significant in isolated cases. As a result, these procedures should not be applied to other geographic or environmental situations without careful review and modification.

Pre-Feasibility Stage:

This preliminary stage of project assessment, which the Mission has termed Rapid Initial Assessment or RIA, is intended solely to determine if a given sub-pboject site is not obviously infeasible for implementation under the project, according to certain minimal economic, technical, social and environmental threshold criteria. This RIA approach has been selected here primarily in the interest of conserving limited time and resources which would otherwise be wasted in performing detailed assessments and designs for sites which had little or no chance of meeting project objectives. Accordingly, at this stage, site information, assessment and reporting requirements are restricted to only the minimum measures necessary to accurately apply these ciriteria and arrive at a "yes-or-no" determination regarding whether or not a particular site merits further consideration for implementation under the project. Although designed to be brief and relatively simple in nature, the RIA serves an extremely important site elimination function. Thus, it becomes critical that the little information required is collected and reported properly and accurately. Errors and oversights at this stage could result in serious cost overruns and implementation problems at subsequent stages of project development.

As mentioned above, RIA information requirements are limited to the minimal data required to effectively locate the proposed site and determine whether or not it is feasible for consideration for implementation under the project. Given the prevailing degraded condition of most of the lands within the project target region (see above), it is not envisioned that any potential site would be rejected from further project consideration solely on environmental grounds. Nevertheless, it is recommended that a short, one-two day site visit be made at this stage simply to verify that there are no significant remaining "pockets" of natural vegetation which could be seriously affected by the proposed project development activities, and to identify any other potentially significant environmental characteristics of the site for use in future activity design work (e.g., shallow aquifers, large livestock populations, etc.). Information requirements at this stage would be limited to a 1:50,000-scale topographic map of the proposed project area, delineating the approximate locations of all proposed development works (i.e., dam, impoundment and adjacent watershed areas; downstream channel and irrigated perimeter areas; materials source area(s); and any associated construction staff residence, access road, utility and/or resettlement facilities requirements. Following this site visit, the investigators(s) will prepare a brief, one-two page, Initial Environmental Appraisal of the site describing the general condition of the existing lands within the proposed development area and stating that the site is environmentally acceptable for inclusion into the project. Any additional information which might have environmental significance for future project development activities should also be included in this appraisal document. Based upon a review of this document, the Mission Environmental Officer will then make a determination whether or not the site is acceptable for further project consideration.

Design Stage:

Once a site has been accepted for further consideration under the project through the RIA procedure described above, it then moves into the sub-project feasibility and design stage of the development process. This second phase of project assessment serves the twofold purposes of confirming the RIA findings and results, and developing detailed design specifications and implementation recommendations for the sub-project, including associated environmental mitigative requirements. The successful completion of this phase of sub-project development will result in an environmentally acceptable sub-project activity with detailed system design, implementation, operations and maintenance, and monitoring specifications and recommendations. As this result will represent significant financial and resource investments, it is extremely important that decisions made at this stage of sub-project development are based upon a careful review and assessment of all available, relevant information and possible implementation choices to arrive at the best and most cost-effective and resource-efficient development alternative. Mistakes made here will inevitably have serious negative financial, technical and/or environmental implications for ultimate activity success.

Due to the existing environmental conditions within the project target region, it is anticipated that virtually all potentially significant adverse project-related impacts would occur following the completion and at least initial operation of the dam and associated downstream irrigation works. The only exception to this general rule would be the relatively short-term, incidental, negative impacts resulting from system construction activities which would not normally prove to be significant for projects of this scale (see below). Thus, major areas of environmental concern would include the following:

- adverse changes in water quality and/or quantity within the proposed development area and neighboring downstream areas;

- increased incidence of water-related (e.g., malaria, bilharzia) and/or waterborne (e.g., dysenteries, gastro-intestinal disorders, etc.) diseases within the proposed development area and neighboring downstream areas; and

- increased soil erosion in surrounding watershed areas resulting from increased numbers and/or changed patterns of use of existing pastoral livestock populations.

Table G-1 provides a listing of these potentially significant impacts along with the recommended environmental information requirements and possible mitigative measures for each. The information listed in the Table is required primarily to ascertain existing environmental "baseline" conditions regarding certain key parameters against which any potential changes resulting from a project can be accurately assessed. This baseline information is also required to identify those areas of particular environmental significance within a given sub-project area, thereby allowing for a greater focus of mitigative and monitoring efforts and avoiding any unnecessary expenditure of financial and human resources. It should also be noted that not all of this information will necessarily be collected by project environmental staff. Certain of these requirements, such as water quantity data, will undoubtedly

become available through the associated efforts of other project design personnel. Similarly, it is expected that not all of this information will be available for each proposed sub-project site. Environmental staff will therefore be required to make judgments regarding the amount of time and effort deemed to be reasonable in obtaining a particular piece of information as compared against its potential environmental significance towards overall project success. Serious information shortcomings identified at this stage can form the basis of appropriate project research and monitoring studies in the ensuing stages of sub-project implementation (see below).

The various mitigation measures listed in Table G-1 are considered to be representative for the corresponding, potential impacts of concern. Actual measures to be adopted at a given site will depend upon the specific characteristics of that particular site. Additional, more generic information regarding appropriate mitigative considerations for projects of this nature is provided in several AID-approved environmental publications which will also be made available to project environmental staff during personnel training and sub-project assessment activities.

Although the environmental requirements at this stage are somewhat more demanding, the assessment procedure is essentially the same as that described above for the RIA. Relevant background information is assembled and subsequently verified and refined through site visits to the sub-project area. The results are then assessed to identify any potentially significant environmental impacts and corresponding appropriate implementation alternatives and/or mitigative measures. The results of this completed analysis will then be documented in a final sub-project Environmental Analysis report (Table G-2) for submission to, and review and approval by, the Mission Environmental Officer.

Implementation Stage:

This phase of the sub-project development process is devoted to the construction of the various system components in accordance with the final, approved design specifications and implementation recommendations developed during the design stage described above. The environmental requirements of this stage are minimal, yet are also important for activity success. These requirements, which primarily consist of a periodic supervisory and monitoring function, include the following:

1. <u>Ensure that the various sub-project environmental components are implemented in accordance with the approved design specifications and recommendations</u>. Although the focus here will be on supervising and monitoring the successful completion of sub-project environmental mitigative requirements, attention will also need to be devoted to the other aspects of sub-project implementation. Should changes or modifications be required in other activity components, corresponding changes may also be necessary in the environmental design requirements.

Table G-1

ENVIRONMENTAL DESIGN CONSIDERATIONS

POTENTIAL IMPACT	INFORMATION REQUIREMENTS	POSSIBLE MITIGATION MEASURES
Reduced Water Quality	Location and quality of existing local water supplies (e.g., surface waters, groundwater aquifers, wells, springs, other) within the project development area and neighboring downstream areas.	Improved construction practices; improved farming practices; alternative sources of supply.
Diminished/Excessive Water Quantity	Local rainfall data; surface water flooding and flow rate data; water table data (e.g., depth, or as evidenced through waterlogging and levels of springs and wells); downstream floodplain characteristics (e.g., size, duration, frequency, etc.).	Dam design and/or operational modifications; pumping; indemnification and/or new lands to affected downstream populations.
Increased Incidence of Waterborne and/or Water-Related Diseases	Local morbidity and mortality statistics (e.g., bilharzia, malaria, dysentery, gastrointestinal disorders, etc.); existing local public health infrastructure.	Improved sanitation practices; improved public health treatment capabilities; biological controls (e.g., Gambusia spp. fish); enhanced vector control measures (e.g., manual, mechanical and/or chemical control programs); restricted access to reservoir (e.g., fencing, use agreements, alternative sources of supply).
Increased Livestock-Induced Erosion in Surrounding Watershed	Numbers and types of local pastoral livestock populations; existing watering points; general areas and patterns of use.	Structural and/or vegetative soil conservation measures; limit livestock numbers, access and/or movements; alternative watering points.

Table G-2

Environmental Analysis

1. Introduction (purpose statement)

2. Project Description

   a. Proposed Dam Specifications (e.g., size, type, areal extent, etc.)
   b. Project Purpose (irrigation vs. groundwater, including downstream infrastructure requirements; target population; etc.)

3. Detailed Site Description

   a. Location
   b. Physical Characteristics (e.g., rainfall, water, etc.)
   c. Environmental Characteristics (e.g., existing flora and fauna, vegetative cover, etc.)
   d. Socio-Economic Characteristics (e.g., local health situation, current land use patterns, etc.)
   e. Existing Local Capabilities (e.g., public health, livestock/range management, etc.)
   f. Other Significant Characteristics

4. Discussion of Environmental Impacts

   a. General Considerations (e.g., construction, etc.)
   b. Site-Specific Considerations (e.g., water, vegetative cover, health, etc.)

5. Discussion of Alternatives

   a. System Construction (e.g., size, scope, design, use, etc.)
   b. Environmental Mitigative Options (e.g., erosion control, water control, vector control, health, etc.)

6. Recommended Mitigative Requirements

   a. Technical/Physical Requirements
   b. Administrative/Management Requirements
   c. Manpower Requirements
   d. Equipment and Materials Support Requirements
   (both for short-term implementation and long-term system operation and maintenance and monitoring requirements)

Table G-2 (cont.)

7. Conclusions

   a. Overall Environmental Liabilities/Merits
   b. Special Project-Specific Considerations (e.g., covenants, conditions, etc.)
   c. Concluding Remarks

8. Bibliography (list of references/contacts)

9. Appendices

   a. Maps, Plans, etc.
   b. Other Pertinent Information
      1) detailed mitigative specifications
      2) scopes of work
      3) other

2. Document any substantive changes in sub-project environmental design. Per 1. above, certain modifications in activity design might be required from time to time due to previously unforeseen site conditions encountered once construction activities have commenced This is a common occurrence in activities of this nature. It is important that all such substantive design modifications are properly documented and incorporated into final, "as-built" system plans for effective future operations and maintenance and monitoring requirements.

3. Ensure that incidental negative environmental impacts resulting from system construction activities are kept to a minimum. A certain amount of short-term environmental damage (e.g., noise, air pollution, etc.) is inevitable in projects of this nature. However, it is also important that such impacts be kept to minimum. Of particular concern here are those "incidental" impacts arising from construction manpower and materials requirements which may not have been planned for in the overall system design (e.g., access roads, staff residential requirements, materials source areas, etc.).

It is only through the diligent and careful carrying out of these implementation monitoring and supervisory functions that project management can be assured that environmental issues are properly addressed. Although conceptually simple, this stage is where many projects encounter serious difficulties.

Operations, Maintenance and Monitoring Stage:

In order for a completed system to function as intended over its design life, it must be properly operated and maintained. Environmental systems O&M requirements will also vary in accordance with the specific characteristics and mitigative requirements of a given site. Representative O&M considerations might include such factors as reservoir releases to downstream areas, increased efficiency of agricultural inputs, improved agricultural land management practices, restricted access of resident livestock populations, miscellaneous vector habitat control measures, enhanced public health facilities, improved local sanitation practices and various water quality control measures. Although universally acknowledged to be of critical importance to overall project success, this final stage of project implementation is usually the most difficult to accomplish successfully. Often referred to as routine and boring, system maintenance requirements are chronically subject to underfunding, manpower shortages and other forms of oversight and neglect, eventually resulting in project failure or diminished economic success. To address this potentially significant problem, project environmental training and assessment requirements will stress the importance of proper systems operations and maintenance for overall project success (see Table G-2).

Ideally, if properly constructed and maintained, each system should function in accordance with its intended design objectives. However, due to varying technical, climatic, socio-economic or other possibly previously unforeseen influences, this ideal situation is frequently difficult to maintain in practice. This is the fundamental reason for system monitoring.

It is only through the periodic assessment of certain key external variables that one can accurately determine the best methods for meeting ongoing system operations and maintenance needs. In addition, proper environmental monitoring is important in the present project in the interest of furthering its institutional objectives and ensuring that project evaluation requirements are met. In this manner, additional information gained through performance monitoring of earlier sub-projects can be utilized to improve the design of subsequent activities, thereby ensuring the most cost-effective investment of limited development resources. This information will also provide the basis for assessing the project's ultimate development impact and success towards the attainment of its objectives.

Environmental monitoring considerations would generally include the same types of information already identified for the environmental baseline data indicated in Table G-1. Although considered to be representative for projects of this nature, it is important to note that the type and frequency of these requirements will vary greatly among sub-projects depending upon site-specific conditions, design objectives and overall system complexity. Thus, individual monitoring requirements will have to be established for each sub-project activity, some of which will be the focus of special research and performance evaluation studies to be financed under the project.

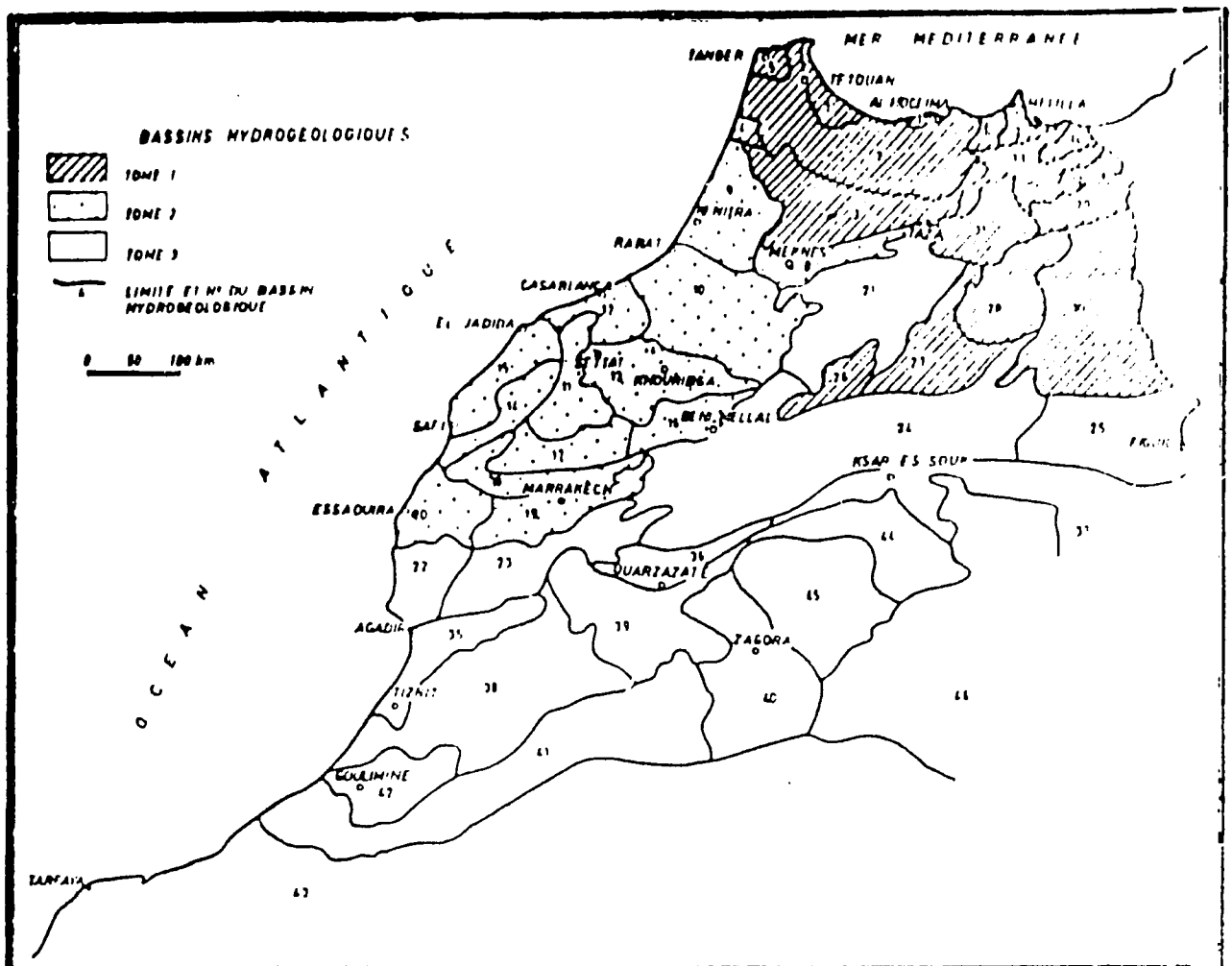
B. Manpower Requirements

In many instances, a multi-disciplinary approach will be required to properly implement the procedures described above. However, to conserve scarce project resources, it is recommended that full-time program environmental staff requirements at this time be limited to a single expert, skilled in environmental assessment and monitoring techniques. It is anticipated that, for certain sites, this person will be able to successfully accomplish all of the required environmental workload. As specific local conditions warrant, however, this person may also require the occasional assistance of the existing local staff of MARA's Water and Forests and Animal Husbandry Divisions, and the services of a local Public Health specialist. Similarly, as ongoing program needs dictate, this "core" environmental staff can be augmented in the future as required.

As described previously, this expertise does not currently exist among present program staff. To remedy this situation, the project will provide short-term technical assistance and training to strengthen, and at least initially, augment existing staff capabilities in these requisite skill areas. Suitable local expertise is currently available to provide these inputs which will be supplemented as required with short-term expatriate consultant assistance. All project training activities will be implemented through highly participatory, on-the-job techniques to the greatest extent possible. In this manner, project institutional strengthening objectives can be pursued while still allowing for the timely and proper completion of the environmental assessment requirements associated with the project's supplemental irrigation construction activities.

4. Summary and Conclusions

The project proposes to increase the standard of living in rural, semi-arid regions of Morocco by strengthening the GOM's capability to select, design, implement and manage small dam projects for supplemental irrigation. This will be accomplished through a combination of technical assistance, training, miscellaneous studies and limited commodities support, and funds for the construction of approximately ten small dams. Section 216.2(d) of the Agency Environmental Procedures stipulates that an Environmental Assessment or Impact Statement is required for all irrigation or water management projects of this nature. However, Section 216.2(c) of said Procedures provides some degree of flexibility in meeting this requirement for those instances which involve the application of AID-approved environmental design criteria or standards. In accordance with this latter provision, the Mission has developed an appropriate set of environmental criteria and guidelines to be followed during the various stages of assessment and implementation of each small dam construction activity financed under the project. These procdures will be duly applied by skilled personnel, who have been properly trained under the project in environmental assessment principles and practices. All team findings and recommendations will be reviewed and approved by the Mission Environmental Officer prior to USAID approval for financing of any sub-project construction activities. Accordingly, it is concluded that this project will be implemented in an environmentally acceptable manner which satisfies salient Agency environmental regulations.



Settat Command Area

TOME 1 (Paru en 1971)	TOME 2 (Présent ouvrage)	TOME 3 (A paraître)
Domaine Rifain	**Plaines et bassins atlantiques**	**Domaine atlasique**
1 Zone axiale du Rif	8 Plateau de Meknès, Fes et couloir Fes, Taza	21 Moyen Atlas et Causse
2 Zone rifaine	9 Rharb et Dradère - Saveire	22 Haut Atlas occidental
3 Zone et rides prérifaines	10 Mesela	23 Massif ancien du Haut Atlas
4 Bas Loukkos	11 Rehamna	24 Haut Atlas calcaire
5 Tangerois	12 Chaouia côtière et plaine de Berrechid	25 Haut Atlas oriental, Tamlelt
6 Kerte	13 Plateau des Phosphates	**Domaine du sillon sud-atlasique**
7 Gareb et Bou Areg	14 Doukkala, Abda	35 Souss et bassin de Tiznit
Domaine du Maroc Oriental	15 Sahel de Safi à Azemmour	36 Bassin de Ouarzazate
26 Haute Moulouya, Ilzer	16 Tadla	37 Bassin Ksar es Souk, Boudenib
27 Moyenne Moulouya	17 Bahira	**Domaine anti-atlasique**
28 Rekkame	18 Jbilete et Moussate	38 Anti-Atlas, zone axiale
29 Chaîne des Horsts	19 Haouz de Marrakech	39 Anti-Atlas oriental
30 Hauts Plateaux	20 Synclinal Essaouira, Chichaoua	40 Moyenne vallée du Drâ
31 Guercif		41 Bas-Drâ et Bani
32 Couloir Taourirt, Oujda		42 Seyad - Noun
33 Bni-Bou-Yahi, Bni-Snassene		43 Sud du Drâ et Hamada du Drâ
34 Triffa		**Domaine du sud-est marocain**
		44 Tafilalet
		45 Moidère
		46 Hamada du SE

Figure G-1 — Situation géographique du domaine Atlantique.
(Geography of the Settat Command Area)

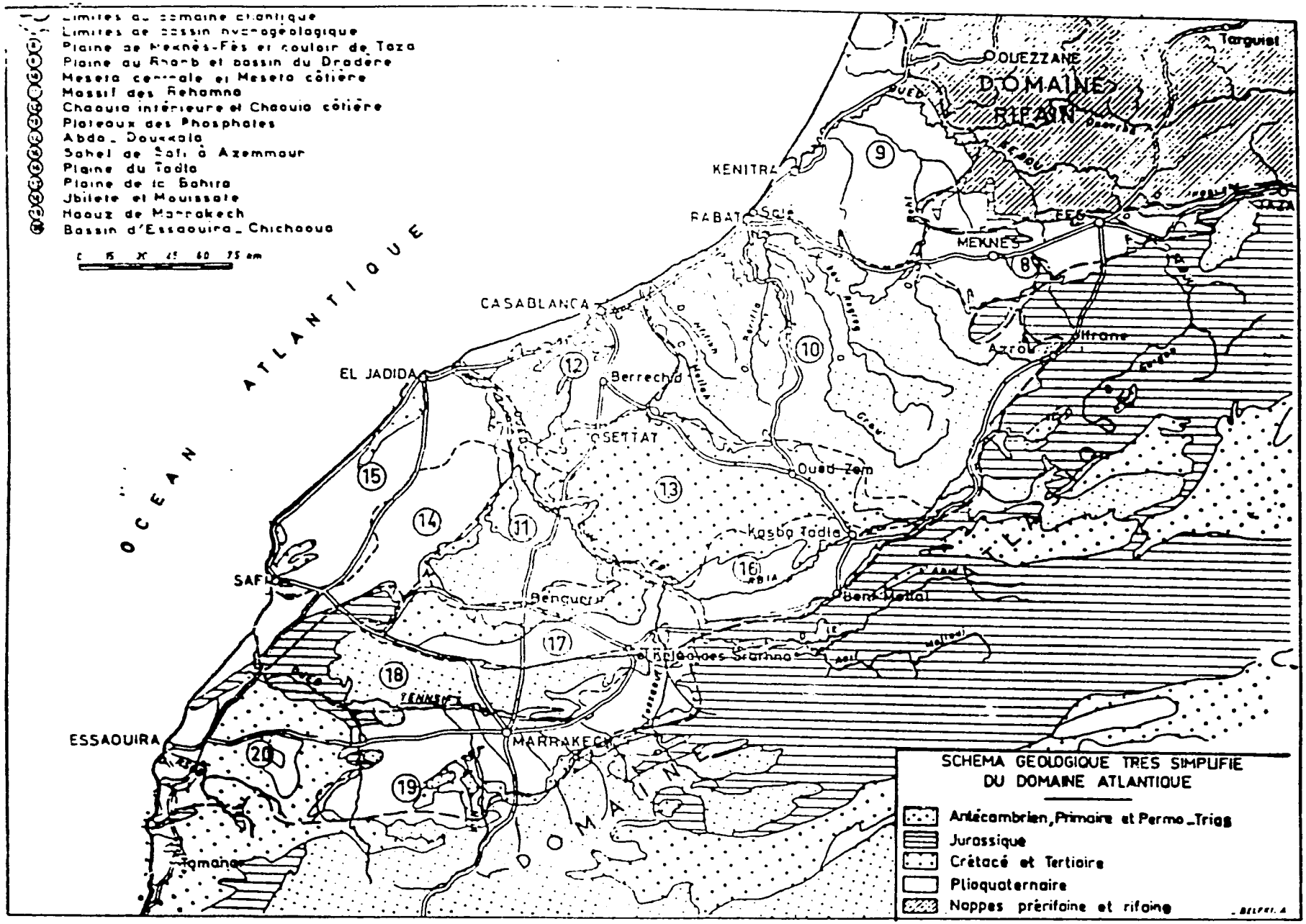


Figure G-2 — Schema géologique très simplifié du domaine Atlantique.
(Geology of the Settat Command Area)

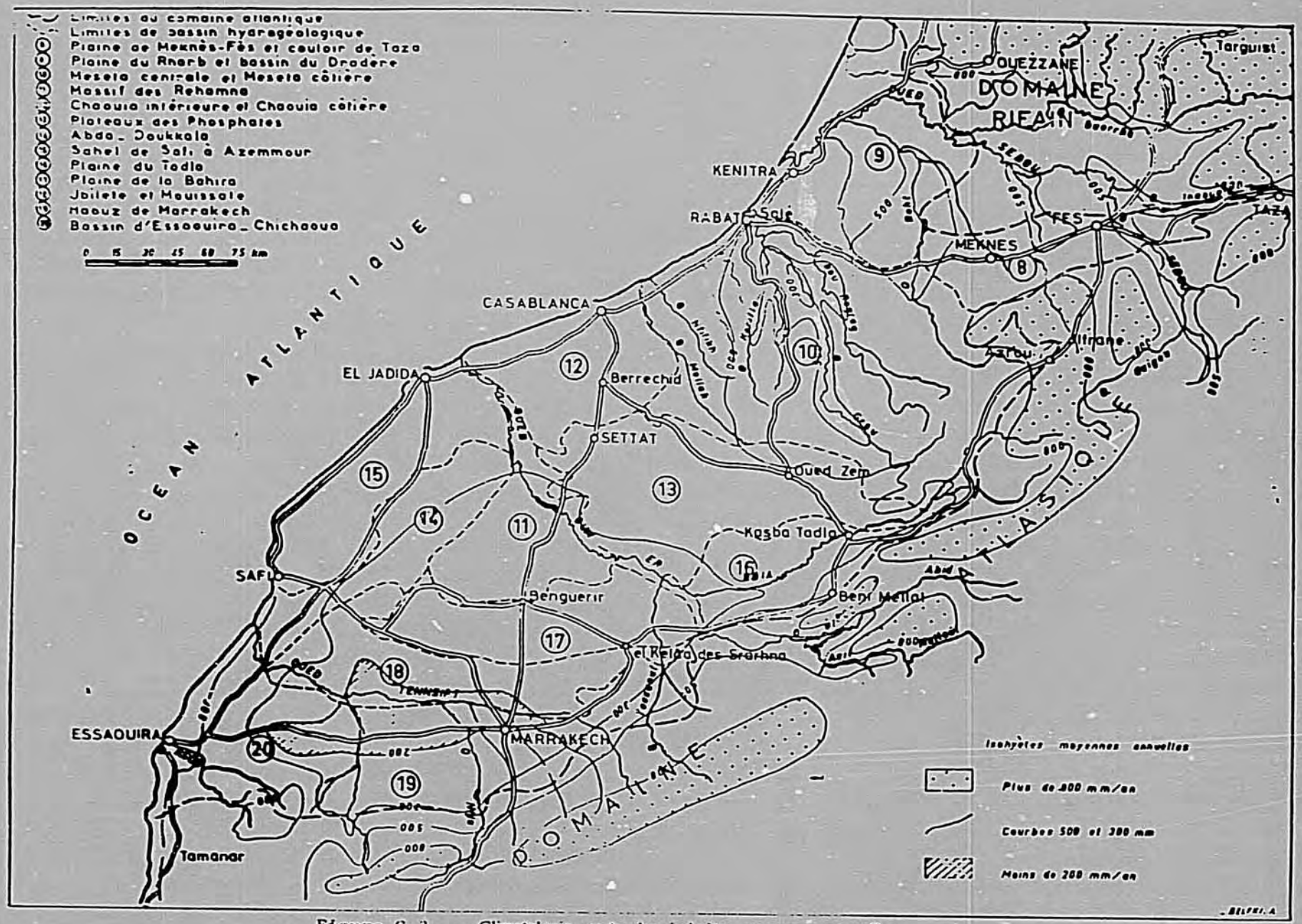


Figure G-3 — Climatologie, carte des isohyètes moyennes annuelles.
(Rainfall in the Settat Command Area)

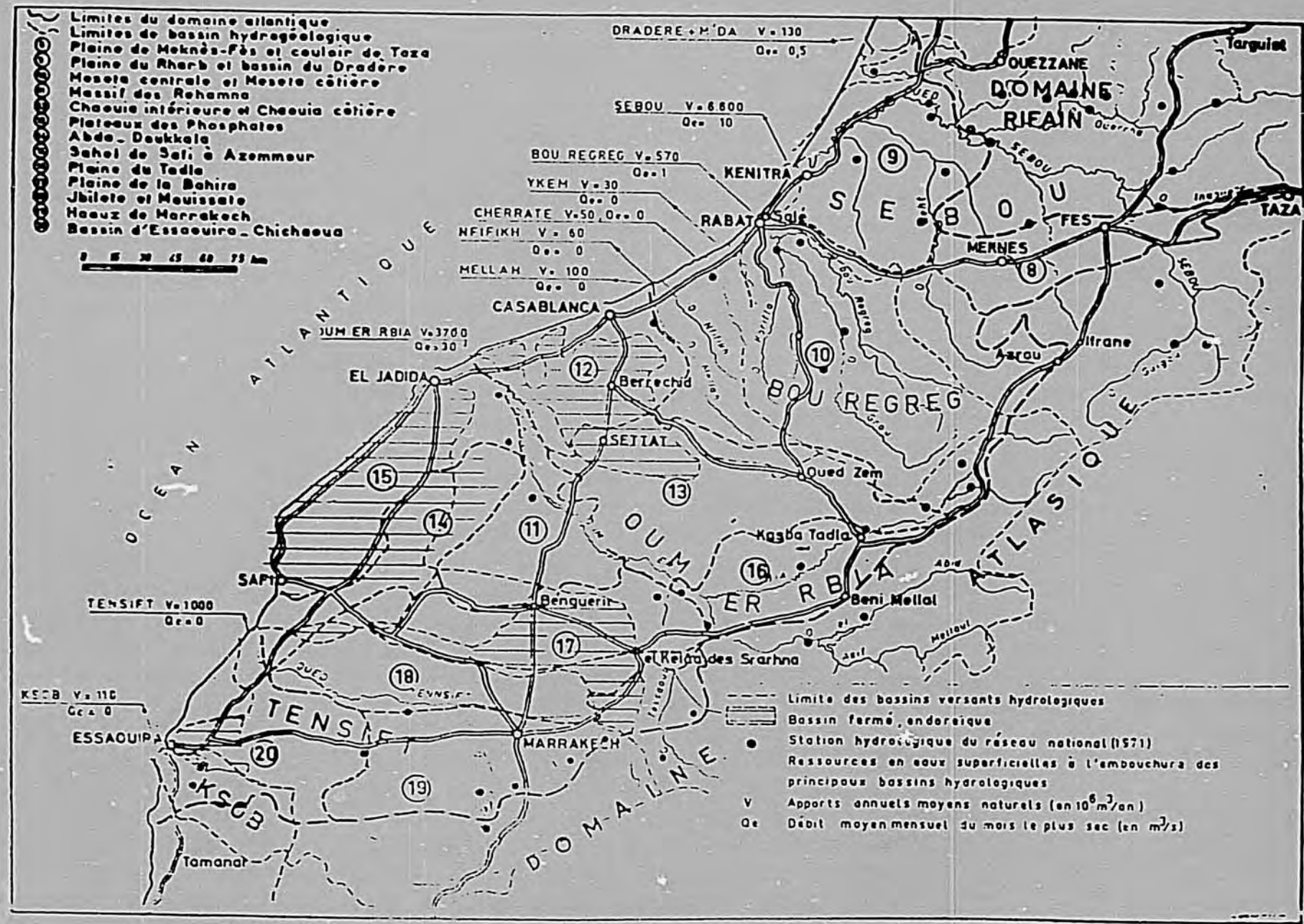


Figure G-4 — Bilan des ressources en eaux superficielles à l'embouchure des principaux bassins, en modules annuels et à l'étiage. Situation du réseau national de mesures de la Division des Ressources en Eau (1971).

(Major River Basins of the Settat Command Area)

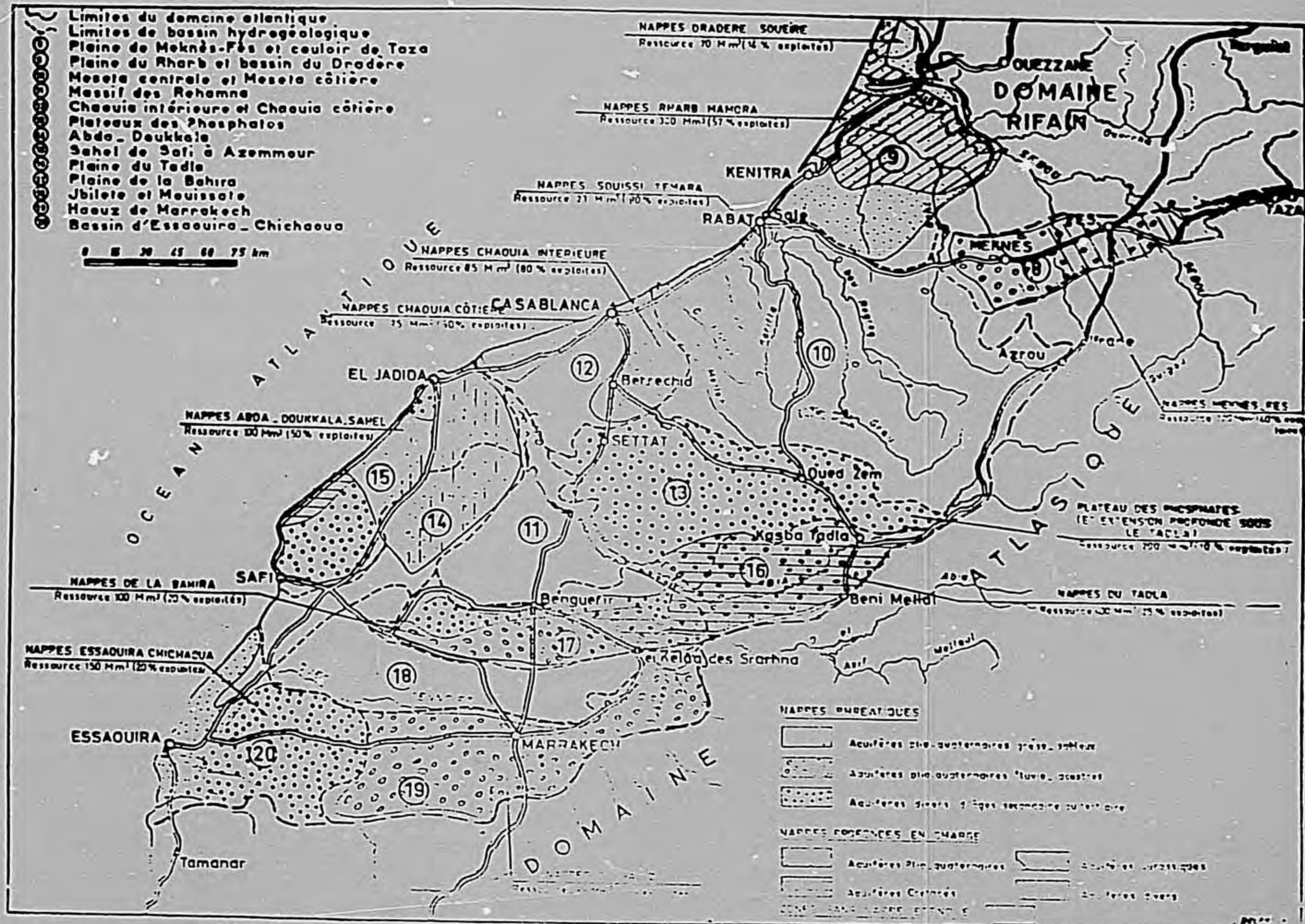


Figure G-5 — Bilan des ressources en eaux souterraines par aquifères avec indication du taux d'exploitation (1975)

(Groundwater Resources of the Settat Command Area)

ANNEX H

PID APPROVAL CABLE

ACTION AIDS INFO: DCM PCON/5

VZCZCNAOC47EEU541
OO RUEHNA
DE RUEHC #1875/01 1581657
ZNR UUUUU ZZE
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ANNEX H

-H-1-

LOC: 187 356
08 JUN 88 1555
CN: 05955
CHRG: AID
DIST: AID

AIDAC

E.O. 12356: N/A
TAGS:
SUBJECT: MOROCCO SUPPLEMENTAL IRRIGATION (608-0197) PID REVIEW

1. REVIEW OF SUPPLEMENTAL IRRIGATION PROJECT IDENTIFICATION DOCUMENT (PID) WAS HELD ON MAY 24 WITH REPRESENTATIVES FROM PD, DP, GC, TR, AND MENA IN ATTENDANCE. PARTICIPATION OF MISSION REP., DEP. DIRECTOR J. BALLANTYNE, WAS VERY BENEFICIAL. PID REPRESENTED A FEASIBLE AND APPROPRIATE PROJECT ACTIVITY IN KEEPING WITH MISSION AGRICULTURAL STRATEGY AND PORTFOLIO MIX. ACTING AA/ANE W. FULLER HEREBY APPROVES SUBJECT PID AND MISSION IS AUTHORIZED TO PROCEED DIRECTLY WITH PP DESIGN AND, AS MISSION DEEMS APPROPRIATE, WITH PP APPROVAL AND PROJECT AUTHORIZATION.

2. NO SERIOUS ISSUES WERE RAISED DURING PID REVIEW. HOWEVER, CERTAIN IMPORTANT CONCERNS NEED TO BE ADDRESSED AS PART OF PP DESIGN AND PROJECT IMPLEMENTATION. THESE ARE GROUPED UNDER THE FOLLOWING HEADINGS: PROJECT FOCUS, CRITERIA ESTABLISHMENT, POLICY EMPHASIS, MEASUREMENT OF PROGRESS, ENVIRONMENTAL ASSESSMENTS, AND RESOURCE ALLOCATION.

3. PROJECT PURPOSE: PURPOSE OF PROJECT, WHICH IS BASICALLY THE ESTABLISHMENT OF METHODOLOGIES AND SYSTEMS FOR SELECTING, DESIGNING, CONSTRUCTING, AND MANAGING VIABLE, SUPPLEMENTAL GOM IRRIGATION ACTIVITIES, SHOULD BE MADE MORE EXPLICIT IN PP AND CLEARLY SPELLED OUT. MISSION IS REMINDED THAT PRIOR TO A.I.D. FINANCING OF IRRIGATION SYSTEM CONSTRUCTION, A.I.D. MUST HAVE PRELIMINARY COST AND ENGINEERING DATA IN ACCORDANCE WITH FAA SECTION 611(A). PROJECT INCLUDES DAM CONSTRUCTION, BUT THIS IS ONLY ONE ASPECT OF IMPROVED USE OF WATER RESOURCES. ABILITY TO SELECT AMONG ALTERNATIVES AND DETERMINE MOST APPROPRIATE ACTIVITIES, BASED ON A SET OF CRITERIA, AND ABILITY TO CARRY OUT THOSE SELECTED ACTIVITIES IN A COST EFFECTIVE MANNER, ARE ESSENTIAL INGREDIENTS OF THE PROJECT. INTENT OF PROJECT, AS WE UNDERSTAND IT, IS TO AFFECT ALL GOM SUPPLEMENTAL IRRIGATION ACTIVITIES BY INSTITUTIONALIZING THE SELECTION SYSTEM WITHIN THE GOM APPARATUS OVERSEEING THIS PROGRAM. LINKAGE TO MISSION'S OVERALL STRUCTURAL

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ADJUSTMENT INITIATIVE REGARD TO IMPROVING THE EFFICIENCY OF GOM IN DELIVERING SERVICES SHOULD BE SEEN.

4. CRITERIA ESTABLISHMENT: AN ESSENTIAL FEATURE OF THE PROJECT IS THE ESTABLISHMENT OF A SET OF CRITERIA WHICH MUST BE MET BEFORE RESOURCES ARE ALLOCATED FOR ANY SUPPLEMENTAL IRRIGATION ACTIVITY. SUCH CRITERIA, AMONG OTHERS, SHOULD INCLUDE A COST/BENEFIT ANALYSIS, AN ENVIRONMENTAL ASSESSMENT THAT REVEALS NO SIGNIFICANT ADVERSE IMPACTS, AND MANAGEMENT AND MAINTENANCE SUSTAINABILITY. THE CRITERIA AND BASE-LINE DATA GATHERED FOR DETERMINING FEASIBILITY SHOULD ALSO BE USED TO MEASURE PROGRESS AND RESULTS DURING ON-GOING MONITORING AND EVALUATIONS.

5. POLICY EMPHASIS: AID/W AGREES WITH POLICY TARGETS AS STATED IN PID. ECONOMIC FEASIBILITY STANDARDS, MAINTENANCE/RECURRENT COST COVERAGE, AND ENVIRONMENTAL FEASIBILITY STANDARDS ARE IMPORTANT POLICY REFORMS AND LOGICALLY FIT THE OVERALL MISSION REFORM AGENDA. IT IS SUGGESTED THAT MISSION CONSIDER INCLUDING COVENANTS IN PROJECT PAPER AND PROJECT AGREEMENT ON ESTABLISHMENT OF OPERATIONS AND MANAGEMENT PROCEDURES AND ON FORMALIZATION AND LEGALIZATION OF WATER USER ASSOCIATIONS FOR SUPPLEMENTAL IRRIGATION SYSTEMS.

6. MEASUREMENT OF PROGRESS: USING BASE-LINE DATA GATHERED FOR DETERMINING SUPPLEMENTAL IRRIGATION SYSTEM

SELECTION, PROGRESS OF INCREASED PRODUCTION, INCOME, ETC. CAN BE MEASURED OVER TIME THROUGH MONITORING AND EVALUATIONS. PROJECT PAPER SHOULD LAY OUT FORMAT FOR BASE-LINE SURVEYS, MEANS OF MONITORING PROGRESS THROUGH VERIFIABLE INDICATORS, AND PERIODIC IN-DEPTH ANALYSES DONE AS PART OF EVALUATIONS. WITH KNOWN GEOGRAPHIC BOUNDARIES FOR IRRIGATION SYSTEMS AND BENEFICIARIES, THERE WILL BE AN EXCELLENT OPPORTUNITY TO CLEARLY SHOW IMPACT OF THE PROJECT. THE DEGREE OF INSTITUTIONALIZATION AND ADHERENCE TO ESTABLISHED SELECTION CRITERIA FOR SUPPLEMENTAL IRRIGATION SYSTEMS NOT FUNDED THROUGH A.I.D. CAN ALSO BE DETERMINED, ALTHOUGH MEASUREMENTS OF PROGRESS IN PRODUCTION, COST REDUCTION, IMPROVED INCOME, ETC. MAY BE DONE DIRECTLY BY THE GOM.

7. ENVIRONMENTAL ASSESSMENTS: ANE/PD/ENV AGREES THAT AN ENVIRONMENTAL ASSESSMENT (EA) CANNOT BE CONDUCTED WHILE DAM LOCATIONS ARE STILL UNKNOWN. A.I.D. REG. 216 SECTION 216.3(A)(7) ANTICIPATES THIS SITUATION AND PP MUST INDICATE THAT AN EA WILL BE PRODUCED FOR EACH SUPPLEMENTAL IRRIGATION SYSTEM FINANCED BY AID ONCE

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SITES ARE SELECTED, IN ORDER TO MEET THE REQUIREMENTS. G. SMALLY LEFT GUIDANCE ON SCOPE OF WORK FOR ENVIRONMENTAL ANALYSES WHILE ON TDY IN MOROCCO IN APRIL. IN ORDER TO FACILITATE DECISION-MAKING ON THE BASIS OF THE SEPARATE ECONOMIC AND ENVIRONMENTAL FEASIBILITY STUDIES, ANE/PD/ENV ENCOURAGES INCLUSION OF ENVIRONMENTAL CRITERIA AS PART OF OVERALL SELECTION CRITERIA.

8. RESOURCE ALLOCATION: IT IS UNDERSTOOD THAT BUDGET SHOWN IN PID IS ILLUSTRATIVE. MISSION MIGHT EXPLORE CERTAIN OPTIONS IN RESOURCE ALLOCATION. THESE INCLUDE A HIGHER PERCENTAGE OF GOM FINANCIAL PARTICIPATION IN ESTABLISHMENT OF SUPPLEMENTAL IRRIGATION SYSTEMS, USE OF LOCAL CURRENCY GENERATED BY FUTURE AID PROGRAMS (CIP, PL 480) TO FUND A PORTION OF LOCAL COSTS, AND INCREASED USE OF RESOURCES FOR ESTABLISHMENT OF SYSTEMS APPROACH IN SITE SELECTION, DESIGN, AND MANAGEMENT.

A) GOM FINANCIAL PARTICIPATION IS MENTIONED IN PID AT A LEVEL OF 20 PERCENT. INCREASED GOM COMMITMENT COULD ALLOW PROJECT TO EXPAND NUMBER OF IRRIGATION SYSTEM INSTALLATIONS AND COULD EXPAND NUMBER OF SITES THAT WOULD BE REQUIRED TO MEET STRICT SELECTION CRITERIA.

B) USE OF LOCAL CURRENCY GENERATIONS FROM FUTURE AID ACTIVITIES COULD FREE UP U.S. DOLLARS FOR OTHER PROJECTS. IN COSTS OF IRRIGATION SYSTEMS CONSTRUCTION ARE OVER 80 PERCENT IN LOCAL CURRENCY, THEN LOCAL CURRENCY GENERATION USAGE COULD MEAN SAVINGS (AND CONSEQUENTLY ALLOW FOR ADDITIONAL ACTIVITIES) OF OVER DOLLARS FIVE MILLION. MISSION MIGHT EXPLORE THIS OPTION IN LATER YEARS.

C) ILLUSTRATIVE BUDGET SHOWS ABOUT 7 PERCENT OF RESOURCES BEING USED FOR TECHNICAL ASSISTANCE, TRAINING, EVALUATIONS, AND AUDITS. WITH FOCUS OF PROJECT ON ESTABLISHMENT OF SYSTEMS FOR SELECTING, DESIGNING, CONSTRUCTING, AND MANAGING IRRIGATION ACTIVITIES, ADDITIONAL RESOURCES MAY BE NEEDED FOR TECHNICAL ASSISTANCE AND TRAINING. MISSION SHOULD FEEL FREE TO ADJUST BUDGET ACCORDINGLY.

9. AID/W LOOKS FORWARD TO SEEING OUTCOME OF THIS MISSION-APPROVED PP. AS INDICATED TO MISSION DEPUTY DIRECTOR, AID/W STANDS READY TO SUPPORT PP DESIGN EFFORT IN ANY WAY POSSIBLE. WALLIS
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ANNEX I

PROJECT CHECKLIST

5C(2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B(1) applies to all projects funded with Development Assistance; B(2) applies to projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES:	IS COUNTRY CHECKLIST UP TO DATE?	(a) Prepared by AID/W yearly.
	HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?	(b) Yes

A. GENERAL CRITERIA FOR PROJECT

1. FY 1988 Continuing Resolution Sec. 523; FAA Sec. 634A.

   If money is sought to obligated for an activity not previously justified to Congress, or for an amount in excess of amount previously justified to Congress, has Congress been properly notified?

   Congressional notification submitted August 10,1988

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

   (a) Yes

   (b) Yes

3. FAA Sec. 611(a)(2). If legislative action is required within recipient country, what is the basis for a reasonable expectation that such action will be completed in time to permit orderly accomplishment of the purpose of the assistance?

   No legislation action is required to validate ProAg.

4.	FAA Sec. 611(b); FY 1988 Continuing Resolution Sec. 501. If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable. In accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.)	Yes
5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively?	Yes
6.	FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No
7.	FAA Sec. 601(a). Information and conclusions on whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	(a) No (b) No (c) Yes; Project activities contemplate the creation of water users' associations which will assist in 1) the management of water distribution; 2) maintenance of the system and, 3) the collection of fees or othe exchange for accomplishing the require maintenance. (d) No (e) Yes; The primary purpose of the. project is to enhance the GOM's capability to select, design, and manage supplemental irrigation systems, which should enable farmers to realize an increase of farm incomes and overall standard of living in semi-arid regions of the country. (f) No

8.	FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Commodities will be purchased from private US suppliers and LT-TA will be provided by private US contractors.
9.	FAA Sec. 612(b), 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The host country is contributing 25% of total estimated local currency project costs.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	US does not own excess foreign currency of Morocco.
11.	FY 1988 Continuing Resolution Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	Although the project's activities should enhance the capability of farmers to produce agricultural commodities, the primary purpose of this project is not to produce commodities for export.
12.	FY 1988 Continuing Resolution Sec. 553. Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of	No.

facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?

13.	FAA Sec. 119(q)(4)-(6). Will the assistance (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?	(a) No (b) No (c) No (d) No
14.	FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (either dollars or local currency generated therefrom)?	N/A
15.	FY 1988 Continuing Resolution. If assistance is to be made to a United States PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government?	N/A

16. FY Continuing Resolution Sec. 541. If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirement of A.I.D., and is the PVO registered with A.I.D. ? N/A

17. FY 1988 Continuing Resolution Sec. 514. If funds are being obligated under an appropriation account to which they were not appropriated, has prior approval of the Appropriations Committees of Congress been obtained? N/A

18. FY Continuing Resolution Sec. 515. If deob/reob authority is sought to be exercised in the provision of assistance, are the funds being obligated for the same general purpose, and for countries within the same general region as originally obligated, and have the Appropriations Committees of both Houses of Congress been properly notified? N/A

19. State Authorization Sec. 139 (as interpreted by conference report). Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision). N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FY 1988 Continuing Resolution Sec. 552 (as interpreted by conference report). If

	assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities (a) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expreted to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (b) in support of research that is intended primarily to benefit U.S. producers?	(a) N/A (b) N/A
b.	FAA Sec. 102(b), 111, 113, 281(a). Describe extent to which activity will (a) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, dispersing investment from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life, and otherwise encourage democratic	(a) An objective of the project is to construct supplemental irrigation systems in the semi-arid regions of the country which should increase farm incomes and the overall standard of living among rural households. (b) An objective of the project is the establishment of water users' associations to ensure beneficiary participation in the operation and management of the irrigation systems. (c) Project activities should enhance agricultural production capability of small farmers and their ability to produce food for domestic consumption. (d) Project activities are not directe specifically at women but enhanced income of rural families should have residual benefits to the status of women.

	private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status, (e) utilize and encourage regional cooperation by developing countries.	(e) Project activities will have no obvious effect on regional cooperation.
c.	FAA Sec. 103, 103A, 104, 105, 106, 120-21. Does the project fit the criteria for the source of funds (functional account) being used?	N/A
d.	FAA Sec. 107. Is emphasis placed on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	Yes
e.	FAA Sec. 110, 124(d). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?	Yes
f.	FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?	Yes

g.	FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.	See Project Paper Section III
h.	FY 1988 Continuing Resolution Sec. 538. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions?	No
	Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilizations?	No
	Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?	No
i.	FY 1988 Continuing Resolution. Is the assistance being made available to any organization or program which has been determined to support or participate in the management of a program of coercive abortion or involuntary sterilization?	No

	If assistance is from the population functional account, are any of the funds to be made available to voluntary family planning projects which do not offer, either directly or through referral to or information about access to, a broad range of family planning methods and services?	N/A
j.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes
k.	FY 1988 Continuing Resolution. What portion of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, colleges and universities having a student body in which more than 20 percent of the students are Hispanic Americans, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?	None
l.	FAA Sec. 118(c). Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16?	Yes
	Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (a) stress the	N/A

importance of conserving and sustainably managing forest resources; (b) support activities which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (c) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (d) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (e) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (f) conserve forested watersheds and rehabilitate those which have been deforested; (g) support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (h) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (i) conserve biological diversity in forest areas by supporting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a condition of support for activities involving forest	(a) N/A (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A

	clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas;	
	(j) seek to increase the awareness of U.S. government agencies and other donors of the immediate and long-term value of tropical forests; and	(j) N/A
	(k) utilize the resources and abilities of all relevant U.S. government agencies?	(k) N/A
m.	FAA Sec. 118(c)(13). If the assistance will support a program or project significantly affecting tropical forests (including projects involving the planting of exotic plant species), will the program or project (a) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land, and (b) take full account of the environmental impacts of the proposed activities on biological diversity?	N/A
n.	FAA Sec. 118(c)(14). Will assistance be used for (a) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; or (b) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas?	(a) No (b) No

o. FAA Sec. 118(c)(15). Will assistance be used for (a) activities which would result in the conversion of forest lands to the rearing of livestock; (b) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undegraded forest lands; (c) the colonization of forest lands; or (d) the construction of dams or other water control structures which flood relatively undegraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?

(a) No

(b) No

(c) No

(d) No

p. FY 1988 Continuing Resolution. If assistance will come from the Sub-Saharan Africa DA account, is it (a) to be used to help the poor majority in Sub-Saharan Africa through a process of long-term development and economic growth that is equitable, participatory, environmentally sustainable, and self-reliant; (b) being provided in accordance with the policies contained in section 102 of the FAA/ (c) being provided, when consistent with the objectives of such assistance, through African, United States and other PVOs that have

N/A

demonstrated effectiveness in the promotion of local grassroots activities on behalf of long-term development in Sub-Saharan Africa; (d) being used to help overcome shorter-term constraints to long-term development, to promote reform of sectoral economic policies, to support the critical sector priorities of agricultural production and natural resources, health, voluntary family planning services, education, and income generating opportunities, to bring about appropriate sectoral restructuring of the Sub-Saharan African economies, to support reform in public administration and finance and to establish a favorable environment for individual enterprise and self-sustaining development, and to take into account, in assisted policy reforms, the need to protect vulnerable groups; (e) being used to increase agricultural production in ways that protect and restore the natural resource base, especially food production, to maintain and improve basic transportation and communication networks, to maintain and restore the natural resource base in ways that increase agricultural production, to improve health conditions with special emphasis on meeting the health needs of mothers and children, including the establishment of self-sustaining primary health care systems that give priority to preventive care, to provide increased access to voluntary family planning services, to improve basic literacy and mathematics especially to those

outside the formal educational system and to improve primary education, and to develop income-generating opportunities for the unemployed and underemployed in urban and rural areas?

2. Economic Support Fund Project Criteria

a.	FAA Sec. 531(a). Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of part I of the FAA?	Yes
b.	FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?	No
c.	ISDCA of 1985 Sec. 207. Will ESF funds be used to finance the construction of, or the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such country is a party to the Treaty on the Non-Proliferation of Nuclear Weapons or the Treaty for the Prohibition of Nuclear Weapons in Latin America (the "Treaty of Tlatelolco"), cooperates fully with the IAEA, and pursues nonproliferation policies consistent with those of the United States?	No
d.	FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	N/A

ANNEX J

STANDARD ITEM CHECKLIST

SC(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. PROCUREMENT

1. FAA Sec. 602(a). Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	Yes; Solicitations for services and commodities required by the Project will be advertised in the US in accordance with AID regulations.
2. FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes; any required waivers will be obtained prior to any non-US procurement.
3. FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?	Yes
4. FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If non-U.S. procurement of agricultural commodity or product thereof is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.)	No; agricultural commodities on products thereof will be procured under this project.
5. FAA Sec. 604(g). Will construction or engineering services be procured from firms of advanced developing countries which are otherwise eligible under Code 941 and which have attained a competitive capability in international markets in one of these areas? (Exception for those	U.S. and Morocco are authorized geographic sources for the Project.

countries which receive direct economic assistance under the FAA and permit United States firms to compete for construction or engineering services financed from assistance programs of these countries.)

6. FAA Sec. 603. Is the shipping excluded from compliance with the requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates? — No

7. FAA Sec. 621(a). If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? Will the facilities and resources of other Federal agencies be utilized, when they are particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs? — Yes; Yes

8. International Air Transportation Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? — Yes

9. FY 1988 Continuing Resolution Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? — Such language will be included in AID direct contracts under the Project.

10. FY 1988 Continuing Resolution Sec. 524. If assistance is for consulting service through procurement contract pursuant to 5 U.S.C. 3109, are contract expenditures a matter of public record and available for public inspection (unless otherwise provided by law or Executive order)? — Yes

B. [redacted]

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services be used?	Some [redacted] assistance services will be provided in connection with construction work; however, actual construction work will be performed by GCM.
2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?	The GCM will perform the construction services.
3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP), or does assistance have the express approval of Congress?	N/A

C. OTHER RESTRICTIONS

1. FAA Sec. 122(b). If development loan repayable in dollars, is interest rate at least 2 percent per annum during a grace period which is not to exceed ten years, and at least 3 percent per annum thereafter?	N/A
2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?	N/A
3. FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries?	Yes; provided for in source/origin requirements

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4. [illegible]

a. [illegible] Section [illegible]. (1) to pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; or (4) to lobby for abortion? — Yes

Funds can only be used to finance activities within t project description. In addition, payment mechanism contemplate AID approval and reiburement after review of GOM expenditures. Other prohibitions listed below are covered in the Standard Provisions Annex to the ProAg.

b. FAA Sec. 483. To make reimbursements, in the form of cash payments, to persons whose illicit drug crops are eradicated? — Yes

c. FAA Sec. 620(g). To compensate owners for expropriated or nationalized property, except to compensate foreign nationals in accordance with a land reform program certified by the President? — Yes

d. FAA Sec. 660. To provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? — Yes

e. FAA Sec. 662. For CIA activities? — Yes

f. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? — Yes

g. FY 1988 Continuing Resolution Sec. 101. To pay pensions, annuities, retirement pay, or adjusted service compensation for prior or current military personnel? Yes

h. FY 1988 Continuing Resolution Sec. 104. To pay U.N. assessments, arrearages or dues? Yes

i. FY 1988 Continuing Resolution Sec. 104. To carry out provisions of FAA section 209(d) (transfer of FAA funds to multilateral organizations for lending)? Yes

j. FY 1988 Continuing Resolution Sec. 510. To finance the export of nuclear equipment, fuel, or technology? Yes

k. FY 1988 Continuing Resolution Sec. 511. For the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? Yes

l. FY 1988 Continuing Resolution Sec. 516; State Authorization Sec. 109. To be used for publicity or propaganda purposes designed to support or defeat legislation pending before Congress, to influence in any way the outcome of a political election in the United States, or for any publicity or propaganda purposes not authorized by Congress? Yes

ANNEK K

REQUEST FOR ASSISTANCE

GA/--

ROYAUME DU MAROC

LE PREMIER MINISTRE

MINISTERE DES AFFAIRES ECONOMIQUES

ANNEX K

Rabat, le

7408 دوالقعدة 27

12 JUIL. 1988

4-1210 OFFICIAL FILE

608 019

MONSIEUR LE DIRECTEUR DE L' U S A I D
137, AVENUE ALLAL BEN ABDELLAH
B.P. 120

R A B A T

ACTION : AGR

DUE DATE: 07/20

INFO: DIR. PROG

CONT-CHRON-RF.

O B J E T / Contribution de l'USAID au Programme des Barrages Collinaires.

R E F E R / Votre lettre du 8 Juin 1988.

Monsieur le Directeur,

ACTION TAKEN

No Action Necessary ✓

Replied by :

RE 28/7/88

Initials & Date

Par votre lettre citée en référence, vous avez bien voulu me faire part de la proposition de contribuer au financement du programme des barrages collinaires actuellement mis en oeuvre par le Gouvernement du Maroc. Vous m'avez informé également du souhait de l'USAID de définir les modalités et les conditions de l'octroi de cette aide dans un accord qui serait à signer par les gouvernements de nos deux pays avant la fin du mois d'Août 1988;

En réponse, j'ai l'honneur de vous faire part de l'avis favorable de la partie marocaine quant à la mise au point d'un accord de don définissant la contribution de l'USAID au programme des barrages collinaires. A cet effet, et ce dans le but d'accélérer la procédure de préparation du projet d'accord, une réunion interministérielle s'est tenue à mon département le 13/6/1988 à l'issue de laquelle il a été décidé que la coopération dans ce domaine, entre votre Institution et le Gouvernement marocain se fera de de la manière suivante :

.../...

USAID / RABAT
C & R
13 JUIL. 1988
RECEIVED
12

154

- Le Ministère des Affaires Economiques auprès du Premier Ministre assurera l'aspect administratif du projet et coordonnera les négociations avec la partie américaine.

- Le Ministère de l'Intérieur et de l'Information (Direction de la Promotion Nationale) supervisera un comité technique interministériel composé des représentants des Ministères de l'Intérieur, de l'Equipement et de l'Agriculture. Le travail d'exploration et d'études techniques qu'effectuera la mission d'experts américains au Maroc sera coordonné et encadré par la Direction de la Promotion Nationale. Cette dernière centralisera les informations techniques à soumettre à la mission d'experts pour les besoins de son étude;

- Le Ministère des Finances consacrera la contrepartie en dirhams de l'aide reçue en dollars, aux projets des barrages collinaires sélectionnés pour être financés par le don de l'USAID.

En vous remerciant de votre précieuse collaboration, je vous prie d'agréer, Monsieur le Directeur, l'expression de mes sentiments les meilleurs.

Le Ministre Délégué
auprès du Premier Ministre
Chargé des Affaires Economiques

Signé : Moulay Zine ZAHIDI

ANNEX L

SECTION 611 (e) CERTIFICATION

ANNEX L

Section 611 (e) Certification

Morocco Supplementary Irrigation Project (608-0197)

This project will develop and institutionalize within the Government of Morocco an improved selection and design procedure for small scale dam/irrigation projects based on in-depth technical, economic, environmental, and social analyses of potential sites. Concurrently, it will contribute to increasing agricultural production and farm incomes in the poorer semi-arid region of the country by financing the development of approximately ten dam/irrigation systems.

This project will be part of a larger on-going Small Dam Program which the Government of Morocco has been successfully implementing since 1985. Under this Program, the entities responsible for its implementation, i.e., the Ministries of Interior, Public Works and Agriculture, have demonstrated that they possess sufficient financial and human technical resources to ensure, either directly or through the creation of organizations composed of the beneficiaries of the program, that the small dams and irrigation systems constructed under the Program are effectively maintained and utilized. The new USAID-funded component of this program will further strengthen the Government of Morocco's existing human technical resources and institutional capability to carry out this Program which, to date, has been appropriately funded and staffed on a long-term basis.

I, Charles W. Johnson, the principal officer of the Agency for International Development in Morocco, as per the authority delegated to me through the Delegation of Authority No. 654, having taken into account among other factors, the uses which have been made of projects or programs in Morocco previously financed or assisted by the United States; and the commitment of the Government of Morocco to meet the support costs associated with this project, do hereby certify that in my judgment the Government of Morocco has both the financial and human resource capability to effectively utilize and maintain the capital assistance activity to be carried out under this project.

Charles W. Johnson

Charles Johnson
Director, USAID/Morocco

Date: August 19, 1988

ANNEX M

BIBLIOGRAPHY

ANNEX M

Bibliography

Abdellaoui, R.M., "Small Scale Irrigation Systems in Morocco: Present Status and Some Research Issues", paper prepared for the International Workshop on Public Intervention in Farmer-Managed Irrigation Systems, sponsored by IIMI, Kathmandu, Nepal, August 4-6, 1986, 20 pp.

Banque Africaine de Développement, Rapport d'Evaluation: Projet de Développement Rural Intégré de la Province de Settat, Maroc, February 1985.

Benatya, Driss, Pascon, Paul, & Zagdouni, Larbi, "L'Agriculture en Situation Aléotoire: Chaouïa 1977-1982", Institute Agronomique et Veterinaire Hassan II, Direction du Developpement, April 30, 1983

Carruthers, Ian, and others, "Irrigation Pricing and Management, Annex 3: Morocco", Devres, Inc., prepared for AID/PPC, September 30, 1985

Conseil Superieur de L'Eau, "Les Barrages Collinaires", May 1988)

Hammoudi, Abdellah, "Substance and Relation: Water Rights and Water Distribution in the Dra Valley", pp. 27-57 in A.E. Mayer, Property and Social Structure in the Near East, State University of New York, 1986.

Instrupa/Aydroplan/Scet, Projet de Développement Intégré de Had Kourt, Ouezzane, September 1987.

International Bank for Reconstruction and Development, Staff Appraisal Report, Kingdom of Morocco, Small and Medium Scale Irrigation Project, Report No. 4197-MOR, February 10, 1983.

_____. Kingdom of Morocco: Second Agricultural Sector Adjustment Loan: Technical Support Volume, 1987

_____. Morocco: Agricultural Sector Adjustment Loan: Loan Summary, 1985

_____. Morocco: Agricultural Sector Adjustment Loan: Technical Support Volume, 1985

_____. Morocco: Basic Economic Report, Volume I: The Main Report, Report No. 3289-MOR, December 30, 1980

_____. Morocco: Basic Economic Report, Volume II: Statistical Annex, Report No. 3289-MOR, December 30, 1980

_____. Staff Appraisal Report, Kingdom of Morocco, Large Scale Irrigation Improvement Project, Report No. 5846-MOR, September 24, 1985

Mahdi, Mohamed, "Private Rights and Collective Management of Water in a High Atlas Berber Tribe", n.d.

Ministère de l'Equipement (A.H.), "Séminaire sur les Barrages Collinaire", Barrage Oued El Makhazine, April 1986.

Ministère des Travaux Publics (DRE), Resources en Eau du Maroc, Plaines et Bassins du Maroc Atlantique, 1975.

Ministère de L'Agriculture Française, Retenues Collinaires, Paris 1963.

Pascon, Paul, La Question Hydraulique - Petite et Moyenne Hydraulique au Maroc, Rabat 1984.

_____. Le Haouz de Marrakech, 1977, Tome 1 et 2

Popp, Herbert, La Question Hydraulique - Effets Socio-Geographiques de la Politique des Barrages au Maroc, Rabat, 1984.

Scet/Maroc, Etude d'Aménagement des Zones Bour dans le Périmètre du Tadla, December 1987.

U.S. Agency for International Development, "A.I.D. Program Evaluation Report No. 8: Irrigation and AID's Experience: A Consideration Based on Evaluations", August 1983.

_____. Dryland Agriculture Applied Research, Project Paper Amendment No. 4. Project 608-0136, March 9, 1988, USAID, Washington D.C.

_____. Irrigation Management Systems, Project Paper, Project No. 263-0132, March 3, 1987, USAID, Washington D.C.

_____. Regional Irrigation Support for Aria Near Z.., Project Paper, Project No. 398-0289, September 16, 1986, USAID, Washington, D.C.

_____. Supplemental Irrigation, Project Identification Document, Project No. 608-0197, May 1988, USAID, Washington D.C.

_____. Morocco: Country Development Strategy Statement, FY 1986, March 1986, USAID, Rabat

Engineering Feasibility Studies for the Sites:

1. N'Zalet Azri, C.I.D.
2. Barrage Imi Larbaa, C.I.D.
3. Tabayat, Scet-Maroc/Equiter
4. Azib Douirani, Scet-Maroc/Equiter
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